University Of Kerala

Four Year Undergraduate Programme (UoK FYUGP)

Syllabus

Major Discipline Computer Science

May 2024

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About the Discipline

The four-year Undergraduate Computer Science (BSc Computer Science) Programme conducted by the University of Kerala, aligned with the Four Year Under Graduate Programme (FYUGP) guidelines proposed by the University Grants Commission (UGC), equips a learner for a thriving career in the IT sector. This programme provides a strong foundation in Computer Science fundamentals, covering areas such as programming languages, data structures and algorithms, operating systems, networks and databases. The learner will delve into theoretical concepts alongside practical applications, gaining expertise in specialized domains, a few being, Software Development, Web Development, Cyber Security, Data Science, Machine Learning, Health Computing and so forth. The curriculum of the BSc Computer Science Programme unfolds and reinforces critical thinking, instigates problem-solving skills, and strengthens the ability to adapt to the ever-changing and ever- evolving technologies. Through a combination of classroom lectures and hands-on laboratory experiences, the student will graduate well equipped to contribute to the diverse IT fields like software engineering, systems analysis, and web development. By offering discipline specific electives in major cutting-edge technologies such as web development, artificial intelligence, machine learning, and cybersecurity, the programme ensures that the graduates possess the necessary skills to stay ahead in the ever-shifting industry trends.

Computer Science is a dynamic and interdisciplinary field that has permeated every sector of human life and plays a vital role in solving complex problems as well as shaping the modern world and contributing to advancement of technology. This Programme isn't just about memorizing technical aspects, but about nurturing the students' analytical thinking, fostering creativity into them, and encouraging collaboration with peers. The students learn to debug programs, think critically, and effectively communicate ideas. They are prepared for further exploration in exciting and focused areas like Machine Learning, Web development, Cybersecurity, Data Science, specifically known as specialization in the curriculum, or any path their curiosity leads them on, notwithstanding the emphasis on responsibility towards humankind, values, and ethics. Furthermore, the FYUGP structures the curriculum in such a manner that the learner gets the chance to investigate diverse subjects of multidisciplinary and allied nature that intrigue and pique their interest.

By the end of this 3/4 year journey, the student who majors in Computer Science will be equipped with the foundational as well as advanced theoretical knowledge and practical skills necessary to navigate the vast world of Computer Science and Information Technology.

Graduate Attributes

Graduate attributes bridge the gap between academia and the real world, fostering lifelong learning and meaningful contributions. They denote the skills, competencies and high-level qualities that a student should acquire during their university education. Apart from gathering content knowledge, these attributes go beyond the assimilation of information to its application in various contexts throughout a graduate's life. It aims in inculcating the art of critical thinking, problem solving, professionalism, leadership readiness, teamwork, communication skills and intellectual breadth of knowledge. The University of Kerala envisages to pave the path in guiding the student's journey to shape these attributes uniquely, making them integral to personal growth and success in various spheres of life. The University strives to ensure that these graduate attributes are not just checkboxes, but they play a pivotal role in shaping the students into capable, compassionate and responsible individuals with a high degree of social responsibility.

Programme Outcomes

No.	Programme Outcomes (POs)
PO-1	**Critical Thinking** ● analyze information objectively and make a reasoned judgment ● draw reasonable conclusions from a set of information, and discriminate between useful and less useful details to solve problems or make decisions ● identify logical flaws in the arguments of others ● evaluate data, facts, observable phenomena, and research findings to draw valid and relevant results that are domain-specific

PO-2	**Complex Problem-solving** ● solve different kinds of problems in familiar and no-familiar contexts and apply the learning to real-life situations ● analyze a problem, generate and implement a solution and to assess the success of the plan ● understand how the solution will affect both the people involved and the surrounding environment
PO-3	**Creativity** ● produce or develop original work, theories and techniques ● think in multiple ways for making connections between seemingly unrelated concepts or phenomena ● add a unique perspective or improve existing ideas or solutions ● generate, develop and express original ideas that are useful or have values
PO-4	**Communication Skills** ● convey or share ideas or feelings effectively ● use words in delivering the intended message with utmost clarity ● engage the audience effectively ● be a good listener who are able to understand, respond and empathize with the speaker ● confidently share views and express himself/herself
PO-5	**Leadership Qualities** ● work effectively and lead respectfully with diverse teams ● build a team working towards a common goal ● motivate a group of people and make them achieve the best possible solution. ● help and support others in their difficult times to tide over the adverse situations with courage

PO-6	**Learning ‘how to learn’ Skills** ● acquire new knowledge and skills, including ‘learning how to learn skills, that are necessary for pursuing learning activities throughout life, through self-paced and self-directed learning ● work independently, identify appropriate resources required for further learning ● acquire organizational skills and time management to set self-defined goals and targets with timelines ● inculcate a healthy attitude to be a lifelong learner
PO-7	**Digital and Technological Skills** ● use ICT in a variety of learning and work situations, access, evaluate, and use a variety of relevant information sources ● use appropriate software for analysis of data ● understand the pitfalls in the digital world and keep safe from them
PO-8	**Value Inculcation** ● embrace and practice constitutional, humanistic, ethical, and moral values in life including universal human values of truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values ● formulate a position/argument about an ethical issue from multiple perspectives ● identify ethical issues related to work, and follow ethical practices, including avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights ● adopt an objective, unbiased, and truthful actions in all aspects of work

Programme Specific Outcomes

No.	Upon completion of the programme the graduate will be able to	PO No.
PSO-1	Exhibit profound understanding of theoretical Computer Science Concepts with a focus on ethical implications and life-long learning.	PO-6,8
PSO-2	Cultivate critical and creative problem-solving skills for designing sustainable solutions to real life problems	PO-1,2,3
PSO-3	Encourage experiential learning and team work by providing hands-on experience in emerging technologies across diverse computing domains	PO-4,5,6,7
PSO-4	Utilise advanced analytical principles in high quality research and development, maintaining rigorous ethical and Quality Standards	PO-1,6,7,8

Structure

Computer Science offers Discipline Specific Core Courses in Core and Vocational categories such as Data Science, Machine Learning, and Health Informatics. In addition to that, Discipline Specific Electives in four specializations such as Cyber Security, Web Development, Data Science and Machine learning are also available for Major Computer Science Students.

A. Level 1 (Level 100-199)

I. Semester 1

1. DSC

Course Code	Course Name	Remarks	Stream
UK1DSCCSC100	Essentials of Computer Science	General	
UK1DSCCSC101	Programming using C	General	
UK1DSCCSC102	Digital Electronics	General	
UK1DSCCSC103	Introduction to Web Programming	General	
UK1DSCCSC104	Informatics	General	
UK1DSCCSC105	Internet Technology	General	
UK1DSCCSC106	Data Science Fundamentals	Vocational and General	Data Science
UK1DSCCSC107	Introduction to Artificial Intelligence	Vocational and General	Machine Learning
UK1DSCCSC108	Health Informatics	Vocational and General	Health Informatics

2. MDC

Course Code	Course Name
UK1MDCCSC100	Web Designing using HTML5 and CSS3
UK1MDCCSC101	Introduction to IT
UK1MDCCSC102	Basics of Microprocessors

UK1MDCCSC103	Introduction to Data Science
UK1MDCCSC104	Animation using Blender
UK1MDCCSC105	Health Informatics
UK1MDCCSC106	Environmental Informatics

3. AEC

(Syllabus by English Faculty)

II. Semester 2

1. DSC

Course Code	Course Name	Remarks	Stream
UK2DSCCSC100	Free and Open Source Softwares	General	
UK2DSCCSC101	Python Programming	General	
UK2DSCCSC102	Computer System Management	General	
UK2DSCCSC103	Introduction to Biometric Systems	General	
UK2DSCCSC104	E-Commerce	General	
UK2DSCCSC105	Multimedia Systems	General	
UK2DSCCSC106	Python for Data Analytics	Vocational and General	Data Science

UK2DSCCSC107	R Programming for Data Science	Vocational and General	Data Science
UK2DSCCSC108	Knowledge Representation and Intelligent Agents	Vocational and General	Machine Learning
UK2DSCCSC109	Electronic Health Record system	Vocational and General	Health Informatics

2. MDC

Course Code	Course Name
UK2MDCCSC100	Digital Marketing
UK2MDCCSC101	Office Automation
UK2MDCCSC102	Social Media Management
UK2MDCCSC103	Digital Logic Systems
UK2MDCCSC104	Data Science using Python

3. AEC

(Syllabus by O/L faculty)

4. Summer Internship (*Not Required Now*)

B. Level 2 (Level 200-299)

I. Semester 3

1. DSC

Course Code	Course Name	Remarks	Stream
UK3DSCCSC200	Data Structures	General	
UK3DSCCSC201	System Software	General	
UK3DSCCSC202	Microprocessor and Assembly Language Programming	General	
UK3DSCCSC203	Computer Graphics	General	
UK3DSCCSC204	Knowledge Representation and Reasoning	General	
UK3DSCCSC205	Visual Programming	General	
UK3DSCCSC206	Low Code Application Development	General	
UK3DSCCSC207	Cyber Crimes & Laws	General	
UK3DSCCSC208	E-Governance	General	
UK3DSCCSC209	Data Mining Concepts and Techniques	Vocational and General	Data Science
UK3DSCCSC210	Data Visualisation	Vocational and General	Data Science

UK3DSCCSC211	Introduction to Machine Learning	Vocational and General	Machine Learning
UK3DSCCSC212	Medical Imaging and Analysis	Vocational and General	Health Informatics
UK3DSCCSC213	Health Data Analytics	Vocational and General	Health Informatics

2. DSE

Course Code	Course Name	Stream
UK3DSECSC200	Introduction to Cyber security	Cyber Security
UK3DSECSC201	Data Science Fundamentals	Data Science
UK3DSECSC202	Introduction to Artificial Intelligence	Machine Learning
UK3DSECSC203	Web Development using HTML5 and CSS3	Web Development

3. MDC (KS)

4. VAC

Course Code	Course Name
UK3VACCSC200	Coding Standards and Practices
UK3VACCSC201	Professional Ethics in Computer Science

II. Semester 4

1. DSC

Course Code	Course Name	Remarks
UK4DSCCSC200	Database Management System	Can opt both Computer Science (Major) and Accounting and Data Science (Interdisciplinary) students
UK4DSCCSC201	Data Communication	
UK4DSCCSC202	Artificial Intelligence	
UK4DSCCSC203	Computer Organization	

2. DSE

Course Code	Course Name	Stream
UK4DSECSC200	Ethical Hacking	Cyber Security
UK4DSECSC201	Python for Data Analytics	Data Science
UK4DSECSC202	Knowledge Representation and Intelligent Agents	Machine Learning
UK4DSECSC203	Web Scripting using JavaScript, ReactJS/Ajax	Web Development

3. INT

Course Code	Course Name
UK4INTCSC200	SUMMER INTERNSHIP

4. SEC

Course Code	Course Name
UK4SECCSC200	Content Management System
UK4SECCSC201	Computer Hardware Maintenance

5. VAC

Course Code	Course Name
UK4VACCSC200	Ethical Hacking
UK4VACCSC201	Software Quality Management
UK4VACCSC202	Ethical AI and Responsible Computing
UK4VACCSC203	Preface to Cyber Laws

C. Level 3 (Level 300-399)

I. Semester 5

1. DSC

Course Code	Course Name	Remarks
UK5DSCCSC300	Programming in Java	
UK5DSCCSC301	Data Mining	
UK5DSCCSC302	Software Engineering	
UK5DSCCSC303	Computer Networks	
UK5DSCCSC304	Design Analysis and Algorithms	
UK5DSCCSC305	Trends in Computing	
UK5DSCCSC306	Statistical Analysis System	Can be opted by both Computer Science (Major) and Accounting and Data Science (Interdisciplinary) students
UK5DSCCSC307	Information Retrieval	
UK5DSCCSC308	Cloud Computing	
UK5DSCCSC308	Recommendation Systems	

2. DSE

Course Code	Course Name	Stream
UK5DSECSC300	Cryptography and Network Security	Cyber Security
UK5DSECSC301	Cyber Forensics	Cyber Security
UK5DSECSC302	Data Analytics with R	Data Science
UK5DSECSC303	Data Mining concepts and Techniques	Data Science
UK5DSECSC304	Introduction to Machine Learning	Machine Learning
UK5DSECSC305	Artificial Neural Networks	Machine Learning
UK5DSECSC306	PHP And MySQL	Web Development
UK5DSECSC307	Web Application Development using Django	Web Development

3. SEC

Course Code	Course Name
UK5SECCSC300	Software Testing
UK5SECCSC301	Web Application Development
UK5SECCSC302	Android Programming Using Kotlin

II. Semester 6

1. DSC

Course Code	Course Name
UK6DSCCSC300	Machine Learning
UK6DSCCSC301	Object Oriented Analysis And Design
UK6DSCCSC302	Cryptography and Network Security
UK6DSCCSC303	Operating Systems
UK6DSCCSC304	Functional Programming
UK6DSCCSC305	Internet of Things

2. DSE

Course Code	Course Name	Stream
UK6DSECSC300	Image Security	Cyber Security
UK6DSECSC301	Mobile & Wireless Security	Cyber Security
UK6DSECSC302	Data Visualisation	Data Science
UK6DSECSC303	Big Data Technologies using Hadoop	Data Science

UK6DSECSC304	Recommendation Systems	Machine Learning
UK6DSECSC305	Deep Learning	Machine Learning
UK6DSECSC306	Mobile Application Development	Web Development
UK6DSECSC307	Emerging Trends in Web Development	Web Development

3. SEC

Course Code	**Course Name**
UK6SECCSC300	Mobile Application Development
UK6SECCSC301	Game application Development
UK6SECCSC302	Image Processing and Applications
UK6SECCSC303	Entrepreneurship in IT

4. INT

Course code	**Course Name**
UK6INTCSC300	Minor Project

D. Level 4 (Level 400-499)

I. Semester 7

DSC

Course Code	Course Name	Remarks
UK7DSCCSC400	Research Methodology	Capstone course
UK7DSCCSC401	Academic Writing and Publishing	Capstone course
UK7DSCCSC402	Natural Language Processing	Capstone course
UK7DSCCSC403	Cloud Computing	
UK7DSCCSC404	Block Chain Technologies	Capstone course
UK7DSCCSC406	Prompt Engineering	Capstone course
UK7DSCCSC407	Theory of Computation	Capstone course
UK7DSCCSC408	Wireless Data Communication	Capstone course
UK7DSCCSC409	Advanced DBMS	Capstone course
UK7DSCCSC410	Bioinformatics	Capstone course
UK7DSCCSC411	Image Processing and Applications	Capstone course
UK7DSCCSC413	Soft Computing	Capstone course
UK7DSCCSC414	Big Data Technologies using Hadoop	Vocational: Data Science

UK7DSCCSC415	Social Media analytics	Vocational: Data Science
UK7DSCCSC416	Text Mining	Vocational: Data Science
UK7DSCCSC418	Deep Learning	Vocational: Machine Learning
UK7DSCCSC419	Computer Vision	Vocational: Machine Learning
UK7DSCCSC420	Artificial Neural Networks	Vocational: Machine Learning
UK7DSCCSC422	Medical Transcription and Telemedicine	Vocational: Health Informatics
UK7DSCCSC423	Medical Image Processing	Vocational: Health Informatics
UK7DSCCSC424	Bioinformatics	Vocational: Health Informatics

DSE

Course Code	**Course Name**	**Stream**
UK7DSECSC400	Cloud Security	Cyber Security
UK7DSECSC401	Social Media Analytics	Data Science

UK7DSECSC402	Computer Vision	Machine Learning
UK7DSECSC403	Full Stack Development	Web Development

Semester 8

DSC (Online) (*Not Required Now*)

DSC (Offline) (*Not Required Now*)

Internship Project (*Not Required Now*)

Research Project (*Not Required Now*)

SYLLABUS

LEVEL 1(100-199)

Semester 1

1. DSC

Course Code	Course Name	L(Hrs)	P(Hrs)	Credits	Remarks	Stream
UK1DSCCSC100	Essentials of Computer Science	3	2	4		
UK1DSCCSC101	Programming using C	3	2	4		
UK1DSCCSC102	Digital Electronics	3	2	4		
UK1DSCCSC103	Introduction to Web Programming	3	2	4		
UK1DSCCSC104	Informatics	4	0	4		
UK1DSCCSC105	Internet Technology	4	0	4		
UK1DSCCSC106	Data Science Fundamentals	3	2	4	Vocational	Data Science
UK1DSCCSC107	Introduction to Artificial Intelligence	4	0	4	Vocational	Machine Learning
UK1DSCCSC108	Health Informatics	4	0	4	Vocational	Health Computing

2. MDC

Course Code	Course Name	L(Hrs)	P(Hrs)	Credits
UK1MDCCSC100	Web Designing using HTML5 and CSS3	2	2	3
UK1MDCCSC101	Introduction to IT	3	0	3
UK1MDCCSC102	Basics of Microprocessors	2	2	3
UK1MDCCSC103	Introduction to Data Science	2	2	3
UK1MDCCSC104	Animation using Blender	2	2	3
UK1MDCCSC105	Health Informatics	3	0	3
UK1MDCCSC106	Environmental Informatics	3	0	3

DSC

1. ESSENTIALS OF COMPUTER SCIENCE

Discipline	COMPUTER SCIENCE				
Course Code	UK1DSCCSC100				
Course Title	ESSENTIALS OF COMPUTER SCIENCE				
Type of Course	**DSC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge of computers is desirable				
Course Summary	This course provides an introduction to key concepts in computer science, covering topics such as fundamentals, internet technologies, emerging trends and Artificial Intelligence. Students will gain a foundational understanding of how computers work and current trends of computer science				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to Computer**	**15**
	1	Introduction, Characteristics of a computer, Stored Programme Concept	
	2	Inside a computer: SMPS, Motherboard, BIOS, CMOS, Ports and Interfaces, Expansion Cards, Ribbon Cables	
	3	Memory: Cache, RAM, ROM, Secondary Memory, Memory hierarchy	
	4	Computer Software and categories: System software, Application software	

	5	Terminology software: Firmware, Liveware, Public-domain software, Freeware, Shareware, Commercial software, Proprietary software, Semi-free software	
II		**Internet Basics and Tools**	**15**
	6	Internet Basics: WWW, URL, Electronic mail, Search Engines, Chatting and Instant Messaging, Video conferencing	
	7	User Generated Content: Blogs and Wikis	
	8	Online Data Acquisition Tools: Form creation, customization, data validation, response management, collaboration features	
	9	Learning Management System, e-library, and Google Scholar	
III		**Emerging technologies**	**15**
	10	Cloud computing: Definition, Types of cloud computing (Public, Private, Hybrid), Types of cloud services (SaaS, PaaS, IaaS)	
	11	E-Commerce	
	12	Virtual /Augmented Reality	
	13	Crypto Currency	
IV		**Introduction to AI tools**	**15**
	14	Artificial Intelligence, History of AI, Types of AI: Narrow AI, General AI, Strong AI, Applications	
	15	Tools for Machine translation, Speech recognition and image recognition	
	16	Introduction to Generative AI, How Generative AI works, Generative AI tools: Chat GPT, GitHub Copilot, Geminy, SciSpace	
	17	Recommendation systems: Definition, Advantages, Challenges, Applications	
V		**Flexi Module- (Not included for End Semester Examination)**	**15**
	18	Digital Society, Digital Divide, Social Network- Services, Issues, Popular networks	
	19	Cybercrime, Cyber Security, Cyber Addiction, e-waste, e-waste Management	
	20	IPR, Copyrights, Patents, Plagiarism	

References

Core Book

1. Reema Thareja. Fundamentals of Computers. Oxford University Press, 2019.
2. Introduction to Information Technology, 2nd Edition, ITL Education Solutions Limited, Pearson, 2012.
3. Akshay Kulkarni, Adarsha Shivananda , Anoosh Kulkarni , Dilip Gudivada. “Applied Generative AI for Beginners- Practical Knowledge on Diffusion Models, ChatGPT, and Other LLMs”, APress, 2023.

Additional References

4. Vijayakumaran Nair K, Vinod Chandra S S, “Informatics”, PHI 2014.
5. Rajaraman, “Introduction to Information Technology”, PHI, Third Edition, 2018.
6. Pradeep.K.Sinha, Priti Sinha, “Information Technology: Theory and Practices”, PHI Learning, 2016.
7. Balaguruswamy, “Fundamentals of Computers”, Second Edition,2009.

Lab Exercises

PART A

1. Familiarisation of components of a computer.
2. Create a resume using a document editor.
3. Create a student rank list using spreadsheet.
4. Create a presentation.
5. Create blog sites.
6. Edit Wikipedia.
7. Create a data form to capture data for student feedback/satisfaction survey on a course and analyse it.
8. Identify the features of a sample Learning Management System.
9. Familiarise with a sample e-library.
10. Familiarise with Google Scholar.

PART B

11. Scheduling tasks in Google Calendar.
12. Create/Upload documents / spreadsheets and presentations online.
13. Share and collaborate in real time.
14. Safely store and organize your work in an online storage system.
15. Create brochures.
16. Create videos.
17. Create posters.
18. Familiarise Tools for Machine translation, Speech recognition and image recognition
19. Develop Contents using AI tools.
20. Create Presentation using AI tool

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarise the basic concepts about computer	U	PSO-1, 3
CO2	Illustrate internet basics and tools usage	Ap	PSO-1, 3
CO3	Make use of emerging technologies in Computer Science	Ap	PSO- 1, 3
CO4	Identify some foundation level tools used in Artificial Intelligence	U	PSO- 1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ESSENTIALS OF COMPUTER SCIENCE

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Summarise the basic concepts about computer	PO- 6,7 PSO-1, 3	U	F, C	L	P
CO2	Illustrate internet basics and tools usage	PO-6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO3	Make use of emerging technologies in Computer	PO-6, 7 PSO-1, 3	Ap	F, C, P	L	P

	Science					
CO4	Identify some foundation level tools used in Artificial Intelligence	PO-6, 7 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	-	2	-	1	-
CO 2	-	-	-	-	-	2	3	-	2	-	2	-
CO 3	-	-	-	-	-	2	3	-	2	-	2	-
CO 4	-	-	-	-	-	2	3	-	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Quiz**	**Assignment**	**Lab Assessment**	**End Semester Examination**
CO 1	✓	✓		✓	✓
CO 2	✓		✓	✓	✓
CO 3	✓	✓		✓	✓
CO 4	✓		✓	✓	✓

2. PROGRAMMING USING C

Discipline	COMPUTER SCIENCE				
Course Code	UK1DSCCSC101				
Course Title	PROGRAMMING USING C				
Type of Course	**DSC**				
Semester	I				
Academic Level	1 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge about computer				

Course Summary	This course introduces the learners to C Programming language, which is a starting level for getting into programming. The course starts from programming basics and gives a holistic view of the C programming, detailing all the aspects of the C language.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to Programming**	**15**
	1	Algorithm & Flow charts	
	2	Program Writing – Structure of the Program, Source code, Object code, Executable file, Extensions of different files, Program Compilation, Running of a program; Header file concept.	
	3	Variables and Constants, Rules for naming the Variables/Identifiers.	
	4	Basic data types of C, int, char, float, double; storage capacity – range of all the data types; Storage classes.	
II		**Basic Concepts**	**15**
	5	Basic Elements: Operators and Expressions: Assignment Operator, Arithmetic Operator and Arithmetic expression, Relational Operator and Relational expression. Logical Operators, Expression Evaluation (Precedence of Operators)	
	6	Control Structures: Decision Making- if, if else, nested if, switch-case, Looping Statements- for, while, do-while, break, continue	
	7	Simple I/O statements: Formatted and Unformatted I/O statements.	
	8	Arrays: Introduction, defining simple arrays, multi-dimensional arrays, declaration, initialization, and processing	
	9	Strings: Declaration and Initialization, string handling functions	
III		**Functions & Pointers**	**15**

	10	Functions: Library, User defined functions, declaration, definition & scope, Recursion	
	11	Pointers: The & and * Operators, pointer declaration, assignment, arithmetic pointers, call by value and call by reference	
	12	Dynamic memory allocation (Concepts only)	
IV		**Structures and Files**	**15**
	13	Declaration and definition of Structures, Array of Structures, Structures within structures.	
	14	Union: Declaration and definition of Union.	
	15	File handling: text and binary files, modes of files, file operations	
V		**Flexi Module: Not included for End Semester Examination**	**15**
	16	Header file creation, Preprocessor Directives, Command line arguments.	
	17	Advanced programs using pointers and files	

Core Textbooks

1. E. Balaguruswamy, Programming in ANSI C, McGrawhill, Sixth Edition

Reference Books

1. Ashok N. Kamthene, Programming in C, Pearson Education, Second edition
2. Yashavant Kanitkar, Let us C Authentic Guide to C programming Language, 17th edition.
3. Computer Fundamentals and Programming in C by Reema Thareja, 2nd Edition, Oxford publication

Web Resources

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.programiz.com/c-programming
3. https://www.w3schools.in/c-tutorial

LAB EXERCISES

Part A (Minimum 15 Questions)

- Program to demonstrate the syntax and use of basic data types,
- Program to demonstrate the syntax and use of operators.
- Program to demonstrate the syntax and use of decision-making statements.
- Program to demonstrate the syntax and use of looping statements.

Part B (Minimum 15 Questions)

- Arrays: Program related to arrays and its operations
- Strings: Programs related to string handling functions.
- Functions- Simple Examples of declaring and using functions, call by value, call by reference, Recursive functions.
- Pointers: Simple program to demonstrate pointers, array of pointers.
- Structures and union: Simple program to declare and define a structure, array of structures.
- Files: Simple programs to demonstrate file concepts.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Illustrate the concepts and structure of a C program.	Ap	PSO-1,2,3
CO-2	Make use of control structures, arrays and strings.	Ap	PSO-1,2,3
CO-3	Develop programs using functions and pointers.	Ap	PSO-1,2,3
CO-4	Demonstrate the concepts of structures, union and files.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: PROGRAMMING USING C

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Illustrate the concepts and structure of a C program.	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P

2	Make use of control structures, arrays and strings.	PO-1,2, 6,7 PSO-1,2,3	Ap	F, C, P	L	P
3	Develop programs using functions and pointers.	PO-1,2, 6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Demonstrate the concepts of structures, union and files.	PO-1,2, 6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	2	1	-	-	-	2	2	-	2	2	2	-
CO 2	2	2	-	-	-	2	2	-	3	2	2	-
CO 3	2	2	-	-	-	2	2	-	3	2	2	-
CO 4	1	1	-	-	-	2	2	-	3	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examination
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

3. DIGITAL ELECTRONICS

Discipline	COMPUTER SCIENCE				
Course Code	UK1DSCCSC102				
Course Title	DIGITAL ELECTRONICS				
Type of Course	**DSC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lectures per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	-				
Course Summary	After finishing the course, students will have a solid grasp of digital electronics basics. They will be able to handle different number systems, logic gates, simplify expressions with Boolean algebra, and design digital circuits.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Number Systems**	**15**
	1	Introduction to Number Systems: Binary, Decimal, Octal, and Hexadecimal.	
	2	Conversion between Number Systems.	
	3	Binary Arithmetic (Addition, Subtraction, Multiplication, and Division)	
	4	1's and 2's complement subtraction methods.	
	5	Gray code, BCD and BCD addition	
II		**Logic Gates**	**15**
	6	Basic Gates(AND, OR, NOT), Universal gates(NAND, NOR), XOR and XNOR gates	

	7	Universal property of NAND and NOR gates	
	8	Logic IC's 74 series	
	9	Applications of Logic gates	
III	**Boolean Algebra**		**15**
	10	Basic Laws of Boolean algebra.	
	11	DeMorgan’s theorems.	
	12	SOP, POS, minterm and maxterm	
	13	Simplification of Boolean expressions-Karnaugh Maps.	
IV	**Digital Circuits**		**15**
	14	Multiplexers and Demultiplexers	
	15	Encoders and Decoders	
	16	Adders (Half Adder, Full Adder)	
	17	Flip-Flops (SR, JK, D and T Flip-Flops)	
V	**Flexi Module : Not included for End-Semester Exams**		**15**
	Advanced Digital Systems and Applications		
	18	Registers and Counters: PIPO, SIPO, PISO, SISO, counter design and applications	
	19	Memory units: types, working principle, and interfacing techniques	
	20	Application case study: Digital Signal Processing (DSP), significance, basic building blocks, case study: Designing a digital filter using DSP and implementing it on a microcontroller or FPGA platform	

CORE REFERENCES:

1. Thomas L. Floyd, Digital Fundamentals, Pearson, 11th edition
2. M. Morris Mano, Digital Logic and Computer Design, Pearson, 2023
3. John F. Wakerly, Digital Design: Principles & Practices, Prentice Hall, Third Edition (for Logic IC's 74 series)

LAB EXERCISES

1. Familiarisation of Logic IC’s (AND, OR, NOT, NAND, NOR, XOR and XNOR gates)

2. Implementation of Logical Expressions (Eg: A.(B+C)) - To get practical awareness about simple Boolean Algebra expressions.

3. Construct Half Adder circuit using Logic gates

4. Construct Full Adder circuit using logic gates

5. Construct an SR Flip-Flop.

6. Construct a 2x4 decoder.

7. Construct 2X1 MUX

8. Construct 1X2 DEMUX

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the fundamentals of number systems.	U	PSO-1
CO-2	Develop digital circuits using logic gates.	Ap	PSO-1, 2, 3
CO-3	Use the principles of Boolean algebra for simplifying logical expressions.	Ap	PSO-1, 2, 3
CO-4	Construct various combinational digital circuits.	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: DIGITAL ELECTRONICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Explain the fundamentals of number systems.	PSO-1	U	F, C	L	-
2	Develop digital circuits using logic gates.	PSO-1, 2, 3	Ap	F, C, P, M	L	P
3	Use the principles of	PSO-1, 2, 3	Ap	F, C, P, M	L	P

	Boolean algebra for simplifying logical expressions.					
4	Construct various combinational digital circuits.	PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C-Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	-	-	2	1	-	2	-	-	-
CO 2	1	1	-	-	-	2	1	-	2	1	2	-
CO 3	2	3	-	-	-	2	2	-	2	2	2	-
CO 4	1	2	-	-	-	2	2	-	2	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

4. INTRODUCTION TO WEB PROGRAMMING

Discipline	COMPUTER SCIENCE				
Course Code	UK1DSCCSC103				
Course Title	INTRODUCTION TO WEB PROGRAMMING				
Type of Course	**DSC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	Web design is the planning and creation of websites. This includes a number of separate skills that all fall under the umbrella of web design. This course aims to instil in students these skills which includes information architecture, user interface, site structure, navigation, layout, colours, fonts, and overall imagery. It also trains students on basic web design elements like overall layout, colour scheme, typography, navigation and content. Simple web pages are designed using HTML5 and CSS3.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Basics of HTML5**		**15**
	1	HTML foundations, usage of Doctype and charset	
	2	Familiarisation of basic html tags including headings, paragraphs and text formats	
	3	Managing information with lists and tables	
	4	Making connections with links – hyperlinks, anchors, urls	
	5	Adding Images to your pages – Image and ImageMaps	
	6	Working with audio and video	
II	**Advanced Features in HTML5**		**15**
	7	Sectioning Elements – nav, article, main, header, footer and section tags	
	8	Progress Elements	
	9	Div and Frames	
	10	IFrames	
	11	Creating Forms using input elements	
III	**Introduction to CSS3**		**15**
	12	Style Element and Stylesheet	
	13	Specifying colors in CSS	

	14	Fonts and typefaces	
	15	Selectors – IDs, Classes and Pseudo classes	
	16	Borders and Backgrounds	
	17	Levels of CSS	
	18	Using HTML with CSS	
IV	**Stylesheets for high level visual designs**		**15**
	19	CSS3 Gradients	
	20	Special effects - images	
	21	Special effects - text	
	22	Introduction to Float Mechanism	
	23	Creating a basic two-column design	
	24	Creating dynamic lists	
	25	Building a basic menu system	
V	**Flexi Module: Not included for end semester exams**		**15**
	26	New features in HTML5 and CSS3,	
	27	Designing a static website of student's choice	
	28	Case study on some recent web designing tools.	

References

Core:

1. Andy Harris, "HTML5 and CSS3 All-in-one for Dummies", A Wiley Brand, Third Edition

Additional: https://books.goalkicker.com/HTML5Book/

LAB EXERCISES

Part A

1. Design a page having suitable background colour and text colour with title “My First Web Page” using all the attributes of the Font tag.
2. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register_Number, Class] aligned in proper order using alignment attributes of Paragraph tag
3. Create a page to show different character formatting (B, I, U, SUB, SUP) tags and heading tags
4. Create web pages using Anchor tag with its attributes for external links.
5. Create a web page with different sections and internal links using links and sectioning elements; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.
6. Create a web page, showing ordered list of semesters and an unordered list of names of all the Diploma Programmes (Branches) in your institution
7. Create a web page which divides the page in two equal frames and place the audio and video clips in frame-1 and frame-2 respectively

Part B

8. Create a registration form using form input tags
9. Use tables to provide layout to your HTML page describing your college infrastructure
10. Create a table to show your class time table. Specify font and border attributes using css.
11. Write a program in html to design a Bio-Data and set style attributes in css using ids and selectors
12. Write a programme in html to create a webpage with four iframes (Picture, table, list, and hyperlink)
13. Design a web page with color background and give gradient effects using css.
14. Create a web page to show text and image special effects.
15. Design a static website for your institution containing at least five web pages (ensure to use iframes, forms, css including special effects, float mechanism and menu system).

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Illustrate the basic features of HTML5	Ap	PSO – 1, 2, 3
CO2	Use advanced HTML features for web designing	Ap	PSO – 1, 2, 3
CO3	Develop basic stylesheets in various CSS levels	Ap	PSO – 1, 2, 3
CO4	Develop stylesheets for high level visual designs	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO WEB PROGRAMMING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Illustrate the basic features of HTML5	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P
2	Use advanced HTML features for web designing	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P
3	Develop basic stylesheets in various CSS levels	PO – 3, 5, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P
4	Develop stylesheets for high level visual designs	PO – 3, 5, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2	PSO3	PSO4
CO1	-	-	3	-	-	3	3	-	2	1	2	-
CO2	-	-	3	-	-	3	3	-	2	1	2	-
CO3	-	-	3	-	1	3	3	-	2	1	2	-
CO4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

5. INFORMATICS

Discipline	COMPUTER SCIENCE				
Course Code	UK1DSCCSC104				
Course Title	INFORMATICS				
Type of Course	**DSC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Nil				
Course Summary	This course serves as an introduction to the field of informatics, covering foundational concepts, theories, and practical applications. Students will explore various aspects of informatics and their societal impact. The course will also emphasise critical thinking and problem-solving skills essential in the field.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to Informatics**	12
	1	Number Systems,- ASCII, BCD, EBCDIC,Binary, Octal, Hexadecimal, Basic Conversions, colour formats- RGB,CMYK, hue,saturation, Latest display devices.	
	2	Network devices- Repeater, Hub, Switch, Modem, Router, Bridge, Gateway.	
	3	Email System- SMTP, POP, MIME	
	4	Mobile Systems- generations- 1G, 2G, 3G, 4G, 5G, GSM	
II		**Knowledge skills for Higher Education**	12

	5	Data information and Knowledge, Internet and Academic search techniques, Search engines	
	6	Creating your cyber presence, Podcasts, Weblogs and Videologs, Webcasts, E-mail.	
	7	Social Informatics: IT and society, issues and concerns, Digital divide, IT and development : new opportunities	
	8	Cyber ethics, cyber crime, cyber threats, cyber security, cyber laws, cyber addictions, Social cybernetics.	
III		**Softwares/Tools for Informatics**	**12**
	9	Geoinformatics, Components of Geoinformatics, Evolution of Geoinformatics as a Multidisciplinary Discipline, Applications, Geoinformatics Products.	
	10	Case study: ArcGIS/ QGIS (Quantum GIS)	
	11	Bioinformatics: Introduction **to** Bioinformatics**,** Definition and scope of bioinformatics, Importance of bioinformatics in biological research	
	12	History of Bioinformatics : Biological Databases and Data Retrieval, Overview of major sequence biological databases (e.g., GenBank, UniProt, NCBI)	
IV		**Digital Marketing/ Artificial Intelligence tools for Business**	**12**
	14	Website creation, Image generator	
	15	Generative AI, AI prompt generator	
	16	Audio/Video Generator, Social Media Advertisements Generator.	
V		**Flexi Module:Not included for End Semester Exams**	**12**
	17	Canva, Gemini	
	18	Wordpress, facebook	
	19	bing.com, chatGPT	

Core References:

1. Alexis Leon, Mathews Leon, Leon Vikas, “Fundamentals Of Information Technology” , Tata McGraw Hill Education, Second Edition, 2009.
2. Informatics and Cyber Ethics : Dr Antony Thomas, Pratibha Publications.

3. Vijayakumaran Nair, Vinod Chandra S S, Informatics, PHI, 2014
4. V.RajaramanIntroduction to Information Technology,, PHI, Third Edition, 2018
5. Pradeep K. Sinha, Priti SinhaInformation Technology,, PHI, 2017
6. Principles and Theory of Geoinformatics, P.K. Garg, Khanna Books, Edition: 1, 2019.

Web site references:

1. https://www.wscubetech.com/blog/ai-tools-for-digital-marketing/

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Explain the basics of computers	U	PSO-1
CO-2	Identify the skills for higher education	U	PSO-1
CO-3	Apply Softwares/Tools for Informatics	Ap	PSO-1, 3
CO-4	Use different Digital Marketing/ Artificial Intelligence tools for Business	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INFORMATICS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Explain the basics of computers	PO- 6, 7 PSO-1	U	F,C	L	-
CO2	Identify the skills for higher education	PO- 3, 6, 7, 8 PSO-1	U	F,C	L	-

CO3	Apply Softwares/Tools for Informatics	PO- 4, 5, 6,7 PSO-1, 3	Ap	F,C,P	L	-
CO4	Use different Digital Marketing/ Artificial Intelligence tools for Business	PO- 5, 6,7 PSO-1, 2	Ap	F,C,P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	-	-	2	1	-	1	-	-	-
CO 2	-	-	-	-	-	2	1	3	2	-	-	-
CO 3	-	-	-	1	2	2	3	-	2	-	1	-
CO 4	-	-	2	-	1	2	3	-	2	1	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examination
CO 1	✓	-	✓
CO 2	✓	✓	✓
CO 3	✓	✓	✓
CO 4	✓	-	✓

6. INTERNET TECHNOLOGY

Discipline	Computer Science				
Course Code	UK1DSCCSC105				
Course Title	INTERNET TECHNOLOGY				
Type of Course	DSC				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	4	4 hours	-	-	4 hours
Pre-requisites	Knowledge of the basics of computers is necessary.				
Course Summary	This course provides an introduction about the components of the Internet, its working and the way in which web pages are designed.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Network Technology**	**12**
	1	Introduction to Computer Networks- Advantages of Networks, Goals of Networks	
	2	Types of Networks- LAN, MAN, WAN, Internet, Public Networks	
	3	LAN topologies- Bus, Star, Ring, Mesh	
	4	Interconnecting Issues, Types, Connectivity Devices, Hubs, Switch, Bridges, Routers	
II		**Web Pages**	**12**
	5	Introduction to WWW-WWW and HTTP, Webpage	
	6	Introduction to Web Browser- BookMarks- Comparison, Directories	
	7	Search Engines-Working and features-Search Strategies – Search Generalization-Search Specialization-Working.	
	8	Uniform Resource Locator (URL), Email-Working with Email-Sending Mail-Reading Mail-Replying to Mail-Deleting Mail-Advantages and Disadvantages of Email	
III		**Internet Protocol**	**12**

	9	Introduction to Internet -Meaning of Internet	
	10	WWW- History, Working of Internet, Browsing, Searching the Web	
	11	Internet protocols- TCP/IP Protocol suite, UDP, IP addresses, IP Versions – IPV4, IPV6	
	12	Services of the Internet- FTP, HTTP, Email	
IV	**Web Design using HTML**		**12**
	18	HTML- Understanding HTML, Text tags	
	19	Graphics, Video and Sound Tags; Link and Anchor Tags	
	20	Table Tags; Frame Tags	
	21	Miscellaneous tags (layers, image maps etc)	
V		**Advanced Internet Technologies**	**12**
	22	3G, 4G, 5G Networks, Internet of Behaviors	
	23	XR, AR, VR, Edge AI	
	24	Serverless Computing, Zero Trust Security, Federated Learning	

Text Books and Materials

1. Dr.Surender Jangra, “Basics of Internet and Web”, Vayu Education of India. New Delhi, 110002
2. Raymond Greenlaw, Ellen Hepp, “Fundamentals of Internet and the World Wide Web, McGraw-Hill.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise about Network Technologies	U	PSO-1
CO-2	Outline structure of a Web Page	U	PSO-1
CO-3	Cite techniques used in Internet Protocol	U	PSO-1
CO-4	Develop Web pages using HTML	Ap	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTERNET TECHNOLOGY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarise about Network Technologies	PO-6, 7 PSO-1	U	F, C	L	-
CO-2	Outline structure of a Web Page	PO-6, 7 PSO-1	U	F, C	L	-
CO-3	Cite techniques used in Internet Protocol	PO-6, 7 PSO-1	U	F, C	L	-
CO-4	Develop Web pages using HTML	PO-3, 5, 6, 7 PSO-1, 2	Ap	F, C,P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	1	1	-	2	-	-	-
CO 2	-	-	-	-	-	2	1	-	3	-	-	-
CO 3	-	-	-	-	-	2	1	-	3	-	-	-
CO 4	-	-	2	-	2	2	1	-	3	1	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Seminar**	**End Semester Examination**
CO 1	✓	✓		✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓	✓	✓

7. DATA SCIENCE FUNDAMENTALS

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK1DSCCSC106</td></tr>
<tr><td>Course Title</td><td colspan="5">DATA SCIENCE FUNDAMENTALS</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">I</td></tr>
<tr><td>Academic Level</td><td colspan="5">1</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course aims to introduce the student to the main concepts of data science, understand the essential principles and to implement spreadsheet-based data analysis. Through a blend of theoretical understanding and hands-on practice, learners will develop a solid foundation in data preprocessing, data integration, data transformation, data reduction and skills to apply statistical analysis techniques using Spreadsheet.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Fundamentals of Data Science**	15
	1	Introduction, Why Data Science, Types of Data analysis: Descriptive analysis, Diagnostic analysis, Predictive analysis and Prescriptive analysis.	
	2	Data Analytics life cycle: Data discovery, Data Preparation, Model planning, Model Building, Communicate Results, and Operationalization.	
	3	Data Science tools: Python programming, R programming, SAS, Spreadsheet, Tableau Public, RapidMiner, Knime, Apache Spark.	
	4	Fundamental areas of study in data science: Machine Learning, Deep Learning, NLP, Statistical data analysis, Knowledge discovery and data mining, Text mining, Recommender systems, Data visualization, Computer Vision, and Spatial data management.	
	5	Role of SQL in data science, Pros and Cons of data science	
II		**Data Pre-processing**	15
	6	Introduction, data types and forms, possible data error types,	
	7	Various data pre -processing operations: Data Cleaning: Filling missing values, Smoothing noisy data, Detecting and removing outliers.	
	8	Data Integration: Virtual integration, physical data integration, Application based integration, Manual Integration, and middleware data integration.	
	9	Data Transformation: Rescaling data, Normalising data, Binarizing data, Standardising data.	
	10	Data Reduction: Dimensionality reduction, Data cube aggregation, Numerosity reduction. Data Discretization: Top-down discretization, Bottom-up discretization.	
III		**Data Analysis with Worksheet**	15
	11	Introduction to Worksheet: Creation and Formatting.	
	12	Ranges and Tables-Data Cleaning with Text Functions, Containing Date Values and Containing Time Values	
	13	Conditional Formatting, Sorting and Filtering	

	14	Subtotals with Ranges, Creating Macros, Pivot Table.	
IV	**Data Plotting and Visualization**		**15**
	15	Introduction, Visual encoding, Basic data visualization tools: Histograms, Bar Charts/Graphs, Scatter plots and Area plots. Data visualization types: Temporal data, Hierarchical data, Network data, Multi-dimensional data, Geospatial data and Multivariate data.	
	16	Lookup Functions: LOOKUP and VLOOKUP and HLOOKUP.	
	17	Data Visualization using Band Chart, Thermometer Chart, Gantt chart, Waterfall Chart and Pivot Charts. Types of jobs in data analytics: Data Analyst, Data scientist, Data engineer, Database administrator, Data architect, and Analytics manager.	
V		**Flexi Module (Not Included for End Semester Examination)**	**15**
	18	Advanced data visualization tools	
	19	Visualization of geospatial data	
	20	Statistical Data Analysis : Probability theory	

REFERENCES

Core

1. Gypsy Nandi and Rupam Kumar Sharma, Data Science fundamentals and practical approaches, First Edition, BPB Publication, 2020 **.**

2. Bernd Held, Excel Functions and Formulas, BPB Publications.

Additional

1. V K Jain, Data Science and Analytics, Khanna Publishing.
2. Joel Grus, Data Science From Scratch, Second Edition, Oreilly.

LAB EXERCISES

PART A

1. Create a workbook and perform the operations: Selecting range of columns, hiding /show rows and columns and rename the worksheet.
2. Create workbook with student mark details. Include formulas to calculate total, percentage and grade.
3. Create worksheet with student mark details and perform the following operations
   i. Find the number of students having percentage more than 70.
   ii. Find the number of students having percentage between 60 and 80.
   iii. Find the number of students passed in a subject

iv. Find the student who got highest mark in a subject.

4. Create a worksheet with Employee salary details. Find mean, median, mode, standard deviation and variance.
5. Create a workbook with sales details and use the functions: TRIM and CLEAN.
6. Create worksheet with student mark details. Use sorting and filtering functions.
7. Create a worksheet with employee details. Use date and time values. Calculate salary details and bonus using functions.
8. Create a worksheet with student name as a column. Add three more columns First name, Last name and e-mail. Find the values of First name, Last name and e-mail(Firstname_lastname@gmail.com). Use text functions.
9. Enter your date of birth and today’s date in two cells. Find your age in days, months and years.
10. Prepare a worksheet with sales details. Make pivot table having product and category in row label.

PART B

11. Create a worksheet for flower shop with invoiceid, flower name, price, qty and total price. Enter 10 records. Make pivot table and pivot charts.
12. Create a worksheet with Fruits supply details. Apply LOOKUP, VLOOKUP and HLOOUP functions.
13. Assign a macro to a command button to display “welcome” in a cell.
14. Assign a macro to a command button to display “welcome” in a message box.
15. Assign a macro to a command button to find total number of sheets in a workbook.
16. Assign a macro to a command button to add a new worksheet.
17. Assign a macro to a command button to add a new workbook.
18. Prepare a worksheet with wildlife population of different states in India. Display in Pie chart and Bar chart.
19. Prepare a worksheet with total number of primary schools in each district of kerala. Include different charts.
20. Create a worksheet with employee salary details. Include charts.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss about the fundamentals of Data Science	U	PSO -1
CO-2	Illustrate the usage of Data Pre-processing techniques	Ap	PSO-1,2,3
CO-3	Use data science concepts in real world problems	An	PSO-1,2,3
CO-4	Build Data Analytics and management Skill	Ap	PSO-1,2,3,4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA SCIENCE FUNDAMENTALS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO-1	Discuss about the fundamentals of Data Science	PO-7 PSO-1,2	U	F, C	L	-
CO-2	Illustrate the usage of Data Pre-processing techniques	PO-7 PSO-1,2,3	Ap	C, P	L	P
CO-3	Use data science concepts in real world problems	PO-7 PSO-1,2,3	An	F, C, P	L	P
CO-4	Build Data Analytics and management Skill	PO-7 PSO-1,2,3,4	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	-	1	-	1	1	-	-
CO 2	-	-	-	-	-	-	2	-	2	2	2	-
CO 3	-	-	-	-	-	-	2	-	1	2	2	-
CO 4	-	-	-	-	-	-	2	-	2	2	2	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4		✓		✓

8. INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Discipline	COMPUTER SCIENCE
Course Code	UK1DSCCSC107
Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Type of Course	DSC
Semester	I
Academic Level	1 .

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Knowledge in basic concepts about inference and logic is preferred				
Course Summary	This course aims to give students a brief idea about Artificial Intelligence and its associated concepts and applications. Artificial intelligence, or AI, as generally termed, is an umbrella term and refers to the simulation of human intelligence by software-coded heuristics. The ideal characteristic of artificial intelligence is its ability to rationalise and take actions, similar to that of the human mind, that have the best chance of achieving a specific goal.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I	**Part 1: Introduction**		**12**
	1	What is Artificial Intelligence	
	2	Foundations and History of Artificial Intelligence	
	3	Applications of Artificial Intelligence	
	4	Intelligent Agents	
	5	Structure of Intelligent Agents	
	Part 2: Search Strategies		**12**
	6	Introduction to Search	
	7	Searching for solutions	
	8	Uninformed search strategies (Breadth First Search, Depth First Search, Depth Limited Search, Uniform Cost Search)	
	9	Informed search strategies (Best First Search, A*, Hill Climbing)	

	10	Local search algorithms and optimistic problems (Travelling Salesman Problem)	
	11	Adversarial Search (Algorithms not needed)	
	12	Current-best-hypothesis search (only basic concept & list of applications)	
II		**Knowledge Representation & Reasoning**	**12**
	13	Overview of Inference, Propositional & Predicate Logic	
	14	Logical Reasoning	
	15	Forward & Backward Chaining	
	16	Resolution	
	17	AI languages and tools - Lisp, Prolog, CLIPS	
III		**Problem Solving**	**12**
	18	Formulating problems	
	19	Problem Types	
	20	Solving Problems by Searching	
	21	Heuristic search techniques	
	22	Constraint satisfaction problems (Only basic concepts)	
	23	Stochastic search methods (Simulated Annealing, Genetic Algorithms)	
IV		**Learning**	**12**
	24	Overview of different forms of learning	
	25	Decision trees	

	26	Rule-based learning	
	27	Neural networks	
	28	Reinforcement learning	
V		**Flexi Module: Not include in End Semester Exams**	**12**
	29	New features in HTML5 and CSS3,	
	30	Designing a static website of student's choice,	
	31	Case study on some recent web designing tools.	

Text Books

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education

References

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill publishers.
3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	U	PSO - 1
CO2	Demonstrate the different searching techniques practised in AI	Ap	PSO - 1, 2, 3
CO3	Summarise knowledge representation and reasoning in the context of AI	U	PSO - 1, 2
CO4	Illustrate AI Problems and different ways of problem solving	Ap	PSO - 1, 2

R-Remember, U-Understand, Ap-Apply, An- Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	PSO - 1	U	F, C	L	-
2	Demonstrate the different searching techniques practised in AI	PSO - 1, 2, 3	Ap	F, C, P	L	-
3	Summarise knowledge representation and reasoning in the context of AI	PSO - 1, 2	U	F, C	L	-
4	Illustrate AI Problems and different ways of problem solving	PSO - 1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	2	2	-	3	-	-	-
CO2	2	1	-	2	1	2	2	-	3	2	1	-
CO3	3	2	-	-	-	2	3	-	3	2	-	-
CO4	2	3	-	-	-	2	2	-	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar *	Quiz	End Semester Examinations
CO1	✓				✓
CO2	✓		✓		✓
CO3	✓			✓	✓
CO4	✓	✓			✓
CO5	✓	✓			✓

***** Seminar on search strategies (to be conducted as group)

9. HEALTH INFORMATICS

Discipline	Computer Science				
Course Code	UK1DSCCSC108				
Course Title	HEALTH INFORMATICS				
Type of Course	DSC				
Semester	I				
Academic Level	1 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge on health is desirable.				
Course Summary	Health informatics focuses on the use of information technology to improve healthcare delivery, patient outcomes, and population health. This course provides an overview of key concepts, methods, and technologies in health informatics, with a focus on practical applications and case studies.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Overview**	12
	1	Introduction, Informatics Definitions, Background, Historical Highlights, Key Players in Health Information Technology, Organisations Involved with HIT, Barriers to Health Information Technology Adoption, Health Informatics Programs, Organizations and Careers, Health Informatics Resources, Future Trends.	
	2	Healthcare Data, Information and Knowledge: Definitions and Concepts- Data, Information and Knowledge, Informatics vs. Information Technology and Computer Science, Converting Data to Information to Knowledge, Clinical Data Warehouses (CDWs), Difficulties of Informatics, Why Health IT Fails Sometimes.	
II		**Healthcare Data Analytics and Electronic Health Records**	12
	3	**Healthcare Data Analytics:** Introduction, Terminology of Analytics, Challenges to Data Analytics, Research and Application of Analytics, Role of Informaticians in Analytics.	
	4	**Electronic Health Records:** Electronic Health Record Definitions, Need for Electronic Health Records, Institute of Medicine's Vision for EHRs, Electronic Health Record Key Components, Computerized Physician Order Entry (CPOE), Clinical Decision Support Systems (CDSS), Electronic Prescribing, Practice Management Integration, Electronic Health Record Adoption, Electronic Health Record and Meaningful Use Challenges, Logical Steps to Selecting and Implementing an EHR.	
III		**Data Standards and Medical Coding**	12

	5	Introduction; **Content Standards**: Extensible Markup Language (XML), Health Level Seven (HL7), The Consolidated Clinical Document Architecture (Consolidated CDA), Digital Imaging and Communications in Medicine (DICOM); **Terminology Standards:** Logical Observations- Identifiers, Names and Codes (LOINC), RxNorm, Systematized Nomenclature of Medicine: Clinical Terminology (SNOMED-CT) , MEDCIN®	
	6	**Transport Standards:** EHR-Lab Interoperability and Connectivity Standards (ELINCS), IEEE 11073, National Council for Prescription Drug Programs (NCPDP), Accredited Standards Committee (ASC) X12; Medical Coding and Reimbursement	
IV	**Health Information - Privacy, Security and Ethics**		**12**
	7	Introduction; HIPAA Review, Basic Security Principles, HIPAA, Meaningful Use, and the HITECH Act, Authentication and Identity Management, Security Breaches and Attacks, Medical Privacy and Security Stories in the News	
	8	Health Informatics Ethics: Informatics Ethics, International Considerations: Ethics, Laws and Culture, Codes of Individual Countries, Difficulties Applying Medical Ethics in the Digital World.	
V	**Flexi Module (Not included for end semester exam)**		**12**
	9	Consumer Health Informatics: The Origins of Current State of Consumer Health Informatics, Classification of Consumer Health Informatics Applications, Health Education & Information Applications	
	10	Mobile Technology and mHealth: Mobile Health (mHealth), Mobile Technology and Patients, Mobile Technology and Clinicians, Mobile Telemedicine Projects	

References

Core

1. Robert E. Hoyt and Ann K. Yoshihashi, “Health Informatics Practical Guide for Healthcare and Information Technology Professionals”, Sixth Edition.

Additional

2. William Hersh, “Health Informatics: A Practical Guide"
3. Stephan P. Kudyba and Richard M. Hillestad, "Healthcare Informatics: Improving Efficiency through Technology, Analytics, and Management"

Case Study

1. Familiarise with any one Health informatic systems
2. Identify and categorise various tools available in Health Informatic systems
3. Prepare a report on various Health Informatic systems, its advantages and limitations.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Explain the basic concepts of Health Informatics	U	PSO-1
CO2	Illustrate the role of Healthcare Data Analytics and Electronic Health Records	Ap	PSO-1, 3
CO3	Summarise Data Standards and Medical Coding concepts	U	PSO-1
CO4	Infer the role of privacy, security and ethics in health systems	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: HEALTH INFORMATICS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Explain the basic concepts of Health Informatics	PO-6,7 PSO-1	U	F, C	L	-
CO2	Illustrate the role of Healthcare Data Analytics and Electronic Health Records	PO-4, 5, 6,7 PSO-1, 3	Ap	F, C, P	L	-
CO3	Summarize Data Standards and	PO-6,7 PSO-1	U	F, C	L	-

	Medical Coding concepts					
CO4	Infer the role of privacy, security and ethics in health systems	PO-6,7, 8 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	1	-	2	-	-	-
CO 2	-	-	-	2	2	2	2	-	2	-	2	-
CO 3	-	-	-	-	-	2	1	-	2	-	-	-
CO 4	-	-	-	-	-	2	1	3	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Case Study	End Semester Examination
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓			✓

MDC

10. WEB DESIGNING USING HTML5 AND CSS3

Discipline	COMPUTER SCIENCE				
Course Code	UK1MDCCSC100				
Course Title	WEB DESIGNING USING HTML5 AND CSS3				
Type of Course	**MDC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 Hours	-	2 Hours	4 hours
Pre-requisites	Basic knowledge of internet				
Course Summary	Web design is the planning and creation of websites. This includes a number of separate skills that all fall under the umbrella of web design. This course aims to instil in students these skills which includes information architecture, user interface, site structure, navigation, layout, colours, fonts, and overall imagery. It also trains students on basic web design elements like overall layout, colour scheme, typography,				

	navigation and content. Simple web pages are designed using HTML5 and CSS3.

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Basics of HTML5**	**12**
	1	HTML foundations, usage of Doctype and charset	
	2	Familiarization of basic html tags including headings, paragraphs and text formats	
	3	Design using basic html tags	
	4	Managing information with lists and tables	
	5	Making connections with links – hyperlinks, anchors, urls	
	6	Design of various lists, tables and links	
II		**Additional Features of HTML5**	**12**
	7	Adding Images to your pages – Image and ImageMaps	
	8	Working with audio and video	
	9	Design using image and media elements (Practical)	
	10	Sectioning Elements – nav, article, main, header, footer and section tags	
	11	Progress Elements	
	12	Design using sectioning and progress elements (Practical)	
III		**Advanced Features of HTML5**	**12**
	13	Div and Frames	
	14	IFrames	
	15	Design of web pages as frames and iframes (Practical)	
	16	Creating Forms using basic input elements	

	17	New Form Input Types	
	18	Designing of Forms (Practical)	
IV		**Introduction to CSS3**	**12**
	19	Style Element and Stylesheet	
	20	Specifying colors in CSS	
	21	Creating your own color scheme	
	22	Fonts and typefaces	
	23	Setting various font attributes	
	24	Selectors – IDs, Classes and Pseudo classes	
	25	New CSS3 Selectors	
	26	Borders and Backgrounds	
	27	New CSS3 border techniques	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	28	Levels of CSS	
	29	Using HTML with CSS	
	30	Designing web pages with stylesheets (Practical)	
	31	Creating dynamic lists	
	32	Building a basic menu system	
	33	Create a simple website using HTML and CSS (Project)	

References

Core:

1. Andy Harris, “HTML5 and CSS3 All-in-one for Dummies”, A Wiley Brand, Third Edition

Additional:

1. https://books.goalkicker.com/HTML5Book/

LAB EXERCISES

Programs(Part A)

1. Design using basic html tags
2. Design of various lists, tables and links
3. Design using image and media elements
4. Design using sectioning and progress elements

Programs(Part B)

1. Design of web pages as frames and iframes
2. Designing of Forms
3. Designing web pages with stylesheets
4. Create a simple website using HTML and CSS

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Illustrate the basic features of HTML5	Ap	PSO-1,2
CO-2	Use advanced HTML features for web designing	Ap	PSO-1,2,3
CO3	Develop basic stylesheets in various CSS levels	Ap	PSO-1,2,3
CO4	Build websites using HTML and CSS	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: WEB DESIGNING USING HTML5 AND CSS3

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Illustrate the basic features of HTML5	PO - 3, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P

2	Use advanced HTML features for web designing	PO-3, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
3	Develop basic stylesheets in various CSS levels	PO -3, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
4	Build websites using HTML and CSS	PO 1, 5, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	1	1	-	2	1	1	-
CO 2	-	-	2	-	-	1	2	-	2	1	1	-
CO 3	-	-	2	-	-	1	2	-	2	1	1	-
CO 4	-	-	3	-	-	2	2	-	2	1	1	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examination**
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

11. INTRODUCTION TO IT

Discipline	Computer Science				
Course Code	UK1MDCCSC101				
Course Title	INTRODUCTION TO IT				
Type of Course	MDC				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3 hours
Pre-requisites	Basic knowledge about computers and Information Technology				

Course Summary	This course provides basic knowledge about Information technology and Computers.

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Basic Ideas of Computer Technology**	9
	1	Introduction, Characteristics of a computer, Stored Programme Concept	
	2	Inside a computer: SMPS, Motherboard, BIOS, CMOS, Ports and Interfaces, Expansion Cards, Ribbon Cables	
	3	Computer Software and categories: System software, Application software	
	4	Terminology software: Firmware, Liveware, Public-domain software, Freeware, Shareware, Commercial software, Proprietary software, Semi-free software	
II		**Computer Hardware**	9
	5	CPU, Memory, Input devices, output devices. Memory units: RAM (SDRAM, DDR RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory;	
	6	Auxiliary storage: Magnetic devices, Optical Devices; Floppy, Hard disk, Memory stick, CD, DVD, CD-Writer;	
	7	Input devices - keyboard, mouse, scanner, speech input devices, digital camera, Touch screen, Joystick, Optical readers, bar code reader;	
	8	Output devices: Display device, size and resolution; CRT, LCD; Printers: Dotmatrix, Inkjet, Laser; Plotters, Sound cards & speaker.	
III		**Introduction to Software**	9
	9	System software, Application software	
	10	Operating systems, different types	
	11	Programming Languages, Compiler, Interpreter, Databases; Application softwares	

	12	Computer Viruses & Protection, Free software, open source.	
IV	**Networks and Internet**		**9**
	13	Connecting computers, Requirements for a network: Server, Workstation, switch, router	
	14	Network Types, Topologies	
	15	Internet: brief history, World Wide Web, Websites, URL, browsers, search engines, search tips	
	16	Internet Protocol- TCP/IP, FTP, HTTP	
	17	Electronic Mail	
V	**Flexi Module: Not included for End Semester Exams**		**9**
	18	Artificial Intelligence, IoT, Digital Twins, 3G, 4G, 5G	
	19	Block Chain, DLT, Biometric Authentication	
	20	Extended Reality – AR, VR, MR	
	21	Cyber Security Techniques, Cloud Computing Basics	

Textbooks and Materials

1. Vijayakumaran Nair K, Vinod Chandra S S," Informatics", PHI 2014

2. V.Rajaraman,"Introduction to Information Technology", PHI, Third Edition

3. Pradeep.K.Sinha, Priti Sinha, "Information Technology: Theory and Practice", Kindle Edition,

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise the basic ideas of Computer Technologies	U	PSO-1

CO-2	Identify Computer Hardware components	U	PSO-1
CO-3	Explain the basics of Software	U	PSO-1
CO-4	Discuss the tools and applications of Network	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Summarise the basic ideas of Computer Technologies	PSO-1 PO-6, 7	U	F, C	L	-
CO-2	Identify Computer Hardware components	PSO-1 PO-6, 7	U	F, C	L	-
CO-3	Explain the basics of Software	PSO-1 PO-5, 6, 7	U	F, C	L	-
CO-4	Discuss the tools and applications of Network	PSO-1 PO-5, 6, 7	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	1	1	-	1	-	-	-
CO 2	-	-	-	-	-	1	1	-	2	-	-	-
CO 3	-	-	-	-	2	1	2	-	3	-	-	-
CO 4	-	-	-	-	2	2	2	-	3	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓

CO 2	✓			✓
CO 3	✓		✓	✓
CO 4		✓	✓	✓

12. BASICS OF MICROPROCESSORS

Discipline	Computer Science				
Course Code	UK1MDCCSC102				
Course Title	BASICS OF MICROPROCESSORS				
Type of Course	**MDC**				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Knowledge on number systems - Binary and Hexadecimal				
Course Summary	This Course covers the architecture and operations of 8085 and 8086 microprocessors, focusing on their instruction cycles, system buses, and binary/hexadecimal data handling. It details the pin functions and instruction sets, emphasising assembly language programming skills. Students will also learn about assembler commands and TASM programming for the 8086.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Introduction to 8085**		**12**
	1	Introduction to microprocessors	

	2	8085 Architecture	
	3	Buses and demultiplexing of buses, Instruction set	
	4	Addressing modes (8085)	
II		**Pins, signals and Instruction Cycle**	**12**
	5	Pin Diagram and Signals	
	6	Fetch, Decode and Execute cycles	
	7	Instruction Cycle - Timing diagram	
III		**Introduction to 8086**	**12**
	8	8086 Architecture	
	9	Flag register and its functions (8086)	
	10	Instruction set of 8086	
	11	Addressing modes	
		8086 -Fetch, Decode and Execute cycles	
	12	Instruction Cycle	
	13	Buses and Demultiplexing of Buses	
	14	8086 Memory banks (Even bank, Odd Bank)	
IV		**Assembly Language Programming**	**12**
	15	Program Development Tools	
	16	Assembler Directives	
	17	Introduction to TASM programs-8086	
V		**Flexi Module: Not included for End-Semester Exams**	**12**
	18	Comparison between 8085 and 8086 microprocessors,	
	19	Discuss the applications of the 8086 microprocessors.	

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8086 .
2. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, 1st edition.
3. Nagoor Kani A, 8085 Microprocessor and Applications, 4th edition.
4. N. Mathivanan, Microprocessors, PC Hardware and Interfacing, PHI Edition, Publisher: PHI.

REFERENCES

1. B. Ram, Fundamentals of Microprocessors and Microcontrollers, 1st edition, Dhanpat Rai Publications, 2018.
2. A Nagoor Kani, 8086 Microprocessor and its applications, 2nd edition, McGraw Hill, 2017
3. John D Carpinelli, Computer system organisation and architecture, Pearson Education, 2002

Web Resources

1. https://www.youtube.com/playlist?list=PLgwJf8NK-2e5vHwmowy_kGtjq9Ih0FzwN
2. https://www.javatpoint.com/instruction-set-of-8085
3. https://www.geeksforgeeks.org/architecture-of-8086/
4. https://en.wikipedia.org/wiki/Intel_8086

LAB EXERCISES (ANY 10 EXPERIMENTS)

PART A (8085 EXPERIMENTS)

1. Basic Arithmetic Operations (Addition, Subtraction, Multiplication, Division)
2. Program to find factorial a number
3. Program to find out the largest among N numbers

PART B (TASM PROGRAMS-8086)

1. Basic Arithmetic Operations (Addition, Subtraction, Multiplication, Division)
2. Program to find the sum of numbers in an array
3. Program to search a number in an array
4. Program to find out the Smallest among N numbers

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Demonstrate the basic architecture and Instruction set of 8085 microprocessor.	Ap	PSO-1, 3
CO-2	Use 8085 Instruction set, Learn Fetch, Decode, Execute operations and timing diagrams.	Ap	PSO-1, 3
CO-3	Illustrate 8086 architecture, instruction set and the timing diagram for 8086 microprocessors.	Ap	PSO-1, 3
CO-4	Develop Assembly Language Programs	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: BASICS OF MICROPROCESSORS

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Demonstrate the basic architecture and Instruction set of 8085 microprocessor	PSO - 1, 3 PO-1, 2, 6, 7	Ap	F, C	L	P
CO-2	Use 8085 Instruction set, Learn Fetch, Decode, Execute operations and timing diagrams	PSO - 1, 2, 3 PO – 1, 2, 6, 7	Ap	F, C, P	L	P

CO-3	Illustrate 8086 architecture, instruction set and the timing diagram for 8086 microprocessors.	PSO - 1,2, 3 PO – 1, 2, 6, 7	Ap	F, C, P	L	P
CO-4	Develop Assembly Language Programs	PSO - 2, 3 PO – 1, 2, 6, 7	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	1	-	-	-	1	1	-	2	1	2	-
CO 2	1	1	-	-	-	1	1	-	2	1	2	-
CO 3	1	1	-	-	-	1	1	-	2	1	2	-
CO 4	2	2	-	-	-	1	2	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1		✓		✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓	✓	✓

13. INTRODUCTION TO DATA SCIENCE

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK1MDCCSC103</td></tr>
<tr><td>Course Title</td><td colspan="5">INTRODUCTION TO DATA SCIENCE</td></tr>
<tr><td>Type of Course</td><td colspan="5">MDC</td></tr>
<tr><td>Semester</td><td colspan="5">I</td></tr>
<tr><td>Academic Level</td><td colspan="5">1</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>3</td><td>2 hours</td><td>-</td><td>2 hours</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course aims to introduce the main concepts of data science, understand the essential principles and to implement spreadsheet-based data analysis. Through a blend of theoretical understanding and hands-on practice, learners will develop a solid foundation in data preprocessing, data integration, data transformation, data reduction and skills to apply statistical analysis techniques using Spreadsheet.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Fundamentals of Data Science**	**12**
	1	Introduction, Why Data Science, Types of Data analysis: Descriptive analysis, Diagnostic analysis, Predictive analysis and Prescriptive analysis.	
	2	Data Analytics life cycle: Data discovery, Data Preparation, Model planning, Model Building, Communicate Results, and Operationalization.	
	3	Data Science tools: Python programming, R programming, SAS, Spreadsheet, Tableau Public, RapidMiner, Knime, Apache Spark.	
	4	Fundamental areas of study in data science: Machine Learning, Deep Learning, NLP, Statistical data analysis, Knowledge discovery and data	

		mining, Text mining, Recommender systems, Data visualization, Computer Vision, and Spatial data management.	
	5	Role of SQL in data science, Pros and Cons of data science	
II		**Data Pre-processing**	**12**
	6	Introduction, data types and forms, possible data error types,	
	7	Various data pre -processing operations: Data Cleaning: Filling missing values, Smoothing noisy data, Detecting and removing outliers.	
	8	Data Integration: Virtual integration, physical data integration, Application based integration, Manual Integration, and middleware data integration.	
	9	Data Transformation: Rescaling data, Normalizing data, Binarizing data, Standardizing data.	
	10	Data Reduction: Dimensionality reduction, Data cube aggregation, Numerosity reduction. Data Discretization: Top-down discretization, Bottom-up discretization.	
III		**Data Analysis with Worksheet**	**12**
	11	Introduction to Worksheet: Creation and Formatting.	
	12	Ranges and Tables-Data Cleaning with Text Functions, Containing Date Values and Containing Time Values	
	13	Conditional Formatting, Sorting and Filtering	
	14	Subtotals with Ranges, Creating Macros, Pivot Table.	
IV		**Data Plotting and Visualization**	**12**
	15	Introduction, Visual encoding, Basic data visualization tools: Histograms, Bar Charts/Graphs, Scatter plots and Area plots. Data visualization types: Temporal data, Hierarchical data, Network data, Multi-dimensional data, Geospatial data and Multivariate data.	
	16	Lookup Functions: LOOKUP and VLOOKUP and HLOOKUP.	
	17	Data Visualization using Band Chart, Thermometer Chart, Gantt chart, Waterfall Chart and Pivot Charts. Types of jobs in data analytics: Data Analyst, Data scientist, Data engineer, Database administrator, Data architect, and Analytics manager.	

V		**Flexi Module (Not Included for End Semester Examination)**	**12**
	18	Advanced data visualization tools	
	19	Visualization of geospatial data	
	20	Statistical Data Analysis : Probability theory	

REFERENCES

Core

1. Gypsy Nandi and Rupam Kumar Sharma, Data Science fundamentals and practical approaches, First Edition, BPB Publication, 2020 **.**

2. Bernd Held, Excel Functions and Formulas, BPB Publications.

Additional

1. V K Jain, Data Science and Analytics, Khanna Publishing.
2. Joel Grus, Data Science From Scratch, Second Edition, Oreilly.

LAB EXERCISES

PART A

1. Create a workbook and perform the operations: Selecting range of columns, hiding /show rows and columns and rename the worksheet.
2. Create a workbook with student mark details. Include formulas to calculate total, percentage and grade.
3. Create worksheet with student mark details and perform the following operations
   i. Find the number of students having a percentage more than 70.
   ii. Find the number of students having percentage between 60 and 80.
   iii. Find the number of students passed in a subject
   iv. Find the student who got highest mark in a subject.
4. Create a worksheet with Employee salary details. Find mean, median, mode, standard deviation and variance.
5. Create a workbook with sales details and use the functions: TRIM and CLEAN.
6. Create a worksheet with student mark details. Use sorting and filtering functions.
7. Create a worksheet with employee details. Use date and time values. Calculate salary details and bonus using functions.
8. Create a worksheet with the student name as a column. Add three more columns: First name, Last name and e-mail. Find the values of First name, Last name and e-mail(Firstname_lastname@gmail.com). Use text functions.
9. Enter your date of birth and today’s date in two cells. Find your age in days, months and years.
10. Prepare a worksheet with sales details. Make a pivot table having product and category in row label.

PART B

11. Create a worksheet for the flower shop with invoice_id, flower name, price, qty and total price. Enter 10 records. Make pivot table and pivot charts.
12. Create a worksheet with Fruits supply details. Apply LOOKUP, VLOOKUP and HLOOKUP functions.
13. Assign a macro to a command button to display “welcome” in a cell.
14. Assign a macro to a command button to display “welcome” in a message box.
15. Assign a macro to a command button to find the total number of sheets in a workbook.
16. Assign a macro to a command button to add a new worksheet.
17. Assign a macro to a command button to add a new workbook.
18. Prepare a worksheet with wildlife populations of different states in India. Display in Pie chart and Bar chart.
19. Prepare a worksheet with the total number of primary schools in each district of kerala. Include different charts.
20. Create a worksheet with employee salary details. Include charts.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss about the fundamentals of Data Science	U	PSO -1
CO-2	Illustrate the usage of Data Pre-processing techniques	Ap	PSO-1, 3
CO-3	Use data science concepts in real world problems	An	PSO-1,2,3
CO-4	Build Data Analytics and management Skill	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO DATA SCIENCE

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Discuss about the fundamentals of Data Science	PO- 6,7 PSO-1,2	U	F, C	L	-
CO-2	Illustrate the usage of Data Pre-processing	PO-6,7 PSO-1,2,3	Ap	F, C, P	L	P

	techniques					
CO-3	Use data science concepts in real world problems	PO-1, 2, 6,7 PSO-1,2,3	An	F, C, P	L	P
CO-4	Build Data Analytics and management Skill	PO-1, 2, 6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PSO 1**	**PSO 2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	1	1	-	1	-	-	-
CO 2	-	-	-	-	-	1	2	-	2	2	2	-
CO 3	1	2	-	-	-	1	2	-	2	2	2	-
CO 4	2	2	-	-	-	1	2	-	2	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Quiz**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓		✓		✓
CO 2	✓		✓	✓	✓
CO 3	✓	✓		✓	✓
CO 4		✓		✓	✓

14. ANIMATION USING BLENDER

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK1MDCCSC104</td></tr>
<tr><td>Course Title</td><td colspan="5">ANIMATION USING BLENDER</td></tr>
<tr><td>Type of Course</td><td colspan="5">MDC</td></tr>
<tr><td>Semester</td><td colspan="5">I</td></tr>
<tr><td>Academic Level</td><td colspan="5">1 ·</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>3</td><td>2 hours</td><td>-</td><td>2</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Nil</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course provides a comprehensive journey through the Blender interface, mastering vital navigation skills. It explores fundamental modelling techniques enabling the creation of 3D objects and characters.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Blender**	**12**
	1	Introduction to Blender, Commercial Software vs Open-source Software	
	2	History of Blender, Downloading and Installing Blender	
	3	Blender UI: Splash screen, Top bar and Status bar, Default Editors	
	4	Understanding Areas and Editors: Resizing areas, Splitting and joining areas, Understanding the types of editors	
II		**Blender Objects**	**12**
	5	Interface Elements: Panels, Pie Menus; 3D Viewport, 3D Scene	
	6	Creating Object, Moving, Rotating, Scaling, Active Tools, Manipulators, Menus	
	7	Modifiers, Workbench, Light options, Rendering	
	8	Stages of a Project, Defining the Stages, Character-Creation plan	
	9	Character Design: Description, Designing Character, adding colour, Finalizing the design	
III		**Modelling in Blender**	**12**
	10	Modelling tools: Vertices, Edges, Faces, making selections, Mesh modelling tools, Modelling Add-ons, LoopTools	
	11	Character Modelling: Mesh topology, modelling methods: Box Modelling, Poly to poly, Sculpt and Retopology, Modifiers	
	12	Hot air balloon modelling, Cartoon Giraffe modelling, Kite Modelling	
IV		**Rigging**	**12**
	13	Unwrapping, Painting, Shading, Character Rigging, Skinning	
	14	Lighting the scene, Analysing the real footage	
	15	Creating and Testing lights	

V	**Flexi Module : Not included for End Semester Exams**		**12**
	16	Animating the character	
	17	Showing/Hiding objects in Render	
	18	Exporting the final Render	

References

1. Oliver Villar, Learning Blender: A Hands-On Guide to Creating 3D Animated Characters, Third Edition, Addison-Wesley, 2021.
2. James Chronister, Blender Basics, Second Edition, 2006.
3. James Chronister, Blender Basics: A Classroom Tutorial Book, 5th Edition, cdscholls.org, 2017.

LAB EXERCISES

Design following models

1. Chair
2. Table
3. Pizza in Blender
4. Coffee Mug
5. French Fries
6. Piggy Bank
7. Donut
8. Table lamp in Blender
9. Penguin
10. Toy

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline fundamental aspects of Blender	U	PSO-1
CO-2	Develop knowledge of Blender interface elements, such as panels, menus, and editor.	Ap	PSO-1, 3
CO-3	Use basic modelling techniques in Blender	Ap	PSO-1,2,3
CO-4	Develop models of various objects	Ap	PSO-1,2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ANIMATION USING BLENDER

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Outline fundamental aspects of Blender	PO-3, 6, 7 PSO-1	U	F, C	L	-
CO-2	Develop knowledge of Blender interface elements, such as panels, menus, and editor.	PO-3, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
CO-3	Use basic modelling techniques in Blender	PO-1, 3, 6, 7 PSO- 1, 2, 3	Ap	F, C, P	L	P
CO-4	Develop models of various objects	PO-1, 3, 6, 7 PSO-1,2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	1	-	-	2	2	-	2	-	-	-
CO 2	-	-	2	-	-	2	2	-	2	1	2	-
CO 3	1	1	3	-	1	2	2	-	2	1	2	-
CO 4	1	1	3	-	1	2	2	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

15. HEALTH INFORMATICS

Discipline	Computer Science				
Course Code	UK1MDCCSC105				
Course Title	Health Informatics				
Type of Course	MDC				
Semester	I				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3 hours
Pre-requisites	Basic knowledge on health is desirable.				
Course Summary	Health informatics focuses on the use of information technology to improve healthcare delivery, patient outcomes, and population health. This course provides an overview of key concepts, methods, and technologies in health informatics, with a focus on practical applications and case studies.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Overview**	9
	1	Introduction, Informatics Definitions, Background, Historical Highlights, Key Players in Health Information Technology, Organisations Involved with HIT, Health Informatics Resources, Future Trends.	
	2	Healthcare Data, Information and Knowledge: Definitions and Concepts- Data, Information and Knowledge, Informatics vs. Information Technology and Computer Science, Clinical Data Warehouses (CDWs), Difficulties of Informatics.	
II		**Healthcare Data Analytics and Electronic Health Records**	9
	3	**Healthcare Data Analytics:** Introduction, Terminology of Analytics, Challenges to Data Analytics, Research and Application of Analytics, Role of Informaticians in Analytics.	
	4	**Electronic Health Records:** Electronic Health Record Definitions, Need for Electronic Health Records, Institute of Medicine's Vision for EHRs, Electronic Health Record Key Components, Computerized Physician Order Entry (CPOE), Clinical Decision Support Systems (CDSS), Electronic Prescribing	
III		**Data Standards and Medical Coding**	9
	5	Introduction; **Content Standards**: Extensible Markup Language (XML), Health Level Seven (HL7), Digital Imaging and Communications in Medicine (DICOM); **Terminology Standards:** Logical Observations- Identifiers, Names and Codes (LOINC), RxNorm, Systematized Nomenclature of Medicine: Clinical Terminology (SNOMED-CT) , MEDCIN®	
	6	**Transport Standards:** EHR-Lab Interoperability and Connectivity Standards (ELINCS), IEEE 11073, National Council for Prescription Drug Programs (NCPDP).	

IV	**Health Information - Privacy, Security and Ethics**		**9**
	7	Introduction; HIPAA Review, Basic Security Principles, HIPAA, Meaningful Use, and the HITECH Act, Authentication and Identity Management, Security Breaches and Attacks.	
	8	Health Informatics Ethics: Informatics Ethics, International Considerations: Ethics, Laws and Culture, Codes of Individual Countries, Difficulties Applying Medical Ethics in the Digital World.	
V	**Flexi Module (Not included for end semester exam)**		**9**
	9	Consumer Health Informatics: The Origins of Current State of Consumer Health Informatics, Classification of Consumer Health Informatics Applications	
	10	Mobile Technology and mHealth: Mobile Health (mHealth), Mobile Telemedicine Projects	

References

Core

1. Robert E. Hoyt and Ann K. Yoshihashi, “Health Informatics Practical Guide for Healthcare and Information Technology Professionals”, Sixth Edition.

Additional

2. William Hersh, “Health Informatics: A Practical Guide"
3. Stephan P. Kudyba and Richard M. Hillestad, "Healthcare Informatics: Improving Efficiency through Technology, Analytics, and Management"

Case Study

1. Familiarize with any Health informatic systems
2. Familiarize with tools available in Health Informatic systems
3. Prepare a report on various Health Informatic systems.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Explain the basic concepts of Health Informatics	U	PSO-1
CO2	Illustrate the role of Healthcare Data Analytics and Electronic Health Records	Ap	PSO-1, 3
CO3	Summarise Data Standards and Medical Coding concepts	U	PSO-1
CO4	Infer the role of privacy, security and ethics in health systems	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: HEALTH INFORMATICS

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Explain the basic concepts of Health Informatics	PO-6,7 PSO-1	U	F, C	L	-
CO2	Illustrate the role of Healthcare Data Analytics and Electronic Health Records	PO-4, 5, 6,7 PSO-1, 3	Ap	F, C, P	L	-
CO3	Summarise Data Standards and Medical Coding concepts	PO-6,7 PSO-1	U	F, C	L	-
CO4	Infer the role of privacy, security and ethics in health systems	PO-6,7, 8 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	-	-	-	-	2	1	-	2	-	-	-
CO 2	-	-	-	2	2	2	2	-	2	-	2	-
CO 3	-	-	-	-	-	2	1	-	2	-	-	-
CO 4	-	-	-	-	-	2	1	3	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Case Study	End Semester Examination
CO 1	✓	✓		✓
CO 2	✓		✓	✓

CO 3	✓	✓		✓
CO 4	✓			✓

16. ENVIRONMENTAL INFORMATICS

Discipline	COMPUTER SCIENCE				
Course Code	UK1MDCCSC106				
Course Title	ENVIRONMENTAL INFORMATICS				
Type of Course	MDC				
Semester	I				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-	-	3 hours
Pre-requisites	Basic knowledge on Environmental science is desirable.				
Course Summary	This course provides students with knowledge and skills related to the use of information technology and computational methods for addressing environmental challenges and promoting sustainability.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to Environmental Informatics**	9
	1	Introduction, Definitions for Environmental Information Systems, Classification of Environment Information System, Industrial Environmental Management Information systems, Background and Issues of Environmental Informatics	

	2	Data Collection and processing: Remote sensing technologies, Ground-based sensors, Weather stations and monitoring networks, Citizen science and crowdsourced data	
II	**Environmental Information Systems**		**9**
	3	Decision Support Systems (DSS) for Environmental Management: Concept and components of DSS, Multi-criteria decision analysis, Scenario analysis and modelling	
	4	Remote Sensing: Principles of remote sensing and image interpretation, Satellite sensors and platforms for environmental monitoring	
III	**Geographic Information Systems**		**9**
	5	The nature of GIS; Definition; GISystems, GIScience and GIS applications; Spatial Data and Geo Information; Models: Models and Modelling, Maps, Databases, Spatial Databases and Spatial Analysis	
	6	Geographic Information and Spatial Data types: Model, Geographic Phenomena: Definition, Types, Geographic fields: Data types and values, Geographic objects, Geographic boundaries; Computer representation of Geographic Information; Topology and spatial relationships	
IV	**GIS Software Tools**		**9**
	7	GIS software tools and functionalities: ArcGIS, QGIS (Quantum GIS), GRASS GIS, MapInfo Professional, GeoServer, PostGIS, Google Earth Engine, ENVI	
V	**Flexi Module (Not included for end semester exam)**		**9**
	8	Applications: Urban and Landscape Development, Waste Management and Logistics, Prevention and Management of Environmental Hazards	

References

1. Claus Rautenstrauch and Susanne Pattig, "Environmental Information systems in Industry and Public Administration" , IDEA Group Publishing
2. Otto Huisman and Rolf.A.Day, "Principles of Geographic information systems: An introductory book"

3. Qihao Weng, Remote Sensing and GIS Integration: Theories, Methods, and Applications, McGrawHill

Case Study

1. Classify various tools available in Environmental Information systems
2. Prepare a report on various Environmental Information systems and its functionalities.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarise the basic concepts of Environmental Informatics	U	PSO-1
CO2	Illustrate the role of Decision Support Systems and Remote Sensing	Ap	PSO-1, 3
CO3	Demonstrate the concept of Geographic Information System.	Ap	PSO-1, 3
CO4	Comprehend the role of GIS tools in various applications	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ENVIRONMENTAL INFORMATICS

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Summarise the basic concepts of Environmental Informatics	PO-6,7 PSO-1	U	F, C	L	-
CO2	Illustrate the role of Decision Support Systems and Remote Sensing	PO-4, 5, 6, 7 PSO-1, 3	Ap	F, C, P	L	-
CO3	Demonstrate the concept of Geographic	PO-4, 5, 6,7 PSO-1, 3	Ap	F, C, P	L	-

	Information System.					
CO4	Comprehend the role of GIS tools in various applications	PO-6,7 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	-	-	-	-	1	1	-	2	-	-	-
CO 2	-	-	-	2	2	2	2	-	2	-	1	-
CO 3	-	-	-	2	2	2	2	-	2	-	1	-
CO 4	-	-	-	-	-	2	2	-	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments

- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Case Study	End Semester Examination
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

Semester 2

A. DSC

Course Code	Course Name	L(Hrs)	P(Hrs)	Credits	Remarks	Stream
UK2DSCCSC100	Free and Open Source Softwares	3	2	4		
UK2DSCCSC101	Python Programming	3	2	4		
UK2DSCCSC102	Computer System Management	3	2	4		
UK2DSCCSC103	Introduction to Biometric Systems	4	0	4		
UK2DSCCSC104	E-Commerce	4	0	4		
UK2DSCCSC105	Multimedia Systems	3	2	4		
UK2DSCCSC106	Python for Data Analytics	3	2	4	Vocational	Data Science
UK2DSCCSC107	R Programming for Data Science	3	2	4	Vocational	Data Science
UK2DSCCSC108	Knowledge Representation and Intelligent Agents	4	0	4	Vocational	Machine Learning

UK2DSCCSC109	Electronic Health Record system	4	0	4	Vocational	Health Computing

B. MDC

Course Code	Course Name	L(Hrs)	P(Hrs)	Credits
UK2MDCCSC100	Digital Marketing	2	2	3
UK2MDCCSC101	Office Automation	2	2	3
UK2MDCCSC102	Social Media Management	2	2	3
UK2MDCCSC103	Digital Logic Systems	2	2	3
UK2MDCCSC104	Data Science using Python	2	2	3

C. AEC

(Syllabus by O/L faculty)

D. Summer Internship (*Not Required Now*)

1. FREE AND OPEN SOURCE SOFTWARES

Discipline	COMPUTER SCIENCE				
Course Code	UK2DSCCSC100				
Course Title	FREE AND OPEN SOURCE SOFTWARES				
Type of Course	**DSC**				
Semester	II				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	-				
Course Summary	This course is designed to ensure that students understand the incidence and usage of open source software in the industry and also the ethical and social impact leading the students to make precise decisions on software selection based on the usage scenarios.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	
	1	Introduction to Open-Source: Open Source, Need and Principles of OSS, Open Standards Requirements for Software, OSS success, Free Software, Examples, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. The Free Software Foundation and the GNU Project.	**15**
II		**Dynamics of Open-Source Software**	**15**
	2	Initiatives, Principle and methodologies, Software Freedom, Open-Source Software Development, Economics of FOSS: Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization	
		Open Source Ecosystem	

	3	Open Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, debuggers, Programming languages, LAMP, Open Source database technologies	
III		**Open Source Projects**	**15**
	4	Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing Open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open source project of students choice	
		Open-Source Ethics & Social Impact	
	5	Open source vs. closed source, Ethics of Open source. Social and Financial impacts of Open source technology, Shared software, Shared source, Open Source in Government, Open Source as a Business Strategy.	
IV		**Licensing**	**15**
	6	Open Source Development Model Licenses and Patents: What Is A License, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.	
		Basic Linux and open source applications	
	7	GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, WordPress, GCC, GDB, GitHub, Libre Office. Basic Linux commands, sample Shell scripting programs	
V		**Flexi Module: Not included in End Semester Exams**	**15**
		Study: Understanding the developmental models, licensing, commercial/non-commercial use. (The students must address key questions about the development processes, and the software that is the result of these processes)	

References

1. Kailash Vadera & Bhavyesh Gandhi,“Open-Source Technology”, University Science Press, Laxmi Publications, 2009
2. Fadi P. Deek and James A. M. McHugh,“Open-Source Technology and Policy”, Cambridge University Press, 2008.
3. Clay Shirky and Michael Cusumano,“Perspectives on Free and Open-Source Software”, MIT press.

4. Andrew M. St. Laurent, “Understanding Open Source and Free Software Licensing”,O’Reilly Media.
5. Dan Woods, Gautam Guliani,“Open Source for the Enterprise”, O’Reilly Media

Web Resources
1. http://kernel.org/
2. https://opensource.org/
3. http://www.linuxfoundation.org/
4. http://www.tldp.org/
5. http://www.docker.com
6. https://en.wikipedia.org/
7. https://en.wikipedia.org/wiki/Wikipedia:Contributing_to_Wikipedia

Lab Exercises
Basic linux commands

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Differentiate Open Source and Proprietary software	U	PSO-1
CO-2	Explain about open-source software and open-source ecosystem	U	PSO-1
CO-3	Illustrate the role of open-source projects, open-source ethics and its social impact	Ap	PSO-1
CO-4	Articulate the benefits, features, licensing and applications of Open-source technologies	Ap	PSO-1, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: FREE AND OPEN SOURCE SOFTWARES

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Differentiate Open Source and Proprietary software	PO-6, 7 PSO- 1	U	F, C	L	-

2	Explain about open-source software and open-source ecosystem	PO-6, 7 PSO- 1	U	F, C	L	-
3	Illustrate the role of open-source projects, open-source ethics and its social impact	PO-6, 7, 8 PSO- 1	Ap	F, C	L	-
4	Articulate the benefits, features, licensing and applications of Open-source technologies	PO-4, 5, 6, 7 PSO- 1, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO 1	-	-	-	-	-	1	2	-	2	-	-	-
CO 2	-	-	-	-	-	2	2	-	2	-	-	-
CO 3	-	-	-	-	-	2	2	3	2	-	-	-
CO 4	-	-	-	1	2	2	2	-	2	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assignments**	**End Semester Examination**
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓

2. PYTHON PROGRAMMING

Discipline	COMPUTER SCIENCE				
Course Code	UK2DSCCSC101				
Course Title	PYTHON PROGRAMMING				
Type of Course	**DSC**				
Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	. Basic knowledge on Computer				
Course Summary	This course provides a comprehensive introduction to Python, covering fundamental concepts, data structures, control flow, functions, modules, and object-oriented programming thus covering essential concepts and practical applications across various domains.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Python**	**15**
	1	Fundamentals of Computing – Identification of Computational Problems, Algorithms, Flow charts and Pseudo codes.	
	2	Introduction to Python - Features of Python, Python interpreter, Interactive and script modes	
	3	Identifiers, Reserved Keywords, Operators ,Comments in Python, Input,Output	
II		**Mutable and Immutable Types**	**15**
	4	Data Types and Operations - int, float, complex	
	5	Strings - escape characters, string formatting functions;	
	6	List - built-in list functions & methods;	
	7	Tuple - built-in tuple functions;	
	8	Set – built-in set function & methods;	
	9	Dictionary - built-in dictionary functions & methods;	
	10	Mutable and Immutable Objects, Data Type Conversion;	
III		**Flow Control & Functions**	**15**
	11	Flow control - Decision Making – if,if …else, if….elif, Iteration -for, range() while, loop with else, nested loop, break, continue, pass;	
	12	List comprehension – nested list;	
	13	Functions- Definition, calling, arguments, anonymous function, recursion, return, filter(),reduce(),map()	
IV		**Packages, Files, Exception handling & Object Oriented Concepts**	**15**
	14	Modules & Packages - Built-in Modules, Creating Modules, import statement, Locating, modules ,Namespaces and Scope-local,& global, dir (), reload (),Packages in Python;	
	15	File Handling- open, close, write, read, methods, rename, delete, directories;	

	16	Exception handling- built in exceptions, Handling, Exception with arguments, Raising and User defined exceptions;	
	17	Object oriented programming- OOPs concepts , class, object, method, attribute- static & instance, encapsulation, constructor, destructor, data hiding;	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	18	Pattern Matching with Regular expression, Database Programming: Connecting to a database, Creating Tables,INSERT, UPDATE, DELETE and READ operations	

CORE TEXTS

1. Jeeva Jose, "Taming PYTHON By Programming", Khanna Publications, 2017
2. Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.

ADDITIONAL REFERENCES

1. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
2. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1st Edition.
3. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to think like a computer scientist: learning with Python", 2012.

LAB EXERCISES

The laboratory work will consist of 20-25 experiments

Part A

1. Programs to write, test and debug simple Pythons programs (Operators & expressions).
2. Programs to demonstrate conditional and looping statements.
3. Programs to demonstrate strings, list, tuples and dictionaries.
4. Programs using list comprehension.
5. Programs to demonstrate the use of functions.
6. Programs to perform list sorting and searching.

Part B

7. Program to read and write data from/to files in Python.
8. Programs to demonstrate creating and handling of modules and packages.
9. Programs to demonstrate Exception Handling situations.
10. Programs to demonstrate Class and Object.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Use basic concepts of Python Programming	Ap	PSO-1, 2, 3
CO2	List mutable and immutable data types in Python	Ap	PSO-1, 2, 3
CO3	Illustrate flow control techniques in python programming	Ap	PSO-1, 2, 3
CO4	Make use of object oriented concepts in python programming	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Use basic concepts of Python Programming	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
2	List mutable and immutable data types in Python	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
3	Illustrate flow control techniques in python programming	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

4	Make use of object-oriented concepts in python programming	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
CO 1	1	1	-	-	-	2	2	-	3	2	2	-
CO 2	1	2	-	-	-	2	2	-	3	2	2	-
CO 3	3	2	-	-	-	2	2	-	3	3	2	-
CO 4	3	2	-	-	-	2	2	-	3	3	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam

- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examination**
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

3. COMPUTER SYSTEM MANAGEMENT

Discipline	COMPUTER SCIENCE				
Course Code	UK2DSCCSC102				
Course Title	COMPUTER SYSTEM MANAGEMENT				
Type of Course	**DSC**				
Semester	II				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	This course is a fundamental course with the objective to impart basic skills necessary in using and managing computer systems for beginners.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Operating Systems Fundamentals**		**15**
	1	Functions and Components of an Operating System	
	2	OS Boot Process and Boot Configuration	
	3	File Systems and Disk Management in Windows	
	4	User Management and Access Control	
	5	Introduction to Windows Registry	
	6	System Performance Monitoring in Windows	
II	**Windows Desktop Management and Storage Management**		**15**
	7	Desktop Customization and Personalization	
	8	Managing Applications and Processes	
	9	Managing User Accounts and Permissions	
	10	Troubleshooting Common Desktop Issues,Security Practices for Windows Desktops	
	11	Understanding Storage Devices (HDDs, SSDs, etc.)	
	12	Disk Partitioning and Formatting	

	13	File Systems Management (NTFS, FAT32, etc.)	
	14	Disk Quotas and File Compression	
	15	Disk Cleanup and Optimization Techniques	
III	**Disk Defragmentation and Fragmentation**		**15**
	16	Understanding Disk Fragmentation	
	17	Impact of Fragmentation on System Performance	
	18	Disk Defragmentation Techniques and Tools	
	19	Automated Defragmentation Settings in Windows	
	20	Monitoring Disk Fragmentation Levels	
IV	**Operating System Security Fundamentals**		**15**
	21	Introduction to OS Security Principles	
	22	User Authentication and Authorization	
	23	Access Control Lists (ACLs) in Windows	
	24	Security Policies and Group Policy Objects (GPOs)	
	25	Windows Update Management and Patching	
V	**Flexi Module: Not included for End Semester**		**15**

	26	System Backup and Recovery Procedures	
	27	Windows Update Management	
	28	System Performance Monitoring and Optimization	
	29	Troubleshooting Common Windows Errors and Issues	
	30	Remote Desktop and Remote Assistance Tools	
	31	Firewall and Network Security Settings	
	32	Antivirus and Antimalware Protection	

References

1. Andrew S. Tanenbaum. "Modern Operating Systems" , Pearson Education. 4th Edition, 2014.
2. Eleen Frisch, "Essential System Administration", O'Reilly Media, 4th Edition, 2021.
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice", Recursive Books, 2nd Edition, 2014.

Resources

1. https://support.microsoft.com/en-us
2. https://developers.google.com/certification
3. https://youtu.be/y2kg3MOk1sY?si=VKw-YeFUZSY5BTrf
4. https://training.linuxfoundation.org/
5. https://aws.amazon.com/dynamodb/resources/training-linux-academy/
6. https://www.youtube.com/c/TheLinuxExperiment
7. https://help.ubuntu.com/
8. https://developers.redhat.com/

Lab Exercises

1. Commands for files and directories cd, cp, mv, rm, mkdir, more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces, Essential Linux commands.

2. Processes in Linux – process fundamentals, connecting processes with pipes, redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep
3. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file, file related commands – ws, sat, cut, grep, dd, etc.
4. Exercises on general desktop management.
5. Using shortcut keys
6. Using File manipulation commands
7. Installing applications
8. Partitioning disks
9. Practising solutions for troubleshooting

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise about Operating Systems	U	PSO-1,3
CO-2	Experiment with desktop activities	Ap	PSO-1,3
CO-3	Illustrate disk fragmentation and partitioning activities	Ap	PSO-1,3
CO-4	Experiment with basic Operating system security	Ap	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: COMPUTER SYSTEM MANAGEMENT

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize about Operating Systems	PSO-1, 3	U	F, C, P	L	P
CO-2	Experiment with desktop activities	PSO-1, 3	Ap	F, C, P	L	P
CO-3	Illustrate disk fragmentation and partitioning activities	PSO-1, 3	Ap	F, C, P	L	P
CO-4	Experiment with	PSO-1, 3	Ap	F, C, P	L	P

	basic Operating system security					

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	-	-	1	1	-	2	-	1	-
CO 2	-	-	-	-	-	2	2	-	2	-	2	-
CO 3	-	-	-	-	-	2	2	-	2	-	2	-
CO 4	-	-	-	-	-	2	2	1	2	-	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments

- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

4. INTRODUCTION TO BIOMETRIC SYSTEMS

Discipline	COMPUTER SCIENCE				
Course Code	UK2DSCCSC103				
Course Title	INTRODUCTION TO BIOMETRIC SYSTEMS				
Type of Course	DSC				
Semester	II				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge about digital images is preferred.				
Course Summary	This course provides an introduction to various biometrics systems. It also helps to study physiological or behavioural characteristics or both, that can be utilised to verify the identity of individuals.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to Biometrics**	**12**
	1	**INTRODUCTION;** Person Recognition; **Biometric Systems**: Enrolment and recognition phases, Sensor module, Feature extraction module, Database module, Matching module; Biometric Functionalities: Verification, Identification, **Biometric System Errors**: Performance measures	
	2	**The Design Cycle of Biometric Systems**: Nature of the application, Choice of biometric trait, Data collection, Choice of features and matching algorithm, Evaluation; Applications of Biometric Systems	
II		**Fingerprint Recognition**	**12**
	3	Introduction; **Friction Ridge Pattern**: Features, Formation; **Fingerprint Acquisition**: Sensing techniques, Image quality; **Feature Extraction**: Ridge orientation and frequency estimation, Singularity extraction, Ridge extraction, Minutiae extraction; Matching: Alignment, Pairing minutiae, Match score generation, Fingerprint individuality, Performance evaluation; Fingerprint Indexing, **Palmprint**: Palmprint features,	
III		**Face and Iris Recognition**	**12**
	4	**Face Recognition**: Introduction- Psychology of face recognition, Facial features, Design of a face recognition system; **Image Acquisition**: 2D Sensors, 3D Sensors, Video sequences; **Face Detection**: Viola-Jones face detector; **Feature Extraction and Matching**: Appearance-based face recognition, Model-based face recognition, Texture-based face recognition, Performance evaluation	
	5	**Iris Recognition**: Introduction; Design of an Iris Recognition System; Image Acquisition; Iris Segmentation; Generating iris masks; Iris Normalization; Iris Encoding and Matching	
IV		**Additional Biometric Traits**	**12**
	6	Introduction; **Ear**: Ear detection, Ear recognition, Challenges in ear recognition; **Gait**: Feature extraction and matching, Challenges in gait recognition; **Hand Geometry**: Image capture, Hand segmentation, Feature Extraction, Feature matching, Challenges in hand geometry recognition; **Soft Biometrics**: Periocular, Facemarks, Tattoo	
V		**Flexi Module: Not included for End Semester Exams**	**12**

	7	Citizen-Facing Applications: Citizen Identification, Criminal Identification, Surveillance; Employee Facing applications: PC/ Network Access; Customer facing applications: Retail/ ATM/ Point of Sale	

Reference Books

1.

2. Anil K. Jain, Patrick Flynn, and Arun Ross, "Introduction to Biometrics", 2011

3. John D. Woodward Jr., Nicholas M. Orlans, and Peter T. Higgins "Biometrics"
4. Biometrics Identity Verification in a Networked World by Sanir Nanavati, Michael Thieme, 2003, Wiley Computer Publishing Ltd, New Delhi.
5. John Vacca, Biometric Technologies and Verification Systems, 2007

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Restate the basic characteristics of Biometrics systems.	U	PSO 1
CO2	Illustrate the role of fingerprint recognition in Biometrics	Ap	PSO 1
CO3	Summarize about face and iris recognition systems	U	PSO 1
CO4	Outline the role of additional traits in biometrics system	U	PSO 1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO BIOMETRIC SYSTEMS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**

CO1	Restate the basic characteristics of Biometrics systems.	PO-5, 6,7 PSO- 1	U	F, C, P	L	-
CO2	Illustrate the role of fingerprint recognition in Biometrics	PO- 6, 7 PSO-1	Ap	F, C, P	L	-
CO3	Summarise about face and iris recognition systems	PO- 6, 7 PSO-1	U	F, C, P	L	-
CO4	Outline the role of additional traits in biometrics system	PO-5, 6, 7 PSO-1	U	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	2	1	3	-	2	-	-	-
CO 2	-	-	-	-	-	1	3	-	2	-	-	-
CO 3	-	-	-	-	-	1	3	-	2	-	-	-
CO 4	-	-	-	-	2	1	3	-	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Quiz/ Seminar	Assignment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

5. E-COMMERCE

Discipline	COMPUTER SCIENCE
Course Code	UK2DSCCSC104
Course Title	E-COMMERCE
Type of Course	DSC

Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge of computers				
Course Summary	This course provides an overview of the evolution, strategies, and implementation of e-commerce, exploring its impact on business and consumer behaviour in the digital age.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to E-Commerce**	**12**
	1	Introduction: Definition, Difference between E-Commerce and E-Bussiness, Technological Building Blocks, Major trends in E-Commerce.	
	2	E-commerce Brief History, Unique Features: Ubiquity, Global Reach, Universal Standards, Richness, Interactivity, Information density, Personalization and Customization.	
	3	Types of E-Commerce: B2C, B2B, C2C, M-Commerce, Social E-Commerce and Local E-Commerce.	
	4	Understanding E-Commerce: Technology, Business, Society	
II		**E-commerce Business Strategies**	**12**
	5	Business Models : Introduction, Eight key Elements of a Business Model.	
	6	B2C: Online Retailer, Community Provider, Content Provider, Portal, Transaction Brocker, Market Creator.	
	7	B2B: E-distributer, E-procurement, Exchanges, Industry Consortia	
	8	Industry Structure, Industry Value Chain, Firm Value Chains, Firm Value Webs, Business Strategy.	
III		**Technology Infrastructure**	**12**

	9	The Internet Backbone, Internet Exchange Points, Tier 3 ISP, Mobile Internet Access	
	10	E-Commerce System Development Life Cycle, Alternative Web Development Methodologies	
	11	Choosing Software, Choosing Hardware, E-Commerce Site Tools.	
	12	E-Commerce Security Environment, Security Threats, E-Commerce Payment systems.	
IV	**Business Concepts and Social Issues**		**12**
	13	Digital Commerce Marketing and Advertising Strategies and Tools	
	14	Online Marketing Technologies, Online Marketing Metrics: Lexicon.	
	15	Social Marketing, Mobile Marketing, Local and Location based Mobile Marketing.	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	16	Case Study: Uber-Everything on Demand.	
	17	Case Study: Skyscanner- The One Stop Travel Platform.	

TEXT BOOK

1. Kenneth C. Laudon, Carol Guercio Traver, E-Commerce 2023-24: Business, Technology, Society,18th Edition(Global), Pearson
2. S. J. Joseph, E-Commerce: an Indian perspective, PHI
3. E-Commerce, Fundamentals And Applications By Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang ·Wiley India Pvt. Limited
4. Introduction to E-commerce,By Jeffrey F. Rayport, Bernard J. Jaworski McGraw-Hill

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise basic concepts of E-commerce	U	PSO-1

CO-2	Identify various types of E-commerce strategies	An	PSO-1
CO-3	Explain E-commerce Technology Infrastructure	U	PSO-1
CO-4	Differentiate between various digital commerce technologies and tools	An	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarise basic concepts of E-commerce	PO-6, 7 PSO-1	U	F, C	L	-
CO-2	Identify various types of E-commerce strategies	PO-6, 7 PSO-1	An	F, C	L	-
CO-3	Explain E-commerce Technology Infrastructure	PO-6, 7 PSO-1	U	F, C	L	-
CO-4	Differentiate between various digital commerce technologies and tools	PO-6, 7 PSO-1	An	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4

CO 1	-	-	-	-	-	2	2	-	2	-	-	-
CO 2	-	-	-	-	-	2	3	-	2	-	-	-
CO 3	-	-	-	-	-	2	3	-	2	-	-	-
CO 4	-	-	-	-	-	2	3	-	2	-	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Discussion**	**End Semester Examinations**
CO 1	✓			✓

CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4		✓		✓

6. MULTIMEDIA SYSTEMS

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK2DSCCSC105</td></tr>
<tr><td>Course Title</td><td colspan="5">MULTIMEDIA SYSTEMS</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">II</td></tr>
<tr><td>Academic Level</td><td colspan="5">1</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Nil.</td></tr>
<tr><td>Course Summary</td><td colspan="5">The aim of this course is to introduce students to the diverse world of multimedia, covering foundational concepts, practical skills, and ethical considerations. Students will explore the definition and characteristics of multimedia, gaining an understanding of its widespread applications across various domains. By the end of the course, students will have a comprehensive understanding of multimedia principles, practical skills in multimedia content creation and editing, and awareness of the ethical considerations in multimedia technologies. They will be equipped with the knowledge and skills to pursue further studies or careers in multimedia-related fields.</td></tr>
</table>

Detailed Syllabus:

<table>
<tr><th>Module</th><th>Unit</th><th>Content</th><th>Hrs (L+P)</th></tr>
<tr><td>I</td><td colspan="2">Introduction to Multimedia</td><td>15</td></tr>
</table>

	1	Introduction to Multimedia: Definition and characteristics of Multimedia.	
	2	Multimedia application -Definition - Classification -Multimedia Hardware - Multimedia software - Image editing softwares, Video editing softwares, Audio editing softwares, Slideshow creation-Prezi, Screen recording tools-Camtasia, OBS Studio (basic concepts of all tools only)	
	3	Overview of Multimedia elements: text, images, audio, video, animations, and interactive elements.	
	4	Multimedia Text: Text in Multimedia -Multimedia graphics: coloring - digital imaging fundamentals - development and editing - file formats - scanning and digital photography.	
II	**Multimedia Representation and Formats**		**15**
	5	Understanding Multimedia data representation and storage formats.	
	6	Common Multimedia file formats (e.g., JPEG, MP3, MPEG, GIF) and their properties.	
	7	Compression techniques for reducing Multimedia file sizes while preserving quality.	
	8	Multimedia Audio: Digital medium - Digital audio technology - sound cards - recording - editing - MP3 - MIDI fundamentals - Working with MIDI - audio file formats - adding sound to Multimedia project.	
III	**Multimedia Content Creation**		**15**
	9	Multimedia Project: Stages of a project - Multimedia skills - design concept - authoring - planning and costing –Multimedia Team.	
	10	Introduction to Multimedia authoring software tools and platforms. What is Multimedia authoring Software, Necessity of Multimedia Authoring software, Types of Multimedia Authoring tools- just basics and examples, (e.g., Adobe Creative Suite, Blender, Unity).	
	11	Creating Multimedia projects using authoring tools, incorporating text, images, audio, and video.	

	12	Multimedia Content Creation: Techniques for creating and editing multimedia content. Multimedia Animation: Computer animation fundamentals - Kinematics - morphing - animation s/w tools and techniques	
	13	Image editing and manipulation basics and examples (e.g., Photoshop, GIMP), Image Editing software: selection tools, working with layers, masks and channels, correcting and enhancing photographs	
	14	Audio recording, editing, and mixing (e.g., Audacity, Adobe Audition).	
	15	Multimedia Video: How video works - broadcast video standards - digital video fundamentals – digital video production and editing techniques - file formats Video editing and post-production (e.g., Adobe Premiere Pro, Final Cut Pro).	
IV	**Multimedia Programming and Applications**		**15**
	16	Basics of multimedia programming languages and frameworks (e.g., HTML5, JavaScript, Python with libraries like OpenCV and Pygame) (basics only).	
	17	Integration of multimedia elements into web pages, mobile apps, and interactive environments.	
	18	Multimedia Applications and Platforms: Analysis of multimedia applications across various domains (e.g., entertainment, education, advertising, healthcare).	
	19	Legal and Ethical Issues: Copyright and intellectual property considerations in multimedia content creation and distribution. Ethical implications of multimedia technologies (e.g., privacy concerns, representation and bias in media).	
V	**Flexi Module - Not included for End Semester Exams**		**15**
	20	Scripting multimedia interactions and animations, Interactive animations.	
	21	Virtual reality (VR) and augmented reality (AR) systems, 3D multimedia content creation and rendering	

	22	Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing	
	23	Immersive multimedia experiences and interactive storytelling, Wearable multimedia devices and applications	
	24	Multimedia Analytics- Multimedia content analysis and understanding	

References

1. S.Gokul, "Multimedia Magic", BPB Publications, 2nd Edition.
2. Tay Vaughen, "Multimedia Making it Work", TMH, 9th Edition.
3. Ralf Steinmetz and Klara Nahrstedt, Introduction to Multimedia Systems
4. Ze-Nian Li, Mark S. Drew, and Jiangchuan Liu, Fundamentals of Multimedia

Lab Exercises

1. Hands-on experience with any text, audio, video, authoring tools.
2. Create a multimedia project using Multimedia tools and techniques learnt.
3. Case studies of successful Multimedia projects and platforms.
4. Report Writing on Emerging trends and future directions in multimedia technology (e.g., virtual reality, augmented reality, immersive experiences etc.).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Infer basic multimedia concepts	U	PSO-1
CO-2	Interpret the various multimedia representations	U	PSO-1
C0 -3	Develop basic multimedia content	Ap	PSO-1, 2, 3
CO -4	Summarise programming aspects applicable for multimedia	U	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MULTIMEDIA SYSTEMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Infer basic multimedia concepts	PO-3, 6, 7 PSO-1	U	F, C	L	-
2	Interpret the various multimedia representations	PO-3, 6, 7 PSO-1	U	F, C	L	-
3	Develop basic multimedia content	PO-3, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
4	Summarize programming aspects applicable for multimedia	PO-1, 2, 3, 6, 7 PSO-1, 2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-		1	-	-	2	2	-	2	-	-	-
CO 2	-	--	1	-	-	2	2	-	2	-	-	-
CO 3	-	-	2	-	-	2	2	1	2	1	2	-
CO 4	1	2	1	-	-	2	2	-	2	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Trivial content creation assignments
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓		✓

7. PYTHON FOR DATA ANALYTICS

Discipline	COMPUTER SCIENCE
Course Code	UK2DSCCSC106
Course Title	PYTHON FOR DATA ANALYTICS

Type of Course	DSC/ VOCATIONAL				
Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	-				
Course Summary	This course is designed to enable students to get familiar with the features of python, its libraries, module creation, implementing various data structures and data visualization .				

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction**	15
	1	Data Analytics Lifecycle overview – Discovery,Data Preparation,Model Planning, Model Building,communicate results, operationalize.	
	2	Features of Python, Variables, output, input in Python, Operators ,Control flow statements: Decision making structures, Loops, Nesting of conditional statements and loops, abnormal loop termination	
	3	Functions: uses, syntax, Types – built in and user-defined functions, String functions in python. Recursive function	
	4	Errors and Exception handling	
II		**Data Structures**	15
	3	Data Types in Python- Numeric, Dictionary,Boolean, Set,Sequence type	
	4	Modules: In-built modules and user defined modules, import statement, from .... import statement.	
	5	Numpy library for arrays: One-dimensional and multi-dimensional	
III		**Data Processing**	15
	6	Pandas library for data processing	

	7	Basics of data frame, import of data, functions of data frame	
	8	Data extraction, Group by functionality	
	9	Creating charts for dataframe, missing values	
IV		**Data Visualization**	**15**
	10	Matplotlib library for visualization: Visualization for categorical variable, visualization of continuous variable.	
	11	Seaborn library for visualization: Visualization for categorical variable, visualization of continuous variable.	
V		**Additional Core Libraries (Not for end semester Examination)**	**15**
	12	SciPy Library for Statistics	
	13	SQLAlchemy Library for SQL	
	14	StatsModels Library for time series models - Introduction	

TEXT BOOK

1. Bharti Motwani, Data Analytics using Python,Wiley,2022
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data,EMC Education services Wiley Publication

REFERENCES

1. Joel Grus,Data Science from Scratch: First Principles with Python,O'Reilly Media,2015
2. Wes McKinney,Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython,O'Reilly Media,2017
3. Jake VanderPlas,Python Data Science Handbook: Essential Tools for Working with Data,O'Reilly Media,2016
4. Aurélien Géron,Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,O'Reilly Media,2019
5. Python for Data Analysis: 3rd Edition, Wes McKinney ,Publisher(s): O'Reilly Media, Inc.

LAB EXERCISES

1. Programs using Python strings, lists, tuples, and dictionaries.
2. Read and write data from/to files in Python.
3. Programs to demonstrate creating and handling of modules and packages
4. Programs involving regular expressions
5. Programs to draw simple bar chart, pie chart, histogram and scatter plot
6. Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib.

7. Create a python program to export data (store Data Frame in CSV Format)
8. Create a python program to handle the missing data from a dataset using numpy and pandas.
9. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools
10. Programs using Python strings, lists, tuples, and dictionaries.
11. Read and write data from/to files in Python.
12. Programs to demonstrate creating and handling of modules and packages
13. Programs involving regular expressions
14. Programs to draw simple bar chart, pie chart, histogram and scatter plot
15. Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib.
16. Create a python program to export data (store Data Frame in CSV Format)
17. Create a python program to handle the missing data from a dataset using numpy and pandas.
18. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools

    (a) Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib for the following data. The categorical data on 1997 U.S. Health Care Expenditures. The data are in file healthexpendituresdata.csv.

    (b) The monthly data on the total return from the Standard and Poor 500 stock index (with reinvestment of dividends) from 1970 to 2018. The data are in file SandP500stockpricedata.csv. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools. Also create a python program to draw different charts.

    (c)If at the end of each month, a saver deposited $100 into a savings account that paid 6% compounded monthly, h o w much would he have at the end of 10 years? Create a python program to calculate it?

	A	B
1	Category	Expenditures
2	Hospital	371
3	Physician	218
4	Drugs and Supplies	109
5	Other Personal	92
6	Nursing Home	83
7	Dental	51
8	Admin & Insurance	50
9	Public Health	39
10	Home Health	32
11	Research	18
12	Construction	17
13	Eye and Equipment	14

(d)Draw a pie chart and other charts that shows the amount of subscription generated for Indian Bonds from different categories of Investors. Create a python program for the above problem Use pandas and mat plot lib to draw charts

(e)The share holding pattern of a company WIPRO is given. Create a python program for the above problem. Use pandas and matplotlib to draw charts

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Familiarize Data Analytics Lifecycle and Python basics	Ap	PSO-1,2,3
CO-2	Experiment with Python Data Structures and Modules	Ap	PSO-1,2,3

CO-3	Use Pandas library, data frames, and data extraction methods.	Ap	PSO-1,2, 3
CO-4	Experiment with Python libraries Matplotlib and Seaborn for data visualization of both categorical and continuous variables.	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA ANALYTICS USING PYTHON

Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Familiarize Data Analytics Lifecycle and Python basics	PO- 6,7 PSO-1, 2,3	Ap	F, C	T	p
2	Experiment with Python Data Structures and Modules	PO- 6,7 PSO-1, 2,3	Ap	F,C,P	L	P
3	Use Pandas library, data frames, and data extraction methods.	PO-6, 7 PSO-1, 2, 3	Ap	F,C,P	L	P
4	Experiment with Python libraries Matplotlib and Seaborn for data visualization of both	PO-6,7 PSO-1, 2,3	Ap	F,C,P	L	p

	categorical and continuous variables.					

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	-	-	-	-	2	2	-	2	2	2	-
CO 2	-	-	-	-	-	2	2	-	2	2	2	-
CO 3	-	-	-	-	2	2	2	-	2	2	2	-
CO 4	-	-	-	-	2	2	2	-	2	2	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/ Quiz	Seminar	End Semester Examinations
CO-1	✓		✓	✓
CO-2	✓		✓	✓
CO-3	✓	✓		✓
CO-4	✓	✓		✓

8. R PROGRAMMING FOR DATA SCIENCE

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK2DSCCSC107</td></tr>
<tr><td>Course Title</td><td colspan="5">R PROGRAMMING FOR DATA SCIENCE</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC/VOCATIONAL</td></tr>
<tr><td>Semester</td><td colspan="5">II</td></tr>
<tr><td>Academic Level</td><td colspan="5">1</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
</table>

Pre-requisites	Knowledge in basic concepts of Statistics and Probability is desirable.
Course Summary	This course provides fundamental concepts of data analytics, R language & data visualization

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction to R Programming**	**15**
	1	Basic Interaction with R, Using R as a Calculator, functions, Control Structures, factors, data frames	
	2	Using R as a Calculator, functions, Control Structures, factors, data frames	
	3	Data pipelines, coding and naming conventions.	
	4	Data Manipulation: Reading Data, Manipulating and tidying Data with deplorer	
II		**Visualizing Data**	**15**
	5	**Visualizing Data:** Basic Graphics, The Grammar of Graphics and the ggplot2 Package	
	6	Figures with multiple plot	
	7	Working with Large Datasets	
	8	Expressions**,** Basic Data Types, Data Structures, Control Structures, Functions, Recursive Functions	
III		**Advanced R Programming**	**15**
	9	Working with Vectors and Vectorizing Functions	
	10	Advanced Functions, Functional Programming	
	11	Function Operations: Functions as Input and Output, Building an R Package	
	12	Creating an R Package, R oxygen	
IV		**Data analysis using R**	**15**

	13	Exploratory data analysis using R functions –sqrt, range, sort, minimum, maximum, median, average, standard deviation, skewness, variance	
	14	Correlation and covariance between Power tests- Bivariate Analysis-Paired sample t-test, t-test to compare means-one mean and two means	
	15	One factor ANOVA comparing means across several groups, 2-way ANOVA. Simple linear regression.	
V	**Flexi Module (Not included for End semester Examination)**		**15**
	16	Supervised Learning: Machine Learning, Supervised Learning, Regression versus Classification, Inference versus Prediction	
	17	Unsupervised Learning: Clustering, k-Means Clustering, Hierarchical Clustering	
	18	Object Oriented Programming: Immutable Objects and Polymorphic Functions, Data Structures, Classes	

TEXT BOOK

1. Thomas Mailund, Beginning Data Science in R, Data Analysis, Visualization, and Modelling for the Data Scientist, APress
2. Keen, K. J. . Graphics for statistics and data analysis with R. CRC Press, 2010.
3. Tony Fischetti, Data Analysis with R.
4. Joseph Schmuller, Statistical Analysis with R for dummies.

LAB EXERCISES

1) Find roots of a quadratic equation using the R program.
2) Calculate simple interest by creating function in R program
3) Copy spreadsheet data to clipboard and from clipboard transfer to table. Sort the data in ascending order; find average and standard deviation. [Hint dat <- ead.table("clipboard", header=TRUE)].
4) Read the student name and mark from a text file and store it in a table. Find maximum, minimum, average, median and standard deviation of marks. Display histogram and barplot.
5) Read the salesman name and sales amount from a CSV file. Display the average and standard deviation of sales. Visualize using plot and box plot of the sales amount. Inspect the boxplot and comment on the presence of outliers
6) The profit of a company on five products is given. Find the average profit of the company using the R function. Plot the data using plot, hist and pie graphs. Write the screen output to text files [Hint: use the function sink ()]
7) Create dataset of age of 50 students using rnorm() with n=50, mean=3.1 and sd=0.04 and conduct one sample t-test at significance level of 0.05, to check the validity of the statement “

the average age of students joining the play school is 3 years”. Display this diagram. Interpret the result.

8) A table contains expenditure and profit of a company. Conduct Pearson correlation test using R to find the correlation of expenditure on profit. Display data using line graph using ggplot()

9) A shopkeeper has data on the sales per day of one month. He introduced a new scheme in the next month. He wants to check whether there are any significant differences in average sales of the current month and the previous month. Display boxplot for both the data and interpret the result [Hint create suitable dataset using rnorm() and conduct 2 Sample t-test].

10) Crop yield and quantity of fertilizer used in an agricultural field is given. Conduct one-way ANOVA test to check whether the quantity of fertilizer used has any impact on the crop yield. Interpret the result.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Demonstrate the basic features used in R Programming	Ap	PSO-1, 3
CO-2	Illustrate the concepts of data visualization and its usage in various scenarios.	Ap	PSO-1, 3
CO-3	Examine different functions used in advanced R Programming	Ap	PSO-1, 3
CO-4	Experiment with different ways of Data Analysis techniques	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course:R PROGRAMMING FOR DATA SCIENCE

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Demonstrate the basic features used in R Programming	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO-2	Illustrate the concepts of data visualization and its usage in various scenarios.	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P

CO-3	Examine different functions used in advanced R Programming	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO-4	Experiment with different Data Analysis techniques.	PO-1, 2, 4, 6, 7 PSO-1, 2, 3	Ap	F, C, P,	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PSO 1**	**PSO2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	1	-	1	1	-	2	-	1	-
CO 2	-	-	-	1	-	1	2	-	2	-	1	-
CO 3	-	-	-	1	-	2	2	-	2	-	1	-
CO 4	1	1	-	1	-	2	2	-	2	1	1	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examination**
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

9. KNOWLEDGE REPRESENTATION AND INTELLIGENT AGENTS

Discipline	COMPUTER SCIENCE				
Course Code	UK2DSCCSC102				
Course Title	KNOWLEDGE REPRESENTATION AND INTELLIGENT AGENTS				
Type of Course	DSC/ VOCATIONAL				
Semester	II				
Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	The course delves into representing knowledge effectively and designing intelligent agents for problem-solving in artificial intelligence.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Algorithm Analysis and Techniques**	**15**
	1	Concepts in algorithm analysis – the efficiency of algorithms, average and worst – case analysis, Asymptotic notation, time and space complexity.	
	2	Techniques - brute force, divide and conquer, decrease and conquer, dynamic programming, shortest paths, backtracking	
II		**Heuristic Search Techniques**	**15**
	3	Heuristic search techniques - Generate and test, Hill climbing, Simulated annealing, Problem reduction, AO* algorithm, Constraints satisfaction, Means - Ends analysis. Search Techniques- Graph search, Depth First Search, Breadth First Search, Best first search, A* algorithm.	
III		**Knowledge Representation**	**15**
	4	Knowledge Management; Types of Knowledge; Knowledge Representation; Knowledgebase	
	5	Knowledge Representation structures: First order Logic, Frames, Conceptual Dependency, Scripts, Semantic Network	
IV		**Intelligent Agents**	**15**
	6	Intelligent agents - structure, types of agents, environment, autonomous agents. Nature inspired agents, Planning Agent, PEAS Representation	

V	**Flexi module:- Not included for End Semester Examinations**		**15**
	7	Reasoning: Abductive, Deductive, Inductive, Analogical, Cause-and-Effect, comparative, Conditional and Exemplar Reasoning	

References

1. Vinod Chandra S S, Anand H S, Artificial Intelligence: Principles and Applications, Prentice Hall of India, New Delhi, 2020

2. Kevin Knight, Elaine Rich, Artificial Intelligence, 3rd Edn, Pearson, Chennai

3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition Prentice Hall of India, New Delhi, 2009

Lab Exercises

1. Implementation of brute force algorithm
2. Implementation of divide and conquer algorithm
3. Implementation of decrease and conquer algorithm
4. Implementation of shortest paths algorithm
5. Implementation of Heuristic search techniques
6. Implementation of AO* algorithm
7. Implementation of Depth First Search method
8. Implementation of Breadth First Search method
9. Implementation of Best first search method
10. Implementation of A* algorithm.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Interpret the efficiency of different algorithm design methods	U	PSO- 1
CO2	Apply heuristic search techniques	Ap	PSO- 1, 2, 3
CO3	Demonstrate problem-solving skills	Ap	PSO- 1, 2
CO4	Distingush between the types of intelligent agents	U	PSO- 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course:KNOWLEDGE REPRESENTATION AND INTELLIGENT AGENTS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Interpret the efficiency of different algorithm design methods	PO-1, 6,7 PSO-1	U	F, C	L	
CO2	Apply heuristic search techniques	PO-1, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO3	Demonstrate problem-solving skills	PO-1, 6, 7 PSO-1,2	Ap	F, C	L	
CO4	Distinguish between the types of intelligent agents	PO-1, 6, 7 PSO 1, 2	U	F, C	L	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4

CO 1	1	-	-	-	-	3	3	-	2	-	-	-
CO 2	1	-	-	-	-	3	3	-	2	1	2	-
CO 3	1	-	-	-	-	3	3	-	2	1	-	-
CO 4	1	-	-	-	-	3	3	-	2	1	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓			✓
CO 4	✓	✓		✓

10. ELECTRONIC HEALTH RECORD SYSTEM

Discipline	COMPUTER SCIENCE
Course Code	UK2DSCCSC109
Course Title	Health Data Analytics and Electronic Health Records System
Type of Course	**DSC** / DSE / MDC / SEC / VAC / AEC
Semester	
Academic Level	.

<table>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td>-</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic awareness in health-related informatics</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course helps the student to comprehend the concepts of Electronic Health Records systems and their importance in healthcare, applications, regulations governing them, and other concerns involved.</td></tr>
</table>

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Health Data Analytics and EHR Systems**	**12**
	1	Definition and Characteristics of Big Data	
	2	Importance of Big Data Analytics in Healthcare Challenges and Opportunities	
	3	Electronic Health Record Systems-EHR- definition, Attributes, Benefits and Shortcomings, Challenges faced	
	4	Applications of EHR	
II		**Regulations for EHR**	**12**
	5	EHR: System Regulations	
	6	Meaningful Use	

	7	Certification Standards	
	8	Certification Commission for Health Information Technology (CCHIT), Office of the National Coordinator for Health Information Technology (ONC) Certification, Health Level Seven International (HL7), International Organization for Standardization (ISO), European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC), Healthcare Information and Management Systems Society (HIMSS), Certified Electronic Health Record Technology (CEHRT)	
III	**Security of Data in EHR**		**12**
	9	EHR Data Security	
	10	Regulatory Frameworks- HIPAA, GDPR	
	11	Other Relevant standards	
	12	Threats and breaches	
	13	Encryption in EHR	
	14	Role based access control, multi factor authentication	
	15	Encryption at Rest	
	16	Secure transmission- Secure Sockets Layer (SSL) / Transport Layer Security (TLS), Virtual Private Networks	
	17	HER Systems and Liability	
IV	**Medical Big Data**		**12**
	18	Medical Big Data - Definition	
	19	Benefits	
	20	Sources of Medical Big Data- Electronic Health Records (EHR) Medical Imaging Data, Wearable Devices and Remote Monitoring, Genomic and Molecular Data	
	21	Quality and Analysis concerns	
	22	Privacy and Autonomy concerns	
V	**Title of the Module**		**15**
	23	Open Data- A special Case, Best practices in EHR	

	24	Emerging trends-Blockchain in Healthcare Artificial Intelligence for Security	
	25	Predictive Analytics for Threat Detection	

References

1. Sharona Hoffman, Electronic Health Records- law and Policy, Cambridge University press, 2016, 1st Edition

Web Resources

NIST Special publications

HIPAA guidelines

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline basic concepts on EHR	U	PSO-1,3
CO-2	Relate with the regulations applicable in EHR	U	PSO-1,3
CO-3	Identify security issues in EHR and solutions available	U	PSO-1,3
CO-4	Summarize on Medical Big Data	U	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Outline basic	PO-6,7,8	U	F, C	L	-

	concepts on EHR	PSO-1,3				
CO-2	Relate with the regulations applicable in EHR	PO-4, 6,8,7 PSO-1,3	U	F, C	L	--
CO-3	Identify security issues in EHR and solutions available	PO-4, 6,7,8 PSO-1,3	U	F, C	L	-
CO-4	Summarise on Medical Big Data	PO-6,7,8 PSO-1,3	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	-	-	2	2	1	2	-	2	-
CO 2	-	-	-	2	-	2	2	1	2	-	2	-
CO 3	-	-	--	2	-	2	2	1	2	-	2	-
CO 4	-	-		-	--	2	2	1	2	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	√			√
CO 2	√		√	√
CO 3	√		√	√
CO 4	√	√		√

MDA

11. DIGITAL MARKETING

Discipline	COMPUTER SCIENCE
Course Code	UK2MDCCSC100
Course Title	DIGITAL MARKETING
Type of Course	MDC

Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic understanding of Information Technology is necessary.				
Course Summary	This course introduces Digital marketing techniques and platforms and knowledge about e-banking concepts.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**12**
	1	Nature, Scope and Importance of Digital Marketing; Evolution of Digital Marketing	
	2	Core Concepts-Inbound Marketing, Content Marketing, Email Marketing, Influential Marketing;	
	3	Holistic Digital Marketing Concept, 10Ps of digital marketing	
	4	Digital Marketing Environment: Macro and Micro Environment.	
II		**E-banking**	**12**
	5	E-banking approaches, devices, services, benefits, drawbacks	
	6	Electronic payment systems credit cards, debit cards, smart cards, credit accounts	
	7	Cyber security, encryption, secret key cryptography, public key cryptography	
	8	Digital signatures, firewalls	
III		**Digital Marketing**	**12**
	9	Search Engine Optimization (SEO), Social Media, Content Marketing	
	10	Email Marketing, Mobile Marketing.	

	11	Challenges for Digital Marketing: Increased Security Risk, Cluttered Market, Less Focus on Keywords, More Ad Blockers, Increased Ad Costs**.**	
IV	**Digital Marketing Techniques**		**12**
	12	Pay per Click-Search Engine Advertising, Advantages, Factors, Conversion Rate Optimization (CRO)	
	13	Digital Marketing- Web Analytic. Social Media Marketing: Facebook, Pinterest, Twitter, LinkedIn, YouTube, Google Adwords, Google Analytics;	
	14	Issues and Future enhancement of Digital Marketing. Case study	
V		**Flexi Module (Not for end semester exam)**	**12**
	15	Collection of current marketing tools, case studies, new trends	

CORE TEXT
Ian Dodson-*The art of Digital Marketing*, Wiley; ISBN:9781119265702

ADDITIONAL REFERENCES
Puneet Singh Bhatia- *Fundamentals of Digital Marketing*, Pearson Educ

Lab Exercises
1. Implementing SEO concepts to a website
2. Creating Social Media content for the created website
3. Implement simple cryptographic methods
4. IPLTeams’s Digital Marketing Strategy by KKR
5. ‘Mom’s Touch’ by Nivea India
6. The Great Indian Freedom Sale by Amazon India

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Infer about various types of digital marketing (DM) and marketing environment	U	PSO-1
CO-2	Discuss about the payment systems and security strategies adopted in e-banking	U	PSO-1
CO-3	Identify the challenges involved in digital marketing strategies	An	PSO-1

CO-4	Use different digital marketing techniques	Ap	PSO-1, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Digital Marketing

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Infer about various types of digital marketing (DM) and marketing environment	PO-6,7 PSO-1	U	F, C	L	-
2	Discuss about the payment systems and security strategies adopted in e-banking	PO-6, 7, 8 PSO-1	U	F, C	L	-
3	Identify the challenges involved in digital marketing strategies	PO- 6, 7 PSO-1	U	F, C	L	-
4	Use different digital marketing techniques	PO-4, 5, 6, 7 PSO-1, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	-	2	-	-	-
CO 2	-	-	-	-	-	2	2	1	2	-	-	-
CO 3	-	-	-	-	-	2	2	-	2	-	-	-
CO 4	-	-	-	1	2	2	2	-	2	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assignment	End Semester Examinations

CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓

12. OFFICE AUTOMATION

Discipline	COMPUTER SCIENCE				
Course Code	UK2MDCCSC101				
Course Title	**OFFICE AUTOMATION**				
Type of Course	MDC				
Semester	II				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic Knowledge in operating Computers				
Course Summary	The course covers both theoretical aspects and practical skills in office automation tools for day to day life.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Open Office Writer for Document Preparation**	12

	1	Introduction to Office automation- Advantages of office automation, Software classification, Proprietary software, free software, Open access software, Office automation packages	
	2	Documentation using Open Office writer: - features of the software, creating and editing document, Auto-text, Autocorrect	
	3	Spelling and Grammar Tool, Document Dictionary, Find and Replace	
	4	Formatting the document- character formatting, paragraph formatting, page formatting, bulleted and numbered list, inserting images, header & footer, page number.	
II		**Advanced features of Open Office Writer**	**12**
	5	Creating tables	
	6	Using Mail merge	
	7	Creating document from templates, previewing and printing documents	
III	**Open Office Calc for Data Manipulation**		**12**
	8	Electronic Spread Sheet - Introduction to Spread Sheet, adding and removing worksheet, inserting, deleting, copying , moving and formatting cells.	
	9	Working with Formula , cell reference –Absolute, relative and mixed	
	10	Functions – Mathematical, statistical, logical functions	
	11	Charts- types of charts, Components of charts, Creating and formatting charts	
	12	Advanced features – Pivot table & Pivot Chart, Linking and Consolidation.	
IV	**Open Office Impress for Presentation**		**12**
	13	Presentation using Open Office Impress-, Creating presentation, Adding , removing , moving ,rearranging and enhancing Slides	
	14	Inserting picture, Word Art, formatting background, adding sounds and video clips	
	15	Inserting Charts & Organizational Charts	
	16	Setting animation and transitions	

	17	Creating hyperlinks in presentations, rehearsing and setting up slide show	
V	**Flexi Module: Not included for End Semester Exams**		
	18	Familiarization of other automation packages for word processing, data manipulation and presentation	**12**

Text Books

1. Office Automation: A User-Driven Method, Don Tapscott, Springer-Verlag New York Inc
2. OpenOffice.org For Dummies, Gurdy Leete, Ellen Finkelstein, Mary Leete
3. OpenOffice 3.4 Volume I: Write,:Christopher N. Cain and Riley W. Walker, Quantum Scientific Publishing,
4. OpenOffice 3.4 Volume II: Calc,Christopher N. Cain and Riley W. Walker, Quantum Scientific Publishing,
5. OpenOffice 3.4 Volume III: Base, Christopher N. Cain and Riley W. Walker, Quantum Scientific Publishing

Web Resources:

1. OpenOffice.org 3.3 Writer Guide by OOoAuthors Team: https://www.openoffice.org/documentation/manuals/userguide3/0200WG3-WriterGuide.pdf

Lab Exercises:

- **Open Office Writer**
    1. Creating Resumes/CVs: Design and format professional resumes or curriculum vitae (CV) using Writer's formatting tools
    2. Create brochure for organizations, clubs, or businesses using text formatting, and graphics insertion
    3. Design and create business letters and proposals using formatting features.
    4. Create Product Catalogs/Inventory lists using table and images
    5. Create tables to summarize sales data, including revenue, units sold, product categories
    6. Create personalized form letters by merging recipient-specific information such as names, addresses, and salutations into a standard letter
- **Open Office Calc**

1. Create a Spreadsheet for preparation of Marklist
2. Create a Spreadsheet for preparation of Ranklist of students
3. Create a Spreadsheet for preparation of Payroll Processing
4. Create a Spreadsheet for sales analysis of salesmen using suitable chart
5. Using suitable charts compare performance metrics such as sales figures over time periods.

- **Open Office Impress**
  1. Create orientation presentations for new students
  2. Create visually appealing presentations for presenting a topic in the class
  3. Design dynamic presentations for a product launch to highlight the features
  4. Design presentations for an awareness program
  5. Compile activity reports summarizing the activities of student clubs, organizations, or academic departments.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Use different types of software to create, edit, format, save and print office documents.	Ap	PSO-1, 3
CO-2	Experiment with advanced features of word processor	Ap	PSO-1,3
CO-3	Manipulate data using spreadsheet software.	Ap	PSO-1,2,3
CO-4	Develop professional presentations using Presentation software.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: OFFICE AUTOMATION

Credits: 2:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Use different types of software to create, edit, format, save and print office documents.	PO-5, 6, 7 PSO-1, 3	Ap	F, C	L	P
2	Experiment with advanced features of word processor	PO-5, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
3	Manipulate data using spreadsheet software.	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
4	Develop professional presentations using Presentation software.	PO-3, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO 3	PO 4	PO5	PO 6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4
CO 1	-	-	-	-	1	1	1	-	2	-	1	-
CO 2	-	-	-	-	1	1	2	-	2	-	2	-
CO 3	2	2	-	-	-	1	2	-	2	2	2	-
CO 4	-	-	2	-	-	1	2	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	√	√	√	√
CO 2	√		√	√
CO 3	√	√	√	√
CO 4	√		√	√

13. SOCIAL MEDIA MANAGEMENT

Discipline	COMPUTER SCIENCE
Course Code	UK2MDCCSC102

Course Title	SOCIAL MEDIA MANAGEMENT				
Type of Course	MDC				
Semester	II				
Academic Level	1				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic knowledge about Social Media is desirable				
Course Summary	The course will deliver the basic ideas various social media channels available to users, learning how to build social media strategies, and practising how to track their effectiveness.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction and Social media content publishing**	**12**
	1	Introduction to social media, Finding a way through social media, Social Media Marketing, SMM & Public Relations, Logic of social media, Social Media Strategy and Planning, Content Strategy.	
	2	Overview of popular social media platforms (e.g., Facebook, Instagram, Twitter, LinkedIn, TikTok).	
	3	Publishing Blogs; Publishing Podcasts and Webinars; Publishing articles, white papers and E-books.	
	4	Sharing Videos; Sharing Photos and images; Webinar.	
II		**Social Network, Microblogging and Discussion Boards**	**12**
	5	**Social Network**: A Brief History of Social Networks; Benefits of Marketing with Social Networks; White label social Networks; Pros and cons of creating a white label social network; Future of Social Network.	

	6	**Microblogging**: Microblogging; A Brief History of Microblogging; Different Uses for Microblogging; Tips for Brand Building with Twitter.	
	7	**Discussion Boards**: Discussion Board; Discussion Forum Structure; A Brief History of Discussion Boards; Discussion Board Netiquette; Marketing with Discussion Forums; Guidelines for Moderators of Online Discussion Groups; Get Product Creation Ideas from Discussion Forums.	
III	**Social News Site, Mobile computing and Location marketing**		**12**
	8	**Social News Site**: Social News Site; A Brief History of Social News Sites; Marketing with Social News Sites	
	9	**Q & A sites:** Q&A Site; A Brief History of Q&A Sites; Marketing with Q&A Sites	
	10	**Mobile computing and Location marketing:** Mobile computing, Marketing with mobile computing, Location Based Social Network, Location-based Social Networks and Gaming , The Growth of Location-based Social Networks, Marketing with Location-based Social Networks, The Future of Mobile Computing and Location Marketing	
IV	**Social Media Monitoring and Social Media Marketing Plan**		**12**
	11	**Social Media Monitoring**: A Brief History of Social Media Monitoring; Tracking; Measuring; Qualitative Key Performance Indicators (KPIs); The Net Promoter Score; Return on Investment; Evaluation; Selecting Social Media Monitoring Tools (Radian 6) The Future of Social Media Monitoring.	
	12	**Social Media Marketing Plan:** Creating an Informative and Eye-Catching Title Page, Automatically Generating a Table of Contents, Writing a Compelling Executive Summary, Composing a Brief Overview, Observing Social Media Presence, Conducting a Competitive Analysis, Setting Goals, Determining Strategies, Identifying the Target Market, Selecting Tools, Implementing, Monitoring, Getting C-Suite Buy-In	
V	**Flexi Module (Not included for end semester exam)**		**12**

	13	Community Management, Social Networking Sites (SNS): LinkedIn & Twitter, Facebook in Business, YouTube and Live streaming, Trends.	

Core References

1. Stephen, A. & Bart, Y. (2017).“Social Media Marketing: Principles and Strategies”.

Additional References

2. Buyer, L. (2016). Social PR Secrets: How to Optimize, Socialize, and Publicize Your Brand. 3rd edition.

LAB EXERCISES

1. Identify the features of various popular social media sites.
2. Analyse the features of various popular blogging sites.
3. Analyse the future of social networks.
4. Prepare features of various microblogging sites.
5. Prepare product creation ideas from discussion forums.
6. Prepare a report of social media monitoring using Radian6.
7. Prepare a Social Media Marketing Plan of a company.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Restate the concepts in social media and relevance of popular social media platforms	U	PSO - 1, 3
CO2	Illustrate the role of social networks, microblogging and discussion boards	Ap	PSO - 1, 3
CO3	Summarise about Social news, Q&A sites, Mobile computing and Location marketing	Ap	PSO - 1, 3
CO4	Experiment with social media tools used	Ap	PSO - 1, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: SOCIAL MEDIA MANAGEMENT

Credits: 2:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Restate the concepts in social media and relevance of popular social media platforms	PO - 5, 6, 7 PSO - 1, 3	U	F, C, P	L	P
CO2	Illustrate the role of social networks, microblogging and discussion boards	PO-5, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO3	Summarise about Social news and Q&A sites	PO-5, 6, 7 PSO-1, 3	Ap	F, C,P	L	P
CO4	Experiment with social media tools used	PO-5, 6, 7 PSO-1, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	-	-	-	1	2	2	-	2	-	2	-
CO 2	-	-	-	-	1	2	2	-	2	-	2	-
CO 3	-	-	-	-	1	2	2	-	2	-	2	-

CO 4	-	-	-	-	1	2	3	-	2	-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

14. DIGITAL LOGIC SYSTEMS

Discipline	COMPUTER SCIENCE

Course Code	UK2MDCCSC103				
Course Title	DIGITAL LOGIC SYSTEMS				
Type of Course	MDC				
Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Knowledge of basic mathematics is desirable				
Course Summary	Course provides a comprehensive understanding of digital logic, covering various number systems, Boolean algebra, logic gates, combinational and sequential logic circuits.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Data Representation**	**12**
	1	Concept of number systems– Binary, decimal, Octal, Hexadecimal and BCD	
	2	1's and 2's complement of binary numbers	
	3	Binary arithmetic operations: Addition, Subtraction, Multiplication	
II		**Boolean Algebra**	**12**
	4	Basic Laws of Boolean Algebra	
	5	**Logic Gates** - OR, AND, NOT, NOR, NAND, XOR, XNOR, Universal gates	
	6	**Realising Boolean Functions**: Min-terms, Max-terms, SOP and POS Expressions, De-Morgan's theorem, simplification of Boolean expression, Karnaugh maps.	

III	**Sequential Logic Circuits**		**12**
	7	Introduction to sequential and combinational circuits	
	8	2- bit synchronous counters and 2-bit asynchronous counters	
	9	Flip flops — SR Flip Flop, JK Flip Flop, D Flip Flop, T Flip Flop	
IV	**Combinational Logic Circuits**		**12**
	10	Arithmetic Circuits: Half adder, Full adder	
	11	2 -4 Decoder, Encoder	
	12	Multiplexer and Demultiplexer	
V	**Flexi Module : Not included for End-Semester Exams**		**12**
	13	Shift Registers-SI-SO, SI-PO, PI-SO, PI-PO	
	14	Seminar / Discussion- Applications of Digital Electronics in day today life	

References

1. Thomas L. Floyd, Digital Fundamentals, 11th edition, Publisher: Pearson,
2. Navas K. and Sam Jose, Digital Electronics Lab Manual, Publisher: Unknown,
3. M Morris Mano, Digital Logic and Computer Design, Publisher: Pearson, Publication Year: 2013
4. D.A. Godse, A.P. Godse, Digital Electronics.
5. R. P. Jain, Digital Electronics.
6. B L Theraja, Basic Electronics, Publisher: Chand Publications.
7. V K Mehta, Rohit Mehta, Principles of Electronics, 12th edition, Publisher: S. Chand & Company.

Web Resourses

1. https://www.nutsvolts.com/magazine/article/April2016_Beginner-Guide-to-Digital-Electronics

Lab Exercises

1. Truth table verification of basic gates.
2. Realization of Boolean functions.
3. Verify the NAND and NOR gates as universal logic gates.
4. Verify the truth table of a J-K flip-flop.
5. Test an S-R flip-flop using XNOR/NAND gates.
6. Verify the truth tables of Half and Full adder circuits.
7. Construct 2X1 MUX.
8. Verify the truth table of a 2-4 decoder.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize the concepts of number systems and digital logic.	U	PSO-1, 3
CO-2	Illustrate the basic laws of Boolean algebra and concepts of logic circuits.	Ap	PSO-1,2, 3
CO-3	Develop sequential circuits, such as counters and flip-flops.	Ap	PSO-1,2, 3
CO-4	Design various combinational logic circuits.	Ap	PSO-1,2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DIGITAL LOGIC SYSTEMS

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
CO-1	Summarise the	PO -6,7	U	F, C, P	L	P

	concepts of number systems and digital logic.	PSO-1, 3				
CO-2	Illustrate the basic laws of Boolean algebra and concepts of logic circuits	PO-1, 2, 6,7 PSO-1,2, 3	Ap	F, C, P	L	P
CO-3	Develop sequential circuits, such as counters and flip-flops.	PO-1, 2, 5, 6,7 PSO-1,2, 3	Ap	F, C, P	L	P
CO-4	Design various combinational logic circuits and apply it	PO - 1, 2, 5, 6,7 PSO-1,2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
CO 1	-	-	-	-	-	1	1	-	2	-	2	-
CO 2	2	2	-	-	-	1	1	-	2	2	2	-
CO 3	1	1	-	-	2	2	2	-	2	1	2	-
CO 4	1	1	-	-	2	2	2	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2				✓
CO 3	✓		✓	✓
CO 4		✓	✓	✓

15. DATA SCIENCE USING PYTHON

Discipline	COMPUTER SCIENCE
Course Code	UK2MDCCSC104
Course Title	DATA SCIENCE USING PYTHON

Type of Course	MDC				
Semester	II				
Academic Level	1 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2	4 hours
Pre-requisites	Basic Knowledge about Programming and Computer Technologies				
Course Summary	This course will help to learn the basics of Python along with different techniques in data science.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Basics of Python Programming**	**12**
	1	Introduction to Python, Python tokens, Literal constants, Type conversion	
	2	Variables and identifiers, Creating variables	
	3	Data types of identifiers, Input operation	
	4	Comments, Reserved words, Indentation	
	5	Operators and expressions, Expressions in Python, Decision control statements	
	6	Selection/conditional branching statements, Iterative statements, The range () function, Selecting an appropriate loop, Nested loops	
	7	Break statement, The continue statement, The pass statement, The else statement used with loops	
II		**Basic Data structures in Python**	**12**
	8	Revisiting Data Structures in Python, Introduction to Python strings, String indexing, Finding the number of characters in a string, Traversing a string, Concatenating, appending and multiplying strings, The str() function, Strings are immutable, String formatting operator, The format() function	

	9	Built-in string methods and functions, Comparing strings, ord() and chr() functions, In and not in operator	
	10	Lists, Accessing values in lists, The eval() function, Updating values in lists, Relational operations on lists, Nested lists, List aliasing and cloning, Deleting elements, Deep copies and shallow copies in Python, Basic list operations, List methods	
	11	Tuple, Creating tuple. Utility of tuples, Accessing values in a tuple, Updating tuple, Deleting elements in tuple, Joining tuples, Unpacking tuples, Basic tuple operations, Tuple assignment, Accessing using index, Tuples for returning multiple values, Nested tuples, The count() method, The zip() function, Advantages of tuple over list	
III		**Dictionaries and functions in Python**	**12**
	12	Dictionaries, Creating dictionary, Accessing values in a dictionary, Adding an item in a dictionary, Modifying an item in a dictionary, Deleting items, Traversing a dictionary, Nested dictionaries, The copy() method	
	13	Built-in dictionary functions and methods, Difference between a list and a dictionary.	
	14	Function declaration and function definition, Function definition, Function call, Function parameters, Parameter passing mutable/immutable properties, The return statement, Types of function parameters, Passing strings, lists, tuples, dictionaries to functions, Modules	
IV	**Data Handling Using Numpy and Python Pandas**		**12**
	15	Data and its purpose, Data science and its applications, The numpy module, Creating numpy arrays, Array attributes, Converting 2D numpy array into 1D array	
	16	Array slicing: Accessing subarrays, Reshaping of arrays, Array concatenation (joining) and splitting	
	17	How numpy broadcasting works, Performing mathematical operations on numpy arrays, Transposing arrays, Inserting and deleting array elements	
	18	Find the index of a value, Sorting a numpy array, Normalize array, Array subsets	
	19	Python Pandas, Data frame, Pandas data frame functions and attributes, Pivoting data frame, Sorting, Missing data, Combining data frames	

	20	Descriptive statistics, Summarizing or describing data, Function application, Aggregation (group by), Transform function in Python, Reindexing in Pandas dataframe, Altering column labels, Data wrangling, Time series data structures	
V	**Flexi Module: Not included for End Semester Exams**		**12**
	21	Plotting Graphs, Importance of data visualization, Bar chart, Plotting histograms, Frequency polygon, Box plot, Scatter plot, Correlation matrix plot, The Seaborn library, The color palette, Plotting univariate distribution, Plotting bivariate distribution	
	22	Visualizing pairwise relationship, Box Plot in Seaborn, Violin plots, Statistical estimation, Plotting categorical data, Facet grid and facetgridmap(), Pair grid, Linear relationships, Heatmap, Bubble chart, Plotting time series data, Visualizing sparse matrix	

References

1. Dr. Reema Thareja, Data Science and Machine Learning using Python, McGraw Hill Education (India) Private Limited

Lab Exercises

AQuestions on Python based on the syllabus related to Data Science

1. Programs using Python strings, lists, tuples, and dictionaries.
2. Read and write data from/to files in Python.
3. Programs to demonstrate creating and handling of modules and packages
4. Programs involving regular expressions
5. Programs to draw simple bar chart, pie chart, histogram and scatter plot
6. Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib.
7. Create a python program to export data (store Data Frame in CSV Format)
8. Create a python program to handle the missing data from a dataset using numpy and pandas.
9. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools
10. Programs using Python strings, lists, tuples, and dictionaries.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed

CO-1	Develop knowledge on Python	Ap	PSO-1,2,3
CO-2	Identify basic Data structures in Python	Ap	PSO-1,2,3
CO-3	Use Dictionaries and functions in Python	Ap	PSO-1,2,3
CO-4	Manipulate Data Using Numpy and Python Pandas	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA SCIENCE USING PYTHON

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial (T)	Practical (P)
CO-1	Develop knowledge on Python	PO-1, 2, 6,7 PSO-1,2, 3	Ap	F, C, P	L	P
CO-2	Identify basic Data structures in Python	PO-1, 2, 6, 7 PSO-1,2, 3	Ap	F, C, P	L	P
CO-3	Use Dictionaries and functions in Python	PO-1, 2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO-4	Manipulate Data Using Numpy and Python Pandas	PO-1, 2, 6, 7 PSO-1,2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO4
CO 1	1	1	-	-	-	2	2	-	3	1	2	-
CO 2	2	1	-	-	-	2	2	-	3	2	2	-
CO 3	2	1	-	-	-	2	2	-	3	2	2	-
CO 4	2	2	-	-	-	2	2	-	3	2	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Lab Assignment**	**End Semester Examinations**
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

LEVEL 2 (200-299)

Semester 3

A. Disciplinary Specific Core (DSC)

Course Code	Course Name	L (Hrs)	P (Hrs)	Credits	Remarks	Stream
UK3DSCCSC200	Data Structures	3	2	4		
UK3DSCCSC201	System Software	3	2	4		
UK3DSCCSC202	Microprocessor and Assembly Language Programming	3	2	4		
UK3DSCCSC203	Computer Graphics	3	2	4		
UK3DSCCSC204	Knowledge Representation and Reasoning	4	0	4		
UK3DSCCSC205	Visual Programming	3	2	4		
UK3DSCCSC206	Low Code Application Development	3	2	4		

UK3DSCCSC207	Cyber Crimes & Laws	4	0	4		
UK3DSCCSC208	E-Governance	4	0	4		
UK3DSCCSC209	Data Mining Concepts and Techniques	3	2	4	Vocational	Data Science
UK3DSCCSC210	Data Visualization	3	2	4	Vocational	Data Science
UK3DSCCSC211	Introduction to Machine Learning	3	2	4	Vocational	Machine Learning
UK3DSCCSC212	Medical Imaging and Analysis	3	2	4	Vocational	Health Computing
UK3DSCCSC213	Health Data Analytics	3	2	4	Vocational	Health Computing

B. Disciplinary Specific Electives (DSE)

Course Code	Course Name	Stream	L (Hrs)	P (Hrs)	Credits
UK3DSECSC200	Introduction to Cyber security	Cyber Security	4	0	4

UK3DSECSC201	Data Science Fundamentals	Data Science	3	2	4
UK3DSECSC202	Introduction to Artificial Intelligence	Machine Learning	4	0	4
UK3DSECSC203	Web Development using HTML5 and CSS3	Web Development	3	2	4

C. Multi Disciplinary Courses (KS)

D. Value Added Courses (VAC)

Course Code	**Course Name**	**L (Hrs)**	**P (Hrs)**	**Credits**
UK3VACCSC200	Coding Standards and Practices	3	0	3
UK3VACCSC201	Professional Ethics in Computer Science	3	0	3

DSC

1. DATA STRUCTURES

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC200				
Course Title	DATA STRUCTURES				
Type of Course	**DSC**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge in C Programming is mandatory.				
Course Summary	This course helps to understand the basic concepts involved in organising, storing, retrieving and modifying data using various data structures.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction to Data Structures**	15
	1	Introduction to Data Structures: Definition, Classification of data structures -Linear and Non- Linear, Static and Dynamic, Data Structure Operations, Applications of Data Structures	
	2	Array-Single dimensional array, memory representation, Operations-insertion, deletion	
	3	Searching: Linear search, Binary search	

	4	Sorting: Bubble Sort, Selection Sort, and Insertion Sort.	
	5	Time and Space complexities of algorithm	
	6	Multidimensional array- memory representations- row major & column major, Sparse matrix – array representation	
II		**Linked List**	**15**
	4	Linked List: Concept of Linked List, Memory representation , Difference of Linked List and Array.	
	5	Singly Linked List – Memory Representation, Operations - Traversing, Searching, Insertion, Deletion	
	6	Doubly Linked List- Memory representation, Operations-Traversing, Searching, Insertion, Deletion; Circular linked list- concepts only	
III	**Stack & Queue**		**15**
	8	Stack: Implementation and operations on Stack using arrays and linked list	
	9	Applications of Stack – Polish & Reverse Polish notations, Conversion of arithmetic expressions- infix to postfix using stack. Evaluation of postfix expression using stack	
	10	Queue: Implementation and operations on Queue using arrays and linked list, Applications of queue, Deque - Types- Input and output restricted, Priority Queues (Basic concepts)	
IV	**Trees**		**15**
	11	Trees: Concept of Trees, Tree terminologies, Binary tree: Types- Complete Binary tree, Full Binary Tree & Perfect Binary tree, Expression trees.	
	12	Representation of Binary Tree, Traversing Binary Trees – Preorder, Inorder, Postorder	
	13	Binary Search Tree (BST): Creating a Binary Search Tree, Search, Insertion and Deletion operations, applications of trees	
	14	Graphs - Terminologies, Representations, DFS & BFS	
V	**Flexi Module: Not included for End Semester Exams**		**15**
	15	Circular Linked List - Insertion & Deletion	

		Header Linked List - Grounded and Circular Applications of Graphs	

References

1. Seymour Lipschutz, Data Structures, Schaum's outline Series. The McGraw Hill

2. S.K.Srivastava, Deepali Srivastava. Data Structures Through C in Depth. BPB Publications

3. K Sharma. Data Structures using C. Pearson, Second Edition.

4. Ashok N. Kamthane, Introduction to Data Structures in C, Pearson

5.Jean-Paul Tremblay ,Paul G. Sorenson, An Introduction to Data Structures with Application, MCGrawhill, Second Edition.

6. Ten Baum Publisher , Data Structures using C & C++ , Prentice-Hall International.

<u>Lab Exercises</u>

The laboratory work will consist of 20-25 experiments that should be implemented in C language

Part A

1. Implementation of different searching techniques
   - Linear Search
   - Binary Search
2. Implementation of different sorting techniques.
   - Bubble Sort
   - Selection Sort
   - Insertion Sort
3. Stack Operations implemented as array
4. Queue Operations implemented as array

Part B

5. Singly Linked List Operations
6. Doubly Linked List Operations.
7. Stack operations implemented as Linked List
8. Queue operations implemented as Linked List
9. Tree traversals

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Discuss about data structure classification and applications in searching and sorting	Ap	PSO-1,2, 3
CO2	Demonstrate the concept and usage of linked lists	Ap	PSO-1,2,3
CO3	Summarise about stack, queue and its applications	Ap	PSO-1,2,3
CO4	List various types of trees and operations	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA STRUCTURES

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Discuss about data structure classification and applications in searching and sorting	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
2	Demonstrate the concept and usage of linked lists	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
3	Summarise about stack, queue and its applications	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P

4	List various types of trees and operations	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	2	1	-	-	-	1	1	-	3	2	2	-
CO 2	2	2	-	-	-	1	1	-	3	2	2	-
CO 3	2	2	-	-	-	2	1	-	3	2	2	-
CO 4	2	2	-	-	-	2	1	-	3	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

2. SYSTEM SOFTWARE

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK3DSCCSC201</td></tr>
<tr><td>Course Title</td><td colspan="5">SYSTEM SOFTWARE</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">III</td></tr>
<tr><td>Academic Level</td><td colspan="5">2</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic knowledge on Operating Systems is desirable.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course is designed to provide students with an understanding of the core principles, components, and functionalities of system software.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Types of Software**	**15**
	1	System Software vs Application Software, Different System Softwares– Assembler, Linker, Loader, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating Systems.	
	2	System software and machine architecture – The simplified Instructional Computer (SIC).	
	3	Machine architecture - Data and instruction formats - addressing modes - instruction sets.	
II		**Assemblers**	**15**
	4	Basic assembler functions - A simple SIC assembler – Assembler algorithm and data structures.	
	5	Machine dependent assembler features - Instruction formats and addressing modes – Program relocation.	
	6	Machine independent assembler features - Literals – Symbol-defining statements – Expressions.	
	7	One pass Assembler and Multi pass Assemblers.	
III		**Linkers & Loaders**	**15**
	8	Basic loader functions - Design of an Absolute Loader - Machine dependent loader features - Relocation – Program Linking.	
	9	Machine-independent loader features – Automatic Library Search – Loader Options.	

	10	Linkage Editors – Dynamic Linking – Bootstrap Loaders.	
IV	**MACROPROCESSOR AND SYSTEM SOFTWARE TOOLS**		**15**
	11	Basic macro processor functions - Macro Definition and Expansion.	
	12	Macro Processor system software tools, Text editors - Overview of the Editing Process - User Interface – Editor Structure.	
	13	Interactive debugging systems - Debugging functions and capabilities – Relationship with other parts of the system – User-Interface Criteria.	
V		**Flexi Module: Not included in End Semester Exams**	**15**
	14	Introduction to compilers, Phases of compilation, Finite Automata, Context-free Grammars	

References

1. Leland L. Beck, *System Software – An Introduction to Systems Programming*, 3rd Edition, Pearson Education Asia, 2006.
2. D. M. Dhamdhere, *Systems Programming and Operating Systems*, Second Revised Edition, Tata McGraw-Hill, 2000.

Lab Exercises

1. Implement pass one of a two pass assembler.
2. Implement pass two of a two pass assembler.
3. Implement a single pass assembler.

Lab Resource: https://www.vtuloop.com/system-software-lab-all-in-one/

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO 1	Differentiate between various types of system software and their specific roles.	U	PSO -1
CO 2	Explain basic assembler and loader functions,	U	PSO -1,2,3
CO 3	Identify basic functions of loaders and linkers	U	PSO -1,2,3
CO 4	Use macro processor functionalities, text editing tools, and interactive debugging systems	Ap	PSO -1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create *Note: 1 or 2 COs/module*

Name of the Course: SYSTEM SOFTWARE

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Differentiate between various types of system software and their specific roles.	PO - 6, 7 PSO -1, 3	U	F, C	L	P
2	Explain basic assembler and loader functions,	PO - 1, 2, 6, 7 PSO -1,2, 3	U	F, C, P	L	P
3	Identify basic functions of loaders and linkers	PO - 1, 2, 6, 7 PSO -1,2, 3	U	F, C, P	L	P
4	Use macro processor functionalities, text	PO - 1, 2, 6, 7 PSO -1, 3	Ap	F, C, P	L	P

	editing tools, and interactive debugging systems					

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	1	1	-	-	-	2	1	-	3	1	2	-
CO 2	2	1	-	-	-	2	1	-	3	2	2	-
CO 3	2	1	-	-	-	2	1	-	3	2	2	-
CO 4	-	-	-	-	-	2	3	-	3	-	2	3

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4		✓	✓	✓

3. MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC202				
Course Title	MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING				
Type of Course	**DSC**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lectures per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Students should have an understanding of computer organization, architecture and basic digital circuit design concepts.				
Course Summary	This course will help students to understand the architecture, memory organization, interrupts, pin configurations, and instruction set of an 8086 microprocessor. It also helps to gain practical assembly language programming skills for efficient implementation.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**The 8086 Microprocessor**		**15**
	1.	The 8086 Internal Architecture: Execution Unit, Bus Interface Unit	
	2.	The 8086 Registers, Memory Banks: Even Bank, Odd Bank	
	3.	Pin Configuration, Signals: Minimum mode and Maximum mode	
	4.	Multiplexing of address/ data bus	
	5.	Bus cycles and Timing Diagram	
II	**Instruction Set**		**15**
	6.	Instruction set of 8086: Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation, String Instructions, Branch Control Instructions, Iteration Control Instructions, Interrupt Instructions, Processor Control Instructions.	
	7.	Addressing modes of 8086.	
	8.	Interrupts: Interrupt Vector Table, Response, Types, Priority.	
	9.	Direct Memory Access, DMA Transfer modes, DMA Controller-8257.	
III	**Assembly Language Programming**		**15**
	10	Program Development Tools	
	11	Assembler Directives	
	12	Variables and Constants	
	13	Procedures and macros	
	14	Interrupts of personal computers,	
	15	Hand coding of assembly language programs, examples.	
	Advanced Microprocessors		**15**
	16	Intel Pentium Processor (Architecture and features only)	

IV		Advanced pentium processors: Pentium pro, Pentium II, Pentium III, Pentium 4 (Features only)	
	17	Intel Core i3, i5, i7, i9 series (Features only)	
V	**Flexi Module: Not included for End-Semester Exams**		**15**
	18	Microcontroller: Fundamental concepts, Architecture	
	19	Introduction to Embedded System	

CORE REFERENCES:

1. A. NagoorKani, 8086 Microprocessor and Its Applications, McGraw Hill, Second Edition.
2. N. Mathivanan, Microprocessors, PC Hardware, and Interfacing, PHI Edition.
3. Barry B. Brey, The Intel Microprocessors, 8th Edition, Pearson Education.

LAB EXERCISES

PART A

1. Basic Arithmetic Operations (Addition, Subtraction, Multiplication, and Division)
2. Data Transfer between Memory and Registers
3. Simple Programs using Iteration Control Instructions

PART B

4. Program to find the sum of numbers in an array
5. Program to Reverse word in strings
6. Program to compute the square of a number
7. Program to find the LCM of two 16-bit unsigned numbers
8. Program to search for a number in an array
9. Program to find ascending order in an array
10. Program to move a block of data from one location to another

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise the basic concepts of microprocessors	U	PSO-1
CO-2	Apply various addressing modes and instructions of the 8086 microprocessors for program development.	Ap	PSO-1, 2, 3

CO-3	Develop assembly language programs for the 8086 microprocessors to solve computational problems efficiently.	Ap	PSO-1, 2, 3
CO-4	Outline the features of advanced microprocessors	U	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L) / Tutorial (T)	Practical (P)
1	Summarise the basic concepts of microprocessors	PO - 6, 7 PSO-1	U	F, C	L	-
2	Apply various addressing modes and instructions of the 8086 microprocessors for program development.	PO -1,2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
3	Develop assembly language programs for the 8086 microprocessors to solve computational problems efficiently.	PO -1,2, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
4	Outline the features of advanced microprocessors	PO -6, 7 PSO-1	U	F, C	L	-

F-Factual, C-Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	-	-	-	1	1	-	2	1	-	-
CO 2	2	2	-	-	-	1	1	-	2	2	2	-
CO 3	2	2	-	-	-	2	1	-	2	2	2	-
CO 4	-	-	-	-	-	3	3	-	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

4. COMPUTER GRAPHICS

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC203				
Course Title	COMPUTER GRAPHICS				
Type of Course	DSC				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic C programming Skill is necessary.				
Course Summary	This course is designed to familiarise the various algorithms in computer graphics using the C programming language.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15**
	1	Computer graphics, application of computer graphics, pixel, resolution, aspect ratio, frame buffer, Raster scan, horizontal and vertical retrace, Random scan, video adapter, video controller, Graphics card.	
	2	Display devices- LCD, LED, DVST, 3D viewing devices, stereoscopic and virtual reality systems,	
	3	Properties of Light, Color models (RGB, YIQ, CMY, HSV.	
II		**Output primitives**	**15**

	4	Coordinate systems- modelling coordinates, world coordinates, device coordinates	
	5	Output primitives: Straight line, DDA algorithm, Bresenham's Line drawing algorithm, midpoint circle algorithm.	
	6	Polygon filling algorithms-boundary fill, flood fill, scan line algorithm	
III		**Two dimensional transformations and clipping**	**15**
	7	Basic transformations: Translation, Rotation, Scaling, homogeneous coordinates for uniform matrix operations, composite transformation	
	8	Other transformations: reflection, shearing, transformations with respect to arbitrary points, matrix formulation and concatenation of transformations	
	9	2D clipping; clip window, Point clipping, Line clipping, Cohen-Sutherland Line Clipping algorithms, Midpoint subdivision algorithm.	
IV		**3D concepts and techniques**	**15**
	10	3D display techniques, 3D object representations, basic 3D transformations	
	11	Projections: parallel and perspective projections.	
	12	Visible surface detection algorithms-scan line method, Z buffer algorithm, A- buffer algorithm, depth sorting.	
V		**Flexi Module** (Not for end semester Examination)	**15**
	13	Curves: B-Spline, Bezier	
	14	Animation: Morphing, Tweening, Zooming, Panning, Scissoring	
	15	Shading	

References

1. Donald D. Hearn, M. Pauline Baker, "Computer Graphics" (C Version) 2/e , Pearson

https://archive.org/details/DonaldHearnM.PaulineBakerComputerGraphicsBookFi.org/page/n58/mode/1up (pdf link)

2. Zhigand xiang, Roy Plastock, "Computer Graphics Second edition", Schaum's outlines, Tata Mc Graw hill edition.

3. Amarendra N Sinha and Arun D Udai, Computer Graphics, McGraw Hill Publications.

4. Foley, Van Dam, Feiner and Hughes, “Computer Graphics Principles & practice”, second edition in C, Pearson Education.

5. David F Rogers, “Procedural elements for Computer Graphics”, Tata Mc Graw hill, 2nd edition.

NPTEL Web Course:

1. http://nptel.ac.in/courses/106106090/

NPTEL Video Course:

1. http://nptel.ac.in/courses/106106090/#

Lab Exercises

1.Use functions to draw different shapes

2. Implementing DDA algorithm

3. Implementing Bresenham’s line drawing algorithm

4. Implementing Midpoint circle generation algorithm

5. Implementing Boundary fill & flood fill algorithm

6. Program for performing the basic 2D transformations such as translation, Rotation, Scaling for a given 2D object

7. Program for performing the other 2D transformations Reflection along x-axis and y-axis, x direction shearing and y- direction shearing for a given 2D object

8. Implement composite transformations

9. Program for performing the basic 3D transformations such as translation, Rotation, Scaling for a given 3D object (Hint: bar3d() from graphics.h)

10. Programs for designing simple animations using transformations

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the basic principles of computer graphics, different input/output devices and graphic operations.	U	PSO-1, 2, 3
CO-2	Experiment with algorithms to generate computer graphic primitives, specifically straight line and polygon filling.	Ap	PSO-1, 2, 3
CO-3	Illustrate 2D transformations and clipping operations in computer graphics, different methods for transformations.	Ap	PSO-1,2, 3
CO-4	Demonstrate 3D computer graphics techniques, the concept of projections and various surface detection algorithms.	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: COMPUTER GRAPHICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Outline the basic principles of computer graphics, different input/output devices and graphic operations.	PO-3, 6, 7 PSO-1, 2, 3	U	F, C	L	P

2	Experiment with algorithms to generate computer graphic primitives, specifically straight line and polygon filling.	PO-2, 3, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
3	Illustrate 2D transformations and clipping operations in computer graphics, different methods for transformations.	PO-2,3, 6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Demonstrate 3D computer graphics techniques, the concept of projections and various surface detection algorithms.	PO-2, 3, 6, 7 PSO-1, 2	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO-1	1	-	1	-	-	-	2	-	2	1	2	-
CO-2	2	2	1	-	-	1	2	-	2	2	2	-
CO-3	2	2	1	-	-	1	2	-	2	2	2	-
CO-4	2	2	1	-	-	1	2	-	2	2	-	-

Correlation Levels:-

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/ Quiz./Seminar	Programming Assignments	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓			✓

4. KNOWLEDGE REPRESENTATION AND REASONING

Discipline	COMPUTER SCIENCE
Course Code	UK3DSCCSC204
Course Title	KNOWLEDGE REPRESENTATION AND REASONING
Type of Course	DSC
Semester	III
Academic Level	2

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Nil				
Course Summary	This course delivers various forms of knowledge representations				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to Knowledge Representation**	**12**
	1	The Key Concepts: Knowledge, Representation and Reasoning Knowledge-Based Systems, Knowledge acquisition	
	2	Need for good representation. Various representations - Semantic Net, Frames, Scripts, Conceptual Dependencies, Ontology	
	3	Search Space, Semantic Tree, Search Tree, Goal Tree- Uses of goal trees	
II		**Introduction to Logic**	**12**
	4	Introduction to Logic- Propositional Logic, Use of logic in AI, Logical operators	
	5	Truth Table, Equivalence, Tautology, Contradiction, Various deductions	
	6	Predicate Calculus- First Order Predicate Logic	
	7	Universal Instantiation, The Unification Algorithm	
III		**Rule Based Systems**	**12**
	8	Rules for knowledge representation, Rule Based Systems - Forward and Backward Chaining, Comparing forward & backward chaining	
	9	Basics of Knowledge Engineering.	
	10	Taxonomies and Inheritance. Default Reasoning	
IV		**Reasoning**	**12**
	11	Reasoning in Artificial intelligence	
	12	Inductive reasoning Vs Deductive reasoning	

	13	Probabilistic reasoning in Artificial intelligence	
V		**Flexi Module (Not included for end semester exam)**	**12**
	14	Expert Systems – Architecture of Expert System	
	15	Case Study: DENDRAL, MYCIN, PXDES, CaDeT	

References

1. Ben Coppin: Artificial Intelligence Illuminated, Jones and Bartlett Publishers
2. Ronald J Brachman, Hector J Levesque: Knowledge Representation and Reasoning
3. John F Sowa: Knowledge Representation: Logical, Philosophical & Computational Foundations

4. Nilsson N.J.: Artificial Intelligence - A New Synthesis, Harcourt Asia Pvt. Ltd
5. Stuart Russell and Peter Norvig: Artificial Intelligence: A Modern Approach, 3rd Edition. Prentice Hall.

Web Resources

https://nptel.ac.in/courses/106106140

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise the concepts of knowledge, representation, and reasoning	U	PSO – 1, 2
CO-2	Identify equivalences, tautologies, and contradictions.	Ap	PSO – 1, 2
CO-3	Sketch the fundamentals of knowledge engineering	Ap	PSO – 1, 2
CO-4	Show the design of expert systems	Ap	PSO – 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: KNOWLEDGE REPRESENTATION AND REASONING

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Summarise the concepts of knowledge, representation, and reasoning	PO –1,2,6,7 PSO – 1, 2	U	F, C	L	-
2	Identify equivalences, tautologies, and contradictions.	PO –1,2,5, 6,7 PSO – 1, 2	Ap	F, C, P	L	-
3	Sketch the fundamentals of knowledge engineering	PO –1,2,6,7 PSO – 1, 2	Ap	F, C, P	L	-
4	Show the design of expert systems	PO –1,2,5, 6,7 PSO – 1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PSO 1	PSO 2	PSO 3	PSO4
CO 1	2	1	-	-	-	2	1	-	3	1	-	-
CO 2	3	2	-	-	2	2	1	-	3	3	-	-

CO 3	3	2	-	-	-	2	1	-	3	3	-	-
CO 4	2	2	-	-	2	2	1	-	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓

6. VISUAL PROGRAMMING

Discipline	Computer Science				
Course Code	UK3DSCCSC205				
Course Title	VISUAL PROGRAMMING				
Type of Course	**DSC**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic programming skills are desirable.				
Course Summary	This course aims to make the students capable of developing a web site using client server technology ASP.NET. Through this course, students will learn the basic concepts of client-server technology like CLR, web pages and its different web controls, validation controls and ADO.NET.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to ASP.NET**	**15**
	1	The .Net Platform and the Web- The Pathway to Web Application, The Web Client/Server Model, Components of ASP.NET and the .NET framework, Overview of IIS, Overview of ASP.NET, The .NET Common Language Runtime, Language Independence in the .NET framework. Working with ASP.NET- The Features of ASP.NET, The Anatomy of ASP.NET Pages, Introducing Web Forms, Visual Studio IDE Basics, Code-Behind feature. Application Configuration- Overview of Global.asax file and Web.config file.	
II		**Web Controls**	**15**

	2	Introduction to server controls- how to work with button controls, text boxes, labels, check boxes, radio button, list controls and other web server controls like image, image map, hyperlink, file upload, and calendar controls, properties of each control of ASP.NET. ASP.NET Page Directives- @Page, @Control, @Import, @Register, @Assembly, @OutputCache	
III	**Validation and Data Controls**		**15**
	3	Introduction to validation controls- basic validation controls- Required Field Validator Control, Compare Validator Control, Range Validator Control, Regular Expression Validator Control, Custom Validator Control, properties of each validation control of ASP.NET. Introduction to Data List Controls- Repeater Control and DataList Control, Introduction of GridView, Introduction of FormView and Detail View Controls Authoring a User Control- Login Control, LoginView Control, LoginStatus- Control, LoginName Control, PasswordRecovery Control	
IV	**State Management and ADO.NET**		**15**
	4	How to manage state – how to use view state, session state and application state. ASP.NET Intrinsic Objects- The HttpRequest Object, The HttpResponse Object, The HttpApplicationState Object, The HttpSessionState Object Introduction to ADO.NET- ADO.NET Programming Objects and Architecture, Displaying Database Data, Working with The Data Set and Data Table Objects	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	5	Introduction to authentication, how to set up authentication and authorization, how to configure ASP.NET applications, how to deploy an ASP.NET application.	

Core Textbooks

1. Matt J. Crouch, “ASP.NET and VB.NET Web Programming”, Pearson

Reference Books

1. Gerg Buczek, “ASP.NET Developer’s Guide” Publisher: McGraw Hill
2. Imar Spaanjaars, “Beginning ASP.NET 4.0 in C# and VB”, Wiley publishers.
3. Anne Boehm, Murach’s ASP.NET 4 web programming with VB 2010, Shroffs publishers and Distributors Pvt. Ltd.

Web Resources

1. https://www.javatpoint.com/asp-net-tutorial
2. https://learn.microsoft.com/en-us/aspnet/tutorials
3. https://www.tutorialspoint.com/asp.net/index.htm

LAB EXERCISES

The laboratory work will consist of 10-15 experiments.

Part A (1 to 10 programs)

- Programs to demonstrate and use different web server controls in ASP.NET.
- Program to demonstrate working with forms.
- Programs to demonstrate and use of different Validation controls.
- Develop a web form for Email Registration

Part B (11 to 15 programs)

- Program to demonstrate Session Management.
- Design a form that allows the user to enter some simple data and store it in db.
- Design a form to perform delete and update operations in db.
- Design a form to retrieve data from a table and use GridView control.
- Programs to demonstrate Login Control.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Discuss about the various features of visual studio tools.	Ap	PSO-1,2,3
CO-2	Illustrate the usage of different controls in web development.	Ap	PSO-1,2,3
CO-3	Build web pages using validation and data controls in ASP.NET	Ap	PSO-1,2,3
CO-4	Develop dynamic websites using visual studio IDE.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: VISUAL PROGRAMMING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Discuss about the various features of visual studio tools.	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
2	Illustrate the usage of different controls in web development.	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
3	Build web pages using validation and data controls in ASP.NET	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Develop dynamic websites using visual studio IDE.	PO-1,2,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	-	-	-	1	1	-	3	1	2	-
CO 2	2	2	-	-	-	1	1	-	3	2	2	-
CO 3	2	2	-	-	-	2	2	-	3	2	2	-
CO 4	2	2	-	-	-	3	3	-	3	2	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

7. LOW CODE APPLICATION DEVELOPMENT

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK3DSCCSC206</td></tr>
<tr><td>Course Title</td><td colspan="5">LOW CODE APPLICATION DEVELOPMENT</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">III</td></tr>
<tr><td>Academic Level</td><td colspan="5">2</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td></td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic awareness of the computer science domain.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course aids any beginner without profound knowledge in computers in developing applications.</td></tr>
</table>

Detailed Syllabus:

<table>
<tr><th>Module</th><th>Unit</th><th>Content</th><th>Hrs (L+P)</th></tr>
<tr><td rowspan="3">I</td><td colspan="2">Foundations of No-Code Development and Web Scraping</td><td rowspan="3">15</td></tr>
<tr><td>1</td><td>No Code Fundamentals - What is No-Code Development? - Top Benefits and Limitations of No-Code Apps - What can you build with No-Code? - Who can use zero-code platforms? – What is the history and future of no-code? – Popular No-Code development platforms - Fundamentals of Workflow - How can workflow automation help your business? Examples of Workflow Automation.</td></tr>
<tr><td>2</td><td>Introduction to Web Scraping - What is No-Code Web Scraping? - ScrappingBee for Web scraping API</td></tr>
<tr><td rowspan="2">II</td><td colspan="2">No Code Web Development with WebFlow and Bubble</td><td rowspan="2">15</td></tr>
<tr><td>3</td><td>Introduction to WebFlow - How websites are built? - Overview of Designer Interface - The Box Model - Webflows Designer - The User Interface - Changing Font Style And Elements Size - Editing</td></tr>
</table>

		Content - Editing Button And Using Classes - Changing Background Color And Size - Reusing elements with Symbols - Publishing with WebFlow	
	4	Introduction to Bubble - Bubble Core Concepts - What you can build with Bubble? - How to navigate Bubble.io? - Structuring a Bubble Database - Flexbox responsive design - Workflow creation in Bubble	
III	**App Development Essentials with ChatGPT Integration**		**15**
	5	Evolution of Mobile App Builders - The Fundamentals of Glide - Benefits of Glide for App Development - Glide App Editor Overview - Glide Settings Overview - Glide Components - Google Sheets Vs Glide Data Editor - Understanding Table Relations - Glide Actions	
	6	Introduction to Thunkable - Getting Started: Sign In, Creation of New Projects - App Settings, Table View - Assets, UI Components Core Blocks - OpenAI ChatGPT Integration - Publish to App and Web Store.	
IV	**Chatbot Development Essentials**		**15**
	7	Traditional AI Journey - Key AI Components - AI Superpowers - No-Code AI Market - Popular No-Code AI Platforms - No-Code AI Considerations - What is Google Teachable Machine? - Model Training and Testing in Google Teachable Machine - Introduction to Microsoft Lobe.ai - Lobe Overview and Tool Walkthrough - Lobe.ai Examples	
	8	What is a Chatbot? - How a Chatbot can improve your business? - No-Code in Chatbots - Advantages of No-code chatbot development - Popular No-code chatbot builders - How to select the right no-code AI chatbot builder? - Getting Started with Landbot - Optimize the welcome message, Add the first sequence - Ask Questions with different question types (button, button with pics, multiple choice, email)	
V	**Flexi Module: Not included for End Semester Exams**		**15**
	9	Introduction to No-Code Databases and Automation - AirTable Sign Up and Create Database - Design the Workflow - Formula	

		Field Type - Exporting/Importing Bases - Working with Filters - Managing Data with Groups - Sorting Functionality in AirTable - Views offered by AirTable - Kanban View, Form View, Calendar View - Working with multiple tables	
	10	Introduction to No-Code E-commerce App - What is Shopify? - Features of Shopify Platforms - Benefits of the Shopify platform for online store - Steps to create an online store in Shopify - Create a Shopify Account - Add Products to the Catalog - Customizing Your Shopify Online Store and Domain Setup - Payment Processor Activation - Market and Advertise Shopify e-commerce website -	

Text Books:

1. Paul.E.Love, "Mastering No-Code: Create Professional Quality Apps Without Coding (Vol.1)", ISBN: 979-8749478402

Lab Exercises

1. Tour around the different No-Code Tool Landscape
2. Building Workflow Automation using Low-Code
3. Create a web scraping tool using No-Code
4. Working with the Designer interface of WebFlow
5. Create a Responsive WebPage using WebFlow
6. Using Bubble build features like sign-up forms, expense trackers, inboxes, shopping carts
7. Build a Mindfulness app using Glide
8. Build a Task Tracker App Using Glide
9. Detect and Classify Face Masks using GoogleTeachable machine.
10. Build an Image Classification Model Using Lobe.ai
11. Build a Conversational Chatbot using LandBot
12. Create a workflow in AirTable
13. Build an Online Store using Shopify
14. Develop a website using a No-Code Stack of your choice

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise the fundamentals of No-Code, Workflows and perform Web Scraping using a No-Code App	U	PSO-1
CO-2	Build a Website using the popular No-Code Apps Webflow and Bubble.io	Ap	PSO-1,2,3

CO-3	Build Mobile Apps using the popular No-Code Apps Glide and Thunkable	Ap	PSO-1,2,3
CO-4	Build AI-powered apps using No-Code AI Tools	Ap	PSO-1,2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: LOW CODE APPLICATION DEVELOPMENT

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Summarise the fundamentals of No-Code, Workflows and perform Web Scraping using a No-Code App	PO-6,7 PSO-1	U	F, C	L	-
2	Build a Website using the popular No-Code Apps Webflow and Bubble.io	PO-1, 2, 3, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P
3	Build Mobile Apps using the popular No-Code Apps Glide and Thunkable	PO-1, 2, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P
4	Build AI-powered apps using No-Code AI Tools	PO-1, 2, 3, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	-	-	-	2	2		2	2	2	-
CO 2	1	1	2	-	-	2	2		2	1	2	-
CO 3	2	2	-	-	-	2	2		3	2	2	-
CO 4	1	1	2	-	-	2	2		3	1	2	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓			✓
CO 4		✓	✓	✓

8. CYBER CRIME AND LAWS

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC207				
Course Title	CYBER CRIMES AND LAWS				
Type of Course	DSC				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic understanding of computer systems and cyber security is desirable.				
Course Summary	This course explores the landscape of various cybercrimes, while delving into the legal frameworks governing cyberspace and analysing legislation to understand the complexities of prosecuting and defending against digital offences in an increasingly interconnected world.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to Cyber Crimes**	12
	1	**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Cyber Security – Typology of Cyber Crime – Extent & impact of Cyber crime	
	2	**Classification of Cybercrimes:** E-mail Spoofing, Spamming, Cyber Defamation, Salami Attack, Data Diddling, Forgery, Online Frauds,	

		Pornographic Offenders, Software Piracy, Computer Sabotage Email Bombing, Computer Network Intrusion, Password Sniffing, Credit Card Frauds,	
II		**Phishing and Identity Theft**	**12**
	4	**Phishing:** Methods of Phishing, Phishing Techniques, Types of Phishing Scams, Phishing countermeasures,	
	5	**Identity theft**, Types and Techniques of identity thefts and its countermeasures	
III		**IT ACT, Offences and Penalties**	**12**
	8	**Information Technology Act:** Evolution of the IT Act, Salient Features of the IT Act, 2000; Various Authorities Under IT Act; Penalties & Offences, Amendments, Cyber Space Jurisdiction, Jurisdiction Issues Under IT Act, 2000.	
	9	**E-commerce and Laws in India:** Digital/Electronic Signature in Indian Laws, E-Commerce; Issues and Provisions in Indian Law, E-Governance; Concept and Practicality in India, E-Taxation Issues in Cyberspace, E-Contracts and its Validity in India, Cyber Tribunal & Appellate Tribunal, Cyber Regulations.	
IV		**Intellectual Property Rights**	**12**
	11	**Intellectual Property Rights:** Domain Names and Trademark Disputes, Concept of Trademark in Internet Era, Cyber-squatting, Reverse Hijacking, Jurisdiction in Trademark Disputes, Copyright in the Digital Medium, Copyright in Computer Programmes, , Concept of Patent Right, Relevant Provisions of Patent Act 1970.	
	12	**Personal Data Security:** Sensitive Personal Data or Information (SPDI) in Cyber Law, SPDI Definition and Reasonable Security Practices in India, International Perspective, Cloud Computing & Law.	
V		**Flexi Module (Not included for end semester exam)**	**12**
	14	Introduction to Digital Forensics – Types of Digital forensics	
	15	Cyber Security Trends	
	16	Cyber Laws of other countries, Case Studies.	

References

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapur, Wiley
2. Understanding Cybercrime: Phenomena, and Legal Challenges Response, ITU 2012
3. Cyber Crimes and Laws, Sushma Arora, Raman Arora

4. Cyber Security and Cyber laws : Nilakshi Jain , Ramesh Menon , Wiley
5. Security in Computing, Charles P. Pfleeger, Shari Lawrence Pfleeger, Pearson Publication, Fifth Edition 2015
6. Introduction to Information Security and Cyber Law, Surya Prakash Tripathi, Dreamtech Press,2014
7. Cyber Law & Cyber Crimes Simplified , Adv. Prashant Mali - Cyber Infomedia
8. Cyber Crimes and Penalities, Adv.Prasant Mali

Web Resources

1. https://www.itu.int/ITU-D/cyb/cybersecurity/docs/Cybercrime%20legislation%20EV6.pdf
2. https://baou.edu.in/assets/pdf/PGDCL_202_slm.pdf
3. https://ia600709.us.archive.org/21/items/ATextBookOfCyberCrimeAndPenalties/ATextBookOfCyberCrimesAndPenaltiesByAdv.PrashantMali.pdf
4. https://www.bbau.ac.in/dept/Law/TM/1.pdf
5. https://iritm.indianrailways.gov.in/uploads/files/1360312590693-12.Cyber-Laws-chapter-in-Legal-Aspects-Book.pdf
6. https://osou.ac.in/eresources/introduction-to-indian-cyber-law.pdf

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarise the basics of cyber crimes and cyber security	U	PSO-1
CO-2	Outline the methods, techniques of phishing, thefts and solutions.	U	PSO-1
CO-3	Identify the authorities, jurisdictions and penalties under IT Act.	U	PSO-1,3
CO-4	Identify legislative aspects of cyberspace, related to trademark and copyright laws .	U	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CYBER CRIME AND LAWS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Summarize the basics of cyber crimes and cyber security	PO - 6,7 PSO - 1	U	F, C	L	-
2	Outline the methods, techniques of phishing, thefts and solutions.	PO – 6,7,8 PSO - 1	U	F, C	L	-
3	Identify the authorities, jurisdictions and penalties under IT Act.	PO – 6,7,8 PSO- 1,3	U	F, C	L	-
4	Identify legislative aspects of cyberspace, related to trademark and copyright laws .	PO -6,7,8 PSO- 1,3	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO4
CO 1	-	-	-	-	-	2	2	-	2	-	-	-

CO 2	-	-	-	-	-	2	2	1	2	-	-	-
CO 3	1	-	-	-	-	2	2	2	2	-	1	-
CO 4	-	-	-	-	-	2	2	2	3	-	1	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/Discussion / Seminar
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Discussion / Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

9. E-GOVERNANCE

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC208				
Course Title	E-GOVERNANCE				
Type of Course	**DSC**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Awareness of the basics of Information Technology concepts is desirable.				
Course Summary	This course on E-Governance provides a comprehensive understanding of digital governance and its potential in transforming the functioning of governments, services they provide and modes of interaction with citizens.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Concepts of E-Governance**	**12**
	1	Meaning, Concept of E-Governance, Objectives of E-Governance.	
	2	Types of Interactions of E- Governance- Government to Customer, Government to Employees, Government to Government, Government to Business.	
	3	Advantages, Disadvantages, Importance of E-Governance.	
	4	Components-Pillars of E-Governance, Goals of E-Governance, Some E-governance Initiatives in India	
II		**Evolution of E-Governance**	**12**
	5	Phases of E- Government in India-Informatics based E- Government	
	6	Personal Computer based E-Government	

	7	World Wide Web based E-Government	
	8	History and Evolution of E-Governance in India	
III		**E-Governance Technologies and Principles**	**12**
	9	Role of Technologies in E-Governance-Block Chain Technologies and E-Governance	
	10	Information Technology and E-Governance	
	11	Smart E-Government Platform through Technologies	
	12	Cloud Computing in E-Governance	
	13	Core Principles of E-Governance	
	14	E-Government is about Government than Online Presence	
	15	Promotion of E-citizens and E-democracy	
	16	Accessibility, use of Open Source over proprietary software	
	17	E-Business Plan, Strategies for Implementation of E-Governance, National E-Governance Plan	
IV		**E-Governance Architecture**	**12**
	18	E-Governance Architecture- India Enterprise Architecture (INDEA)-Vision, Purpose, Scope of INDEA	
	19	Structure, Principles, Reference Models of INDEA.	
	20	Opportunities, Challenges for E-Governance, Environmental and Social Challenges	
	21	Economic Challenges, Technical Challenges, Challenges of Implementation, Other Challenges, Security Drawbacks	
	22	Role of DeitY in good Governance	
V		**Flexi Module**	**12**
	23	Empowering India through E-Governance- MyGov Platform, Pahal, Paygov India, Aadhar Enabled Payment System, Smart Cities	
	24	Nine Pillars of Digital India	
	25	UMANG, Digital Locker, National Centre of Geo-Informatics, Rapid Assessment System, State Wide Area Network, e-Kranti, e-Taal,	

		e_District, e-Sampark, e-Pramaan- Digital Life Certificate, e-Office, Open Forge Platform	

References

1. M Sumathy, A handbook of E-governance in India, Abhijeet Publishers, September, 2021.
2. M P Gupta, Prabhat Kumar, Jaijit Bhattacharya, Government Online Opportunities and Challenges, Tata McGraw Hill, 2003.
3. Prabhu C S R, E-Governance: Concepts and Case studies, PHI, (Second Edition), 2022.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise concepts of E-Governance	U	PSO-1,2
CO-2	Illustrate the various phases of E-Government	Ap	PSO-1,2
CO-3	Interpret E-Governance Principles	U	PSO-1,2
CO-4	Identify Architecture and challenges in E-Governance	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: E-GOVERNANCE

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Summarize concepts of E-Governance	PO 6,7 PSO-1,2	U	F, C	L	-
CO-2	Illustrate the various phases of E-Government	PO 6,7 PSO-1,2	Ap	F, C	L	-

CO-3	Interpret E-Governance Principles	PO 6, 7 PSO-1,2	U	F, C	L	-
CO-4	Identify Architecture and challenges in E-Governance	PO 6,7 PSO-1,2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	2	2	-	2	2	-	-
CO 2	-	–	-	-	-	2	2	-	2	2	-	-
CO 3	-	-	-	-	-	2	2	-	2	2	-	-
CO 4	-	-	-	-	-	2	2	-	2	2	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Discussion/Seminar	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4	✓	✓		✓

10. DATA MINING CONCEPTS AND TECHNIQUES

Discipline	Computer Science				
Course Code	UK3DSCCSC209				
Course Title	**DATA MINING CONCEPTS AND TECHNIQUES**				
Type of Course	DSC				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	This course, Data Mining Concepts and Techniques, introduces the student to the world of data and the various methods and models used in transforming, Classifying and analysing data.				

Detailed Syllabus:

Module	Unit	Content	Hrs (T+P)
I		**Basics of Data Mining**	15
	1	Definition of data, Information and Data analysis	
	2	Fundamentals of Data Mining , Data mining stages.	
	3	Applications of Data mining, Data Pre –processing.	
	4	Need for Pre-processing the Data, Data Cleaning.	
II		**Data Integration and Transformation**	15
	5	Data Reduction	
	6	Introduction to data warehouse;	
	7	Business Intelligence.	
III		**Classification Models**	15
	9	Classification and Prediction	
	10	Issues Regarding Classification and Prediction.	
	11	Classification by Decision Tree Induction	
	12	KNN, Bayesian Classification	
	13	Neural networks	
	14	Support VectorMachines.	
IV		**Association Rules Mining**	15
	15	Mining Frequent Patterns	
	16	Associations and Correlations	
	17	Efficient and Scalable Frequent Itemset Mining Methods	
	18	Mining various kinds of Association Rules	
	19	From Association Mining to Correlation Analysis.	
V		**Flexi module(Not included for End Semester Examination)**	15

	20	Understanding the Hadoop	
	21	Distributed File System (HDFS) Getting Data into Hadoop	
	22	Understanding Data Processing in Hadoop	

TEXT BOOK

1. Han, J., Pei, J., & Kamber, M. (2011). *Data mining: concepts and techniques*. Elsevier.

REFERENCES

2. Hall M, Frank E, Holmes G, P.fahringer B. Reutemann P &Witten, I.H(2009), The WEKA data mining software: an update. *ACM SIGKDD explorations newsletter*, *11*(1), 10-18.
3. Gupta, G.K (2014) Introduction to Data Mining with Case Studies, 2014, Prentice Hall India.

Lab Exercises

Practical using Python/WEKA Tool

1. List all the categorical (or nominal) attributes and the real-valued attributes separately
2. Calculate: mean, median, mode
3. Demonstration of data preprocessing on dataset
4. Demonstration of data preprocessing on dataset based on missing values
5. Demonstration of Association rule process on dataset using Apriori Algorithm
6. Demonstration of classification rule process on dataset using decision tree induction
7. Demonstration of classification rule process on dataset using naive bayes algorithm
8. Demonstration of clustering rule process on dataset using various clustering methods
9. Practising outlier detection in clustering on dataset

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Cite the fundamentals of data mining	U	PSO- 1,
CO2	Summarise about pre-processing techniques	U	PSO- 1,2
CO3	Illustrate the data integration, transformation and reduction techniques	Ap	PSO- 1,2,3
CO4	Experiment with classification and prediction models.	Ap	PSO- 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA MINING CONCEPTS AND TECHNIQUES

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Cite the fundamentals of data mining	PO-3,6,7 PSO-1,	U	F, C. P	L	P
2	Summarize about pre-processing techniques	PO-3,6,7 PSO-1,2	U	F, C, P	L	P
3	Illustrate the data integration, transformation and reduction techniques	PO-3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Experiment with classification and prediction models.	PO-3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4

CO 1	-	-	3	-	-	3	3	-	2	1	-	-
CO 2	-	-	3	-	-	3	3	-	2	1	-	-
CO 3	-	-	3	-	1	3	3	-	2	1	2	-
CO 4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

11. DATA VISUALIZATION

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC210				
Course Title	DATA VISUALIZATION				
Type of Course	**DSC**				
Semester	III				
Academic Level	2 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic Knowledge of visualization, Data and Image Models Design and Data Analysis is necessary.				
Course Summary	This course helps the student to visualize data using various techniques.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Value of visualization**	**12**
	1	What is visualization? Why create visualizations?	
	2	Conveying information to others– Telling stories with data – Data checking and verification.	
	3	Data Maps – Time series – Graphical excellence.	
II		**Data and Image Models**	**12**
	4	Visualization reference model – data: physical and abstract types– metadata, semantics.	
	5	Conceptual data – properties of images – conceptual model – relational data model – statistical data model.	
	6	Dimensions and measures – Roll-up and Drill- down	

	7	Visual encoding and sign systems - Multidimensional Data -Large design space.	
III		**Design of Visualization**	**12**
	9	Visual encodings, mapping data to image – Design criteria, expressiveness, effectiveness.	
	10	Data transformation –Presentation, titles, captions, annotations legend and grid lines- Testing designs.	
	11	Graphical integrity– Charting, Bar chart, Line chart, Dot plot, Tables	
	12	Heat-maps - Data-based grids – Multi-functioning labels	
IV		**Exploratory Data Analysis**	**12**
	13	EDA Vs Classical Data analysis – Goals of EDA	
	14	Assumptions– Data diagnostics – Statistical models into graphics	
	15	Confirmatory analysis – Hypothesis formulation	
	16	Testing procedure, significance – Graphical inference.	
V		**Flexi Module: Not Included for End Semster Exams**	**12**
	17	Text data; documents, SMS, tweets, logs, tags	
	18	Word clouds, word trees and tagclouds	
	19	Theme visualization – Topic modeling –Seriation, Quantification	

Text Books

1. Tufte, E(2005). *Envisioning Information*, E. Tufte. Graphics Press,2005.
2. Tamara Munzner, Visualization Analysis and Design, CRC Press,2014.

References

3. Nathan Yau, Visualize This- The Flowing Data Guide to Design, Visualization, and Statistics, Wiley, 2011.
4. Scott Murray, Interactive Data Visualization for the Web, O'Reilly,2013.
5. Colin Ware, Visual Thinking for Design, Morgan Kaufman,2008.

LAB EXERCISES

1. Introduction to Matplotlib
2. Bar Chart Visualization

3. Scatter Plot Visualization
4. Histogram Visualization
5. Pie Chart Visualization
6. Box Plot Visualization
7. 3D Plot Visualization

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Differentiate between physical and abstract types	U	PSO- 1,2,3
CO-2	Use Visualization, data maps, time series and text visualization	Ap	PSO- 1,2,3
CO-3	Apply design for visualization	Ap	PSO- 1,2,3
CO-4	Compare different data and image models	U	PSO- 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA VISUALIZATION

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Differentiate between physical and abstract types	PO-3,6,7 PSO-1,2,3	Ap	F, C	L	
2	Use Visualization, data maps, time series and text visualization	PO-3,6,7 PSO-1,2,3	Ap	F, C, P	L	P
3	Apply design for visualization	PO-3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Compare different data and image models	PO-3,5,6,7 PSO-1,2,3	U	F, C	L	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	3	-	-	3	3	-	2	1	2	-
CO 2	-	-	3	-	-	3	3	-	2	1	2	-
CO 3	-	-	3	-	1	3	3	-	2	1	2	-
CO 4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓

CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

12. INTRODUCTION TO MACHINE LEARNING

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC211				
Course Title	INTRODUCTION TO MACHINE LEARNING				
Type of Course	DSC				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	PYTHON PROGRAMMING				
Course Summary	This course offers a comprehensive overview of machine learning fundamentals, spanning supervised, unsupervised, and reinforcement learning techniques. Students will gain practical skills in data preprocessing, visualization, and analysis using Python libraries like NumPy, Pandas, and Scikit-learn. Delving into regression and classification algorithms, including linear regression, logistic regression, and decision trees, learners will acquire the ability to interpret and predict data patterns effectively. Advanced topics explore unsupervised learning methods such as clustering and dimensionality reduction, providing students with essential tools for data analysis. Additionally, the flexi module introduces ensemble learning, neural networks, and autoencoders, paving the way for further exploration into artificial intelligence and machine learning applications.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Introduction to Machine Learning**		15
	1	Definition and Importance of Machine Learning:	

	2	Applications across Various Domains	
	3	Supervised Learning:-Definition and Examples, Regression vs. Classification	
	4	Unsupervised Learning:- Definition and Examples,Clustering vs. Dimensionality Reduction	
	5	Reinforcement Learning:- Definition and Examples, Agent-Environment Interaction, Exploration vs. Exploitation Tradeoff	
	6	Understanding data:- numeric variables – mean, median, mode, Measuring spread.	
	7	Introduction to NumPy, Pandas, and Scikit-learn:- Overview of their Features and Capabilities	
II		**Data Preprocessing and Visualization**	**15**
	7	Introduction to Data Preprocessing, Handling Missing Data: Imputation Techniques, Removal Strategies	
	8	Outlier Detection and Treatment: Z-score, IQR, Winsorization	
	9	Feature Scaling and Normalization: Min-Max Scaling, Z-score Normalization, Encoding Categorical Variables: One-Hot Encoding, Label Encoding	
	10	Introduction to Data Visualization:-Overview of Matplotlib and Seaborn Libraries	
	11	Basic Plot Types: Line Plot, Scatter Plot, Bar Plot, Histogram	
	12	Advanced Plot Types: Box Plot, Violin Plot, Heatmap,Multiple Subplots and Figures	
III		**Supervised Learning**	**15**
	12	Regression - Introduction, Types of Regression, Linear Regression, Multiple Linear Regression, Non-Linear Regression (Polynomial Regression)	
	13	Classification –Introduction, Logistic Regression, Decision Trees, Naïve Bayes Classification, Support Vector Machines:-Intuition and Optimization, K-Nearest Neighbours, Random Forest.	
IV		**Unsupervised Learning**	**15**

	19	Categorization of Major Clustering Methods - Partitioning Methods - K-means, K-medoids. Hierarchical Methods - Agglomerative Clustering, Density-based Methods – DBSCAN.	
	20	Principal Component Analysis (PCA):Understanding the PCA algorithm, Calculating principal components and eigenvalues, Reducing dimensionality using PCA, Interpretation of principal components, PCA implementation and applications	
	21	t-Distributed Stochastic Neighbour Embedding (t-SNE):Introduction to t-SNE algorithm, Similarities and differences between PCA and t-SNE	
V		**Flexi Module: Not included for end semester exams**	**15**
	26	Ensemble Learning: Understanding ensemble methods like bagging and boosting.	
	27	Introduction to Neural Networks: Basics of artificial neural networks (ANN), deep learning frameworks (e.g., TensorFlow).	
	28	Introduction to autoencoders, Encoding and decoding processes in autoencoders, Training autoencoders with backpropagation Denoising autoencoders and variational autoencoders, Applications of autoencoders in unsupervised learning and feature learning	

References

- Introduction to Machine Learning with Python" by Andreas C. Müller & Sarah Guido
- Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili
- Pattern Recognition and Machine Learning" by Christopher M. Bishop
- Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy

Lab Exercises

1. Prepare a dataset of customer having the features date, price, product_id, quantity_purchased, serial_no, user_id,user_type, user_class, purchase_week and visualise the data with
   a. Plot diagram for Price Trends for Particular User, Price Trends for Particular User Over Time
   b. Create box plot Quantity and Week value distribution having parameters of quantity_purchased','purchase_week'

2. **Task:** Conduct exploratory data analysis (EDA) on a designated dataset utilizing NumPy and Pandas.

   Description: Select a dataset of choice (e.g., Iris dataset, Titanic dataset, etc.), and load it into a Pandas DataFrame. Leverage NumPy for numerical computations. Compute the mean, median, and mode of numeric variables within the dataset. Assess the data's spread through techniques such as standard deviation, variance, and range calculations. Employ histograms and box plots to visually represent the distribution of numeric variables. Provide insights and interpretations based on the outcomes of the EDA.

3. Task: Utilize Python programming to preprocess the "Titanic" dataset.

   Description:Implement data preprocessing steps to handle missing data by employing imputation techniques or removal strategies. Detects and treats outliers using Z-score, IQR, or Winsorization methods.

4. Task: Utilize Python programming feature scaling and normalization on the "Titanic" dataset.

   Description:Perform feature scaling and normalization on relevant features, and encode categorical variables using one-hot encoding or label encoding schemes. Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

5. Task: Utilize Python programming visualize on the "Titanic" dataset.

   Description: Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

6. Task: Train regression models on the "Boston Housing" dataset to predict house prices based on various features.

   Description: Utilize the "Boston Housing" dataset available in the scikit-learn library. Train a linear regression model to predict house prices using features such as area, number of bedrooms, and location. Additionally, implement multiple linear regression to predict sales revenue based on advertising spending across different channels. Explore the application of non-linear regression techniques like polynomial regression to capture more complex data patterns in the dataset. Visualize the regression results to understand the relationships between predictors and the target variable.

7. Task: Employ classification techniques on the "Titanic" dataset to predict survival outcomes based on passenger features.

Description: Use the Titanic dataset to train a logistic regression model to predict survival outcomes based on passenger features.

8. Task: Employ classification techniques on the "MNIST dataset"

   Description: Implement a support vector machine classifier to classify handwritten digits using the MNIST dataset.

9. Task: Employ classification techniques on the "iris dataset"

   Description: Experiment with k-nearest neighbors and random forest classifiers on iris dataset and MNIST dataset and compare their performance.

10. Task: Apply K-means clustering on the "Online Retail" dataset to segment customers based on their purchasing behavior.

    Description: Utilize the "Online Retail" dataset, which contains information about customer transactions, including items purchased and their quantities. Implement K-means clustering to segment customers into distinct groups based on their purchasing patterns. Analyze the characteristics of each cluster to understand the preferences and behaviors of different customer segments. Identify potential marketing strategies tailored to each segment to enhance customer engagement and satisfaction.

    Dataset: The "Online Retail" dataset is available from the UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets/Online+Retail).

11. Task: Employ principal component analysis (PCA) on the "Labeled Faces in the Wild" dataset to reduce the dimensionality of facial images.

    Description: Utilize the "Labeled Faces in the Wild" dataset, which contains a collection of facial images belonging to various individuals. Implement PCA to reduce the high-dimensional feature space of facial images while preserving essential information. Visualize the principal components to gain insights into the underlying structure of the data. Reconstruct the facial images using a reduced number of dimensions to observe the effectiveness of dimensionality reduction. Analyze the reconstructed images to understand the impact of dimensionality reduction on facial image quality and interpretability.

    Dataset: The "Labeled Faces in the Wild" dataset is available from the scikit-learn library (https://scikit-learn.org/stable/modules/generated/sklearn.datasets.fetch_lfw_people.html).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed

CO1	Summarise the definition and significance of machine learning	U	PSO – 1, 3
CO2	Cite the principles underlying supervised and unsupervised learning methods.	U	PSO – 1, 2, 3
CO3	Apply data preprocessing procedures using Python libraries to cleanse and organise datasets efficiently,	Ap	PSO – 1, 2, 3
CO4	Illustrate the effectiveness of machine learning models.	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO MACHINE LEARNING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Summarise the definition and significance of machine learning	PO- 1, 2, 3, 4, 6 PSO – 1, 3	U	F, C, P	L	P
2	Cite the principles underlying supervised and unsupervised learning methods.	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	U	F, C, P	L	P
3	Apply data preprocessing procedures using Python libraries to cleanse and organise datasets efficiently,	PO- 1, 2, 3, 4, 8 PSO – 1, 2, 3,3	Ap	F, C, P	L	P
4	Illustrate the effectiveness of machine learning models.	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	Ap	F, C,P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**2**	**1**	**1**	**-**	**2**	**3-**	**-**	**2**	**2**	**2**	**-**
CO2	**3**	**3**	**2**	**1**	**-**	**3**	**3-**	**-**	**3**	**3**	**2**	**-**
CO3	**3**	**3**	**2**	**2**	**-**	**3**	**3**	**3**	**3**	**3**	**2**	**-**
CO4	**3**	**3**	**2**	**2**	**-**	**2**	**3**	**-**	**3**	**3**	**2**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

13. MEDICAL IMAGING AND ANALYSIS

Discipline	Computer Science				
Course Code	UK3DSCCSC212				
Course Title	MEDICAL IMAGING AND ANALYSIS				
Type of Course	**DSC**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	-				
Course Summary	This course introduces students to the principles, techniques, and applications of medical imaging and analysis. Topics covered include various imaging modalities, image processing and analysis methods, and their applications in healthcare.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15**
	1	Medical Imaging, Modalities, Medical Imaging from Physiology to Information Processing, General Performance measures, Biomedical Image Processing and Analysis, Matlab Image Processing toolbox, Imagepro interface in Matlab Environment and Image Databases, ImageJ and Other image Processing Software Packages, Medical image analysis in Python	
II		**Medical Imaging Modalities**	**15**
	2	X-RAY Imaging: Introduction, Generation, X-Ray 2-D Projection Imaging, X-Ray Mammography, X-Ray CT, Spiral X-Ray CT	
	3	Magnetic Resonance Imaging: Principles, Instrumentation, Pulse Sequences	
	4	Ultrasound Imaging: Propagation of a sound in a medium, Reflection and Refraction, Attenuation, Ultrasound Reflection Imaging, Dopler Ultrasound Imaging.	
III		**Image Processing and Segmentation**	**15**
	5	Image Processing: Spatial Domain Methods, Frequency domain Filtering, Wavelet Transform	
	6	Image Segmentation: Edge-based Image Segmentation, Pixel-Based Direct Classification Methods, Region-Based Segmentation.	
IV		**Image Representation, Analysis and Classification**	**15**
	7	Feature Extraction and Representation: Statistical Pixel-level features, Shape features, Texture features, Relational Features.	
	8	Feature Selection: LDA, PCA and GA-Based optimization	

	9	Feature and Image Classification: Statistical classification, Rule Based systems, Neural Network, SVM.	
V		**Flexi Module (Not Included for External Exam)**	**15**
	10	Image Visualization: 2-D and 3-d display methods, VR-Based Interactive Visualization- Virtual Endoscopy	

REFERENCE BOOKS

1. Atam P. Dhawan, "Medical Image Analysis", Wiley Publishers, Second Edition.
2. Isaac N. Bankman, "Handbook of Medical Imaging: Processing and Analysis", Academic Press.

LAB EXERCISES

Lab exercises will contain 15-20 questions like sample questions.

1. Image Loading and Display.
2. Medical Image Enhancement.
3. Medical Image Segmentation.
4. Feature extraction in medical images.
5. Medical images classification problems

COURSE OUTCOMES

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Outline medical images, integrating theory, tools, and ethical considerations effectively.	U	PSO1, 3
CO2	Discuss principles of X-ray, MRI, and ultrasound imaging, enabling effective medical diagnosis.	Ap	PSO1, 2, 3
CO3	Outline image processing and segmentation methods	U	PSO 1, 2, 3
CO4	Identify methods of Image representation, analysis and classification	U	PSO1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MEDICAL IMAGING AND ANALYSIS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Outline medical images, integrating theory, tools, and ethical considerations effectively.	PO 2, 5, 6, 7 PSO 1, 3	U	F, C, P	L	P
CO2	Discuss principles of X-ray, MRI, and ultrasound imaging, enabling effective medical diagnosis.	PO 2,5, 6, 7 PSO 1, 2, 3	U	F, C, P	L	P
CO3	Outline image processing and segmentation methods	PO 2, 5, 6, 7 PSO 1, 2, 3, 4	U	F, C, P	L	P
CO4	Identify methods of Image representation, analysis and classification	PO2, 5, 6, 7 PSO 1, 2, 3	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	2	-	-	1	3	3	-	3	-	3	-
CO 2	-	2	-	-	1	3	3	-	3	2	3	-
CO 3	-	2	-	-	1	3	3	-	3	2	3	-
CO 4	-	2	-	-	1	3	3	-	3	2	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

14. HEALTH DATA ANALYTICS

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSCCSC213				
Course Title	HEALTH DATA ANALYTICS				
Type of Course	DSC				
Semester	III				
Academic Level	2 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours

Pre-requisites	Nil
Course Summary	This course deals with concepts of Data analytics in Healthcare. It introduces the student to the technologies and concepts used in this area.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Fundamentals**	**15**
	1	Healthcare Transformation—Challenges and Opportunities	
	2	The Current State of Healthcare Costs and Quality	
	3	Fundamentals of Healthcare Analytics: How Analytics Can Improve Decision Making	
	4	Analytics, Quality, and Performance	
	5	Applications of Healthcare Analytics, Components of Healthcare Analytics	
II		**Analytics Strategy**	**15**
	6	Purpose of an Analytics Strategy	
	7	Analytics Strategy Framework, with a Focus on Quality/Performance Improvement	
	8	Developing an Analytics Strategy	
	9	Defining Healthcare Quality and Value : Quality, Overview of Healthcare QI, Common QI Frameworks in Healthcare, Working with QI Methodologies	
III		**Data Quality and Governance**	**15**
	10	Introduction,The Need for Effective Data Management	
	11	Data Quality, Data Governance and Management	
	12	Enterprise-wide Visibility and Opportunity	
	13	Working with Data: Data::-The Raw Material of Analytics	

	14	Preparing Data for Analytics, Getting Started with Analyzing Data	
	15	Developing and Using Effective Indicators: Measures, Metrics, and Indicators	
	16	Using Indicators to Guide Healthcare Improvement Activities	
	17	Presentation and Visualization of Information	
IV	**Advanced Analytics in Healthcare**		**15**
	18	Overview of Advanced Analytics, Applications of Advanced Analytics	
	19	Developing and Testing Advanced Analytics	
	20	Overview of Predictive Algorithms	
	21	Becoming an Analytical Healthcare Organization: Requirements to Become an Analytical Organization, Building Effective Analytical Teams	
V	**Flexi Module: Not included for End Semester Exams**		**15**
	22	Machine learning algorithms for healthcare data analytics	
	23	Data analytics in Healthcare recommendation systems.	

References

Core Textbook

1. Trevor. L. Storm, "Healthcare Analytics for Quality and Performance Improvement", WILEY Publishers, 2013.

Additional

2. Hui Yang and Eva K. Lee, "Healthcare Analytics: From Data to Knowledge to Healthcare Improvement", WILEY Publishers.
3. Chandan K. Reddy and Charu C. Aggarwal, "Healthcare Data Analytics", CRC Press, Taylor & Francis Group.

Lab Exercises

1. Clean and preprocess healthcare datasets to ensure data quality and integrity for analysis.

2. Explore descriptive analytics techniques to understand healthcare trends, patient demographics, and service utilization patterns.
3. Utilize predictive modeling to forecast patient readmissions, disease progression, or healthcare resource demands.
4. Implement clustering algorithms to segment patient populations based on healthcare needs and preferences for targeted interventions.
5. Implement Machine Learning algorithms in healthcare datasets.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Restate healthcare analytics to improve decision-making and address challenges in healthcare transformation effectively.	U	PSO-1,2
CO-2	Develop strategies for enhancing healthcare quality, performance, and value through data-driven decision-making processes.	Ap	PSO-1,2,3
CO-3	Establish data governance frameworks to ensure data quality and integrity for informed decision-making in healthcare.	Ap	PSO-1,2,3
CO-4	Implement advanced analytics techniques to predict healthcare outcomes and optimize resource allocation effectively.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: HEALTH DATA ANALYTICS

Credits: 3:0:2 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO-1	Summarize about Telemedicine	PO-6,7 PSO-1,2	U	F, C	T	
CO-2	Explain about Telemedicine	PO-5, 6,7 PSO-	Ap	F, C,P	T	P

	Systems	1,2,3				
CO-3	Describe about platforms necessary for Telemedicine	PO-5, 6,7 PSO-1,2,3	Ap	F, C,P	T	P
CO-4	Explain about Medical Transcription	PO-5, 6,7 PSO-1,2,3	Ap	F, C, P, M	T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	
CO 1	-	-	-	--	1	2	2	-	2	2	-	-	-
CO 2	-	-	-		1	2	2	--	2	2	2	-	-
CO 3	-	-		-	1	2	2	-	2	2	3	-	-
CO 4	-	-	-	--	1	2	2	-	2	2	3		-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz/ Seminar	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4		✓		✓

DSE

1. INTRODUCTION TO CYBER SECURITY (Stream: Cyber Security)

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSECSC200				
Course Title	**INTRODUCTION TO CYBER SECURITY**				
Type of Course	DSE				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours		0	4 hours
Pre-requisites	Basic understanding of computer systems and networking is desirable.				
Course Summary	This course is a disciplinary specific elective in the stream Cyber Security. The course introduction to Cybersecurity highlights the importance of Cybersecurity in modern society, exploring its evolution, and recognizing the various threats that digital systems face. Besides providing insights into the security policies, principles, procedures, and best practices for maintaining a secure environment, The Course provides a solid foundation				

	for individuals seeking to pursue careers in cybersecurity. By mastering the fundamental concepts and techniques covered in this course, students will be better equipped to defend their digital assets, mitigate cyber threats, and contribute to the overall security of information systems in today's digital age.

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**Title of the Module: Introduction to Cyber Security**		**12**
	1	Information Security, Importance, Classification of information, Classification of Information Systems, LAN Classifications, threats-internal, external threats, threat agents, Malicious threat, non-malicious threats, threat intent	
	2	Threats to Security, Employees, Amateur hackers and Vandals, Criminal hackers and Saboteurs,	
	3	Cyber Security, - The C I A Triad, reasons for Cyber-crimes. Importance of Cyber security, Cyber-attacks- damages, history of cyber-crime, evolution of cyber-crime, cyber-crime classification, types of cyber-crimes- categories	
	4	Current scenario- Internet of Things, Challenges faced by Internet of things- Weak passwords, unsecured network access, inappropriate update protocols, unsecured interfaces, default settings, no device management, data storage and transfer challenges, inappropriate privacy protection, outdated components, Evolution of hacking equipments, tools and techniques, growing demand for data access.	
II	**Title of the Module**: **Application Security**		**12**
	5	Introduction, Database Security, Internet Security	
	6	Application Security- types, End Point Security- types, Identity and Access management, Identity management solutions and features	
	7	Mobile Security, Data Security, Drive by download, Infrastructure security, Disaster recovery	
	8	Email Security- S/MIME. PGP, MOSS, PEM, Net Security- SSL. SHTTP, browser scripts.	

III	**Title of the Module**: **Security Threats**		**12**
	9	Introduction to Security threats, Virus, Worms, Trojan Horse, Bombs, Trap Door, Email Spoofing,	
	10	Email Virus, Virus Life cycle, How virus works? Macro Viruses, Malicious Softwares, Network and Services Attack,	
	11	Denial of Service Attack (DOS), Types of DOS, Methods of attack,	
	12	SYN Flood attack, TCP Flooding, UDP Flooding, ICMP Flooding, Smurf, Ping of death, Tear Drop, LAND, Echo-CharGEN, Naptha Attacks	
IV	**Title of the Module: Cyber Security Components and Defense Mechanism**		**12**
	13	OSI Layer, Zero-day attacks- risks of Zero-day attacks	
	14	Network Security- types of attacks- common types of common attacks, port scanning techniques, Unauthorized access, man in the middle attacks, Types of attacks	
	15	Code and SQL injection attacks, types of SQL injections, inferential SQL	
	16	Identity and Access management, Mobile Security	
	17	Fighting Cyber-attacks- Defense in depth, Authentication, Cryptography, Security Technology -Firewall, Data loss Prevention, Antivirus Solutions, Intrusion Detection, Access Control, Access Control Models- discretionary, mandatory, role based, Virtual Private networks, web browsers, Data backup- differential, incremental, biometrics-physiological, behavioural characteristics, authentication factors- two factor, multi factor authentication, passwords- password managers.	
V	**Flexi Module- Not included for End Semester Exams**		**12**
	18	Electronic payment Systems. Credit cards, Debit Cards, Pros and Cons of using Debit vs Credit Cards, Types of Debit Cards, Types of Credit Cards, Credit card payment process, Smart Cards, Emoney, Electronic Fund Transfer. Ecommerce Business Model, Advantages, Disadvantages, Ecommerce Security systems, measures to ensure security Security Protocols in Internet, Electronic Cash, How is it used? Relevance, Cryptography in Information security Symmetric, Asymmetric, Digital Signature, Digital Signature Process, Role of Data Encryption and Challenges in implementing encryption protocols.	

References

Books:

1. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed Fundamentals of Cyber Security Principles Theory and Practices, , BPB Publishers, 2017

2. Anand Shinde, Notion press, Introduction to Cyber Security- Guide to the world of Cyber Security, 2021

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarise the fundamental principles and concepts of cybersecurity.	U	PSO-1
CO-2	Identify best practices for securing digital assets.	U	PSO-1,2
CO-3	Demonstrate awareness of common cyber threats and techniques used by attackers.	U	PSO-1
CO-4	Identify measures for implementing cybersecurity.	U	PSO-1

15R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO CYBER SECURITY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Summarise the fundamental principles and concepts of cybersecurity.	PO-1,2,3,6,7 PSO-1	U	F, C	L	-
2	Identify best practices for securing digital assets.	PO-1,2,3,4,6,7 PSO-1,2	U	F, C	L	-

3	Demonstrate awareness of common cyber threats and techniques used by attackers.	PO-1,2,3,4,6,7 PSO-1	U	F, C	L	-
4	Identify measures for implementing cybersecurity.	PO-1,2,3,6,7 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	-	-	2	2	1	1	-	-	-
CO 2	2	2	1	1	-	2	2	1	2	3	-	-
CO 3	2	2	1	1	-	2	2	1	2	-	-	-
CO 4	2	2	1	-	-	2	2	2	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Discussion	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4		✓		✓

2. DATA SCIENCE FUNDAMENTALS (Stream: Data Science)

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSECSC201				
Course Title	DATA SCIENCE FUNDAMENTALS				
Type of Course	**DSE**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	NIL				
Course Summary	This course aims to introduce the student to the main concepts of data science, understand the essential principles and to implement spreadsheet-based data analysis. Through a blend of theoretical understanding and hands-on practice, learners will develop a solid foundation in data preprocessing, data integration, data transformation, data reduction and skills to apply statistical analysis techniques using Spreadsheet.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Fundamentals of Data Science**	15
	1	Introduction, Why Data Science, Types of Data analysis: Descriptive analysis, Diagnostic analysis, Predictive analysis and Prescriptive analysis.	
	2	Data Analytics life cycle: Data discovery, Data Preparation, Model planning, Model Building, Communicate Results, and Operationalization.	
	3	Data Science tools: Python programming, R programming, SAS, Spreadsheet, Tableau Public, RapidMiner, Knime, Apache Spark.	
	4	Fundamental areas of study in data science: Machine Learning, Deep Learning, NLP, Statistical data analysis, Knowledge discovery and data mining, Text mining, Recommender systems, Data visualization, Computer Vision, and Spatial data management.	
	5	Role of SQL in data science, Pros and Cons of data science	
II		**Data Pre-processing**	15
	6	Introduction, data types and forms, possible data error types,	
	7	Various data pre -processing operations: Data Cleaning: Filling missing values, Smoothing noisy data, Detecting and removing outliers.	
	8	Data Integration: Virtual integration, physical data integration, Application based integration, Manual Integration, and middleware data integration.	
	9	Data Transformation: Rescaling data, Normalizing data, Binarizing data, Standardizing data.	
	10	Data Reduction: Dimensionality reduction, Data cube aggregation, Numerosity reduction. Data Discretization: Top-down discretization, Bottom-up discretization.	
IV		**Data Plotting and Visualization**	15
	15	Introduction, Visual encoding, Basic data visualization tools: Histograms, Bar Charts/Graphs, Scatter plots and Area plots. Data visualization types: Temporal data, Hierarchical data, Network data, Multi-dimensional data, Geospatial data and Multivariate data.	
	16	Lookup Functions: LOOKUP and VLOOKUP and HLOOKUP.	

	17	Data Visualization using Band Chart, Thermometer Chart, Gantt chart, Waterfall Chart and Pivot Charts. Types of jobs in data analytics: Data Analyst, Data scientist, Data engineer, Database administrator, Data architect, and Analytics manager.	
V		**Flexi Module (Not Included for End Semester Examination)**	**15**
	18	Advanced data visualization tools	
	19	Visualization of geospatial data	
	20	Statistical Data Analysis : Probability theory	

REFERENCES

Core

- Gypsy Nandi and Rupam Kumar Sharma, Data Science fundamentals and practical approaches, First Edition, BPB Publication, 2020 **.**
- Bernd Held, Excel Functions and Formulas, BPB Publications.

Additional

- V K Jain, Data Science and Analytics, Khanna Publishing.
- Joel Grus, Data Science From Scratch, Second Edition, Oreilly.

LAB EXERCISES

PART A

1. Create a workbook and perform the operations: Selecting range of columns, hiding /show rows and columns and rename the worksheet.
2. Create a workbook with student mark details. Include formulas to calculate total, percentage and grade.
3. Create worksheet with student mark details and perform the following operations
   i. Find the number of students having a percentage more than 70.
   ii. Find the number of students having a percentage between 60 and 80.
   iii. Find the number of students passed in a subject
   iv. Find the student who got the highest mark in a subject.
4. Create a worksheet with Employee salary details. Find mean, median, mode, standard deviation and variance.
5. Create a workbook with sales details and use the functions: TRIM and CLEAN.
6. Create a worksheet with student mark details. Use sorting and filtering functions.
7. Create a worksheet with employee details. Use date and time values. Calculate salary details and bonus using functions.
8. Create a worksheet with the student name as a column. Add three more columns: First name, Last name and email. Find the values of First name, Last name and e-mail(Firstname_lastname@gmail.com). Use text functions.

9. Enter your date of birth and today's date in two cells. Find your age in days, months and years.
10. Prepare a worksheet with sales details. Make a pivot table having product and category in row label.

PART B

11. Create a worksheet for flower shop with invoiceid, flower name, price, qty and total price. Enter 10 records. Make pivot table and pivot charts.
12. Create a worksheet with Fruits supply details. Apply LOOKUP, VLOOKUP and HLOOUP functions.
13. Assign a macro to a command button to display "welcome" in a cell.
14. Assign a macro to a command button to display "welcome" in a message box.
15. Assign a macro to a command button to find total number of sheets in a workbook.
16. Assign a macro to a command button to add a new worksheet.
17. Assign a macro to a command button to add a new workbook.
18. Prepare a worksheet with wildlife populations of different states in India. Display in Pie chart and Bar chart.
19. Prepare a worksheet with the total number of primary schools in each district of kerala. Include different charts.
20. Create a worksheet with employee salary details. Include charts.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss about the fundamentals of Data Science	U	PSO -1
CO-2	Illustrate the usage of Data Pre-processing techniques	Ap	PSO-1,2,3
CO-3	Use data science concepts in real world problems	Ap	PSO-1,2,3
CO-4	Build Data Analytics and management Skill	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO DATA SCIENCE

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

CO-1	Discuss about the fundamentals of Data Science	PO-6,7 PSO-1,2	U	F, C	L	-
CO-2	Illustrate the usage of Data Pre-processing techniques	PO-6,7 PSO-1,2,3	Ap	F, C, P	L	P
CO-3	Use data science concepts in real world problems	PO-6,7 PSO-1,2,3	Ap	F, C, P	L	P
CO-4	Build Data Analytics and management Skill	PO-6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	2	1	-	1	1	-	-
CO 2	-	-	-	-	-	2	2	-	2	2	2	-
CO 3	-	-	-	-	-	2	2	-	1	2	2	-
CO 4	-	-	-	-	-	2	2	-	2	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Quiz**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4		✓		✓

3. INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Stream: Machine Learning)

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSECSC202				
Course Title	INTRODUCTION TO ARTIFICIAL INTELLIGENCE				
Type of Course	DSE				
Semester	III				
Academic Level	2 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Knowledge in basic concepts about inference and logic is desirable.				
Course Summary	This course aims to give students a brief idea about Artificial Intelligence and its associated concepts and applications. Artificial intelligence, or AI, as generally termed, is an umbrella term and refers to the simulation of human intelligence by software-coded heuristics.				

	The ideal characteristic of artificial intelligence is its ability to rationalize and take actions, similar to that of the human mind, that have the best chance of achieving a specific goal.

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Part 1: Introduction**	**12**
	1	What is Artificial Intelligence	
	2	Foundations and History of Artificial Intelligence	
	3	Applications of Artificial Intelligence	
	4	Intelligent Agents	
	5	Structure of Intelligent Agents	
		Part 2: Search Strategies	
	6	Introduction to Search	**12**
	7	Searching for solutions	
	8	Uninformed search strategies (Breadth First Search, Depth First Search, Depth Limited Search, Uniform Cost Search)	
	9	Informed search strategies (Best First Search, A*, Hill Climbing)	
	10	Local search algorithms and optimistic problems (Travelling Salesman Problem)	
	11	Adversarial Search (Algorithms not needed)	
	12	Current-best-hypothesis search (only basic concept & list of applications)	
II		**Knowledge Representation & Reasoning**	**12**
	13	Overview of Inference, Propositional & Predicate Logic	
	14	Logical Reasoning	
	15	Forward & Backward Chaining	
	16	Resolution	
	17	AI languages and tools - Lisp, Prolog, CLIPS	

III		**Problem Solving**	**12**
	18	Formulating problems	
	19	Problem Types	
	20	Solving Problems by Searching	
	21	Heuristic search techniques	
	22	Constraint satisfaction problems (Only basic concepts)	
	23	Stochastic search methods (Simulated Annealing, Genetic Algorithms)	
IV		**Learning**	**12**
	24	Overview of different forms of learning	
	25	Decision trees	
	26	Rule-based learning	
	27	Neural networks	
	28	Reinforcement learning	
V		**Flexi Module: Not include in End Semester Exams**	**12**
	29	New features in HTML5 and CSS3,	
	30	Designing a static website of student's choice,	
	31	Case study on some recent web designing tools.	

Text Books

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education

References

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	U	PSO - 1

CO2	Demonstrate the different searching techniques practiced in AI	Ap	PSO - 1, 2, 3
CO3	Summarize knowledge representation and reasoning in the context of AI	U	PSO - 1, 2
CO4	Illustrate different ways of problem solving	Ap	PSO - 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	PO - 6,7 PSO - 1	U	F, C	L	-
2	Demonstrate the different searching techniques practiced in AI	PO - 1, 2, 4, 5, 6, 7 PSO - 1, 2, 3	Ap	F, C, P	L	-
3	Summarize knowledge representation and reasoning in the context of AI	PO - 1, 2, 6, 7 PSO - 1, 2	U	F, C	L	-
4	Illustrate different ways of problem solving	PO - 1, 2, 6, 7 PSO - 1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4

CO1	-	-	-	-	-	2	2	-	3	-	-	-
CO2	2	1	-	2	1	2	2	-	3	2	1	-
CO3	3	2	-	-	-	2	3	-	3	2	-	-
CO4	2	3	-	-	-	2	2	-	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar / Quiz*	End Semester Examinations
CO1	✓			✓
CO2	✓		✓	✓
CO3	✓		✓	✓
CO4	✓	✓		✓

***** Seminar on search strategies (to be conducted as group)

4. WEB DEVELOPMENT USING HTML5 AND CSS3 (Stream: Web Development)

Discipline	COMPUTER SCIENCE				
Course Code	UK3DSECSC203				
Course Title	WEB DEVELOPMENT USING HTML5 AND CSS3				
Type of Course	**DSE**				
Semester	III				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	Web design is the planning and creation of websites. This includes a number of separate skills that all fall under the umbrella of web design. This course aims to instill in students these skills which includes information architecture, user interface, site structure, navigation, layout, colors, fonts, and overall imagery. It also trains students on basic web design elements like overall layout, color scheme, typography, navigation and content. Simple web pages are designed using HTML5 and CSS3.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Basics of HTML5**	**15**
	1	HTML foundations, usage of Doctype and charset	
	2	Familiarisation of basic html tags including headings, paragraphs and text formats	
	3	Managing information with lists and tables	
	4	Making connections with links – hyperlinks, anchors, urls	

	5	Adding Images to your pages – Image and ImageMaps	
	6	Working with audio and video	
II	**Advanced Features in HTML5**		**15**
	7	Sectioning Elements – nav, article, main, header, footer and section tags	
	8	Progress Elements	
	9	Div and Frames	
	10	IFrames	
	11	Creating Forms using input elements	
III	**Introduction to CSS3**		**15**
	12	Style Element and Stylesheet	
	13	Specifying colors in CSS	
	14	Fonts and typefaces	
	15	Selectors – IDs, Classes and Pseudo classes	
	16	Borders and Backgrounds	
	17	Levels of CSS	
	18	Using HTML with CSS	
IV	**Stylesheets for high level visual designs**		**15**
	19	CSS3 Gradients	
	20	Special effects - images	

	21	Special effects - text	
	22	Introduction to Float Mechanism	
	23	Creating a basic two-column design	
	24	Creating dynamic lists	
	25	Building a basic menu system	
V		**Flexi Module: Not included for end semester exams**	**15**
	26	New features in HTML5 and CSS3,	
	27	Designing a static website of student's choice	
	28	Case study on some recent web designing tools.	

References

1. Andy Harris, "HTML5 and CSS3 All-in-one for Dummies", A Wiley Brand, Third Edition
2. https://books.goalkicker.com/HTML5Book/

Lab Exercises

Part A

1. Design a page having suitable background color and text color with title "My First Web Page" using all the attributes of the Font tag.
2. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register_Number, Class] aligned in proper order using alignment attributes of Paragraph tag
3. Create a page to show different character formatting (B, I, U, SUB, SUP) tags and heading tags
4. Create web pages using Anchor tag with its attributes for external links.
5. Create a web page with different sections and internal links using links and sectioning elements; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.
6. Create a web page, showing ordered list of semesters and an unordered list of names of all the Diploma Programmes (Branches) in your institution
7. Create a web page which divides the page in two equal frames and place the audio and video clips in frame-1 and frame-2 respectively

Part B

8. Create a registration form using form input tags
9. Use tables to provide layout to your HTML page describing your college infrastructure
10. Create a table to show your class time table. Specify font and border attributes using css.
11. Write a program in html to design a Bio-Data and set style attributes in css using ids and selectors
12. Write a programme in html to create a webpage with four iframes (Picture, table, list, and hyperlink)
13. Design a web page with color background and give gradient effects using css.
14. Create a web page to show text and image special effects.
15. Design a static website for your institution containing at least five web pages (ensure to use iframes, forms, css including special effects, float mechanism and menu system).

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Illustrate the basic features of HTML5	Ap	PSO – 1, 2, 3
CO2	Use advanced HTML features for web designing	Ap	PSO – 1, 2, 3
CO3	Develop basic stylesheets in various CSS levels	Ap	PSO – 1, 2, 3
CO4	Create stylesheets for high level visual designs	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: WEB DEVELOPMENT USING HTML5 AND CSS3

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L) / Tutorial(T)	Practical (P)
1	Illustrate the basic features of HTML5	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P
2	Use advanced HTML features for web designing	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P
3	Develop basic stylesheets in various CSS levels	PO – 3, 5, 6, 7 PSO – 1, 2, 3	Ap	F, C, P,M	L	P

4	Create stylesheets for high level visual designs	PO – 3, 5, 6, 7 PSO – 1, 2, 3	Ap	F, C, P, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	-	-	3	-	-	3	3	-	2	1	2	-
CO2	-	-	3	-	-	3	3	-	2	1	2	-
CO3	-	-	3	-	1	3	3	-	2	1	2	-
CO4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

MDC- Kerala Studies

VAC

1. CODING STANDARDS AND PRACTICES

Discipline	COMPUTER SCIENCE				
Course Code	UK3VACCSC200				
Course Title	CODING STANDARDS AND PRACTICES				
Type of Course	**VAC**				
Semester	III				
Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3 hours
Pre-requisites	None				
Course Summary	Students will develop a thorough understanding of clean coding principles and practices, recognizing the importance of functions in programming for maintaining clean code. They will practise writing clear and concise comments and documentation to improve code readability and understanding. Additionally, they will grasp the principles of unit testing and Test-Driven Development (TDD) to				

	ensure code quality and apply code refactoring techniques to enhance maintainability and extensibility. Finally, they will utilize refactoring tools and techniques to further improve code quality and readability.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Introduction to Clean Coding**	**9**
	1	● Importance of clean code in software development ● Introduction to code readability, maintainability, and scalability. ● Bad Code ● Boy Scout rule	
	1.1	**Meaningful Names** ● Importance of meaningful variable, function, and class names ● Guidelines for choosing descriptive and consistent names	
II		**Functions in Clean Coding**	**9**
	2	**Introduction to Functions** ● Role of functions in programming ● Key characteristics of clean functions. ● Descriptive and meaningful function names ● Guidelines for choosing appropriate function names ● Switch statements. ● Function Argument	
III		**Code Formatting and Style**	**9**
	3	● Consistent code formatting ● Coding style guides and conventions ● Using tools for automated code formatting	

		● Comment-Bad comment,Good comment ● Introduction to documentation tools and practices	
IV	**Testing and Test-Driven Development (TDD)**		**9**
	4	● Introduction to unit testing and test-driven development (TDD) ● Writing testable code ● Identifying testable units ● Implementing unit tests using testing frameworks	
v	5	**Flexi Module: Not included for End Semester Exams**	**9**
		● **Introduction to Code Refactoring** ● Understanding the concept of code refactoring and its importance. ● Common refactoring techniques and patterns. ● Refactoring legacy code and its challenges. ● **Refactoring Tools and Techniques:-** ● Introduction to refactoring tools and IDE plugins. ● Automating refactorings to improve efficiency. ● Best practices for safe and effective refactoring.	

References

1. Robert C. Martin, “A Handbook of Agile Software Craftsmanship"
2. Steve McConnell, "Code Complete: A Practical Handbook of Software Construction"
3. Martin Fowler**, "**Refactoring: Improving the Design of Existing Code"
4. Roy Osherove, **"**The Art of Unit Testing: with Examples in C#"

Web Resources

https://cleancode.com/

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize principles and practices of clean coding .	U	PSO-1
CO-2	Cite the role of functions in programming and their importance in clean coding.	U	PSO-1, 2
CO3	Demonstrate writing clear, readable and concise comments and documentation.	U	PSO-1, 2
CO-4	Prepare unit test cases.	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: CODING STANDARDS AND PRACTICES

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO 1	Summarize principles and practices of clean coding.	PO-6,7,8 PSO-1	U	F, C	L	-
CO2	Cite the role of functions in programming and their importance in clean coding.	PO-6,7,8 PSO-1	U	F, C	L	-
CO 3	Demonstrate writing clear, readable and concise comments and documentation.	PO-6,7,8 PSO-1, 2	U	F, C	L	-
CO 4	Prepare unit test cases.	PO- 6,7,8 PSO-1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	3	3	2	-	-
CO 2	-	-	-	-	-	2	2-	3	3	2	-	-
CO 3	-	-	-	-	-	2	2	3	3	2	-	-
CO 4	-	-	-	-	-	2	2	3	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	**Internal Exam**	**Assignment**	**Seminar**	**End Semester Examinations**
CO 1	✓			✓
CO 2	✓		✓	✓

CO 3	✓	✓		✓
CO 4	✓	✓		✓

2. Professional Ethics

Discipline	COMPUTER SCIENCE				
Course Code	UK3VACCSC201				
Course Title	Professional Ethics in Computer Science				
Type of Course	**VAC**				
Semester	III				
Academic Level	2 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3 hours
Pre-requisites	Nil				
Course Summary	To provide students awareness of professional ethics and the importance of human values in a profession.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Module 1 – Human Values.**	**9**
	1	Morals, values and Ethics – Integrity- Academic integrity-Work Ethics.	
	2	Service Learning- Civic Virtue-Respect for others- Living peacefully- Caring and Sharing- Honestly-courage	
	3	Cooperation commitment- Empathy-Self Confidence -Social Expectations.	
II		**Module 2 - Ethics & Professionalism.**	**9**
	4	Senses of Ethics - Variety of moral issues- Types of inquiry- Moral dilemmas –Moral Autonomy.	

	5	Kohlberg's theory- Gilligan's theory- Consensus and Controversy- Profession and Professionalism**.**	
	6	Models of professional roles-Theories about right action –Self interest- Customs and Religion- Uses of Ethical Theories.	
III		**Module 3- Social Experimentation.**	**9**
	7	Graduates as experimentation, Graduates as responsible experimenters, Codes of Ethics-Understanding its types, uses, Plagiarism.	
	8	A balanced outlook on law - Challenges case study-Bhopal gas tragedy	
IV		**Module 4- Responsibilities and Rights.**	**9**
	9	Collegiality and loyalty – Managing conflict- Respect for authority- Collective bargaining.	
	10	Confidentiality-Role of confidentiality in moral integrity-Conflicts of interest.	
	11	Occupational crime- Professional rights-Employee right- IPR Discrimination.	
V		**Flexi Module: Not included for End Semester Exams**	**9**
	12	Multinational Corporations- Environmental Ethics- Business Ethics- Computer Ethics	
	13	Moral leadership	

References

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited ,New Delhi,2006.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Cite the core values that shape the ethical behavior of a professional.	U	PSO-1, 4

CO-2	Relate with the principles to be followed for a good and ethical life	U	PSO-1, 4
CO-3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.	U	PSO-1, 4
CO-4	Relate moral and ethical problems through experiments.	Ap	PSO-1,4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 3:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Cite the core values that shape the ethical behaviour of a professional.	PO-6, 7, 8 PSO-1,4	U	F, C	L	-
CO2	Relate with the principles to be followed for a good and ethical life	PO-6, 7, 8 PSO-1,4	U	F,C	L	
CO3	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.	PO-6, 7, 8 PSO-1,4	U	F,C	L	-
CO4	Relate moral and ethical problems through experiments.	PO-6, 7, 8 PSO-1,4	Ap	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	2	2	-	-	1
CO 2	-	-	-	-	-	2	2	2	2	-	-	2
CO 3	-	-	-	-	-	2	2	2	2	-	-	2
CO 4	-	-	-	-	-	2	2	2	-2	-	-	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz/ Assignment	Discussion	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓			✓

CO 3	✓		✓	✓
CO 4	✓	✓		✓

Semester 4

1. **DSC**

Course Code	**Course Name**	**L (Hrs)**	**P (Hrs)**	**Credits**
UK4DSCCSC200	Database Management System	3	2	4
UK4DSCCSC201	Data Communication	4	0	4
UK4DSCCSC202	Artificial Intelligence	4	0	4
UK4DSCCSC203	Computer Organization	3	2	4

2. **DSE**

Course Code	**Course Name**	**Stream**	**L (Hrs)**	**P (Hrs)**	**Credits**
UK4DSECSC200	Ethical Hacking	Cyber Security	3	2	4
UK4DSECSC201	Python for Data Analytics	Data Science	3	2	4

UK4DSECSC202	Knowledge Representation and Intelligence Agents	Machine Learning	3	2	4
UK4DSECSC203	Web Scripting using JavaScript and ReactJS	Web Development	3	2	4

3. VAC

Course Code	Course Name	L (Hrs)	P (Hrs)	Credits
UK4VACCSC200	Ethical Hacking	2	2	3
UK4VACCSC201	Software Quality Management	3	0	3
UK4VACCSC202	Ethical AI and Responsible Computing	3	0	3
UK4VACCSC203	Preface to Cyber Laws	3	0	3

4. SEC

Course Code	Course Name	L (Hrs)	P (Hrs)	Credits
UK4SECCSC200	Content Management System	2	2	3
UK4SECCSC201	Computer Hardware Maintenance	2	2	3

1. DATABASE MANAGEMENT SYSTEMS

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSCCSC200				
Course Title	DATABASE MANAGEMENT SYSTEMS				
Type of Course	**DSC**				
Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge in data structures				
Course Summary	This course covers the principles, design, and implementation of database systems.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**INTRODUCTION**	**15**
	1	Database system, Purpose of database systems, Advantages of database systems view of data, Database languages, Database design, Database engine, Database Architectures two-tier and three-tier, Database users and administrators	
	2	**Data models:** Relational model, Hierarchical model, Network model, Entity-Relationship model, Object-oriented data model,	
	3	Introduction to Relational model: Structure of relational database, Database schema, Keys, Schema diagrams, Relational algebra.	
II		**Structured Query Language**	**15**
	4	Overview of the SQL query language, SQL – Basic structure of SQL queries, classification of SQL-DDL, DML, DCL, TCL.	

	5	Additional basic operations, Set operations-union, intersection, set difference, Null values, Aggregate functions, Nested subqueries.	
	6	Views, triggers, cursor, functions, procedure – Embedded SQL.	
III		**DATABASE DESIGN USING ER MODEL**	**15**
	7	Overview of the design process, Entity relational model, Types of attributes-Simple, composite, derived, complex and Multivalued attributes and its latest representations. ER diagrams.	
	8	Mapping cardinalities, Primary key, removing redundant attributes in entity sets	
	9	Reducing ER diagram to relational schema, Entity relationship design issues.	
IV		**NORMALIZATION**	**15**
	10	Features of good relational design, Decomposition using Functional Dependencies-Amstrong axioms, Types of FDS, Normal forms (1NF,2NF, 3NF, BCNF)	
	11	Database-Design Process	
V		**Flexi Module: Not included for end semester exams**	
	12	Security Issues-Basic Security issues, types of Security issues and its solutions	**15**
	13	Database design issues	
	14	NoSQL	

References

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition.
2. Ramon AM and Pauline K. Cushman, Database Management Systems, McGraw Hill Edn.
3. Atul Kahate, Introduction to Database Management Systems.

Web Resources:

1. **NPTEL: Course name: -Database Management Systems.**

https://onlinecourses.nptel.ac.in/noc22_cs51/preview

Lab Exercises

PART A

1. SQL statements for creating, dropping and updating tables.
2. Record manipulation using insert, delete and update.
3. Experiments that clarify the importance of keys.
4. Practise all constraints of attributes.
5. Queries with substring comparison.
6. Usage of BETWEEN.
7. Aggregate functions.
8. Finding values with a certain range.
9. Queries with string comparison and ordering.
10. Usage of GROUP BY clause
11. Create and delete view
12. sage of Procedures.

PART B

CASE STUDY

Draw an ER diagram and Perform normalization on the database.

EXAMPLE: Hospital Management system, Railway Reservation system.

Course Outcomes

No.	**Upon completion of the course, the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Ouline the concept of databases.	U	PSO-1
CO2	Create a database using SQL and perform operations in SQL.	Ap	PSO-1,2
CO3	Build ER diagrams using ER design concepts	Ap	PSO-1,2,3
CO4	Demonstrate the design concepts and normalization in the database.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: DATABASE MANAGEMENT SYSTEMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Outline the concept of database.	PO –3,6 PSO-1	U	F, C	L	
CO2	Create a database using SQL and perform operations in SQL.	PO – 3, 6, 7 PSO-1,2	Ap	F, C, P	L	P
CO3	Build ER diagrams using ER design concepts	PO – 3,5, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
CO4	Demonstrate the design concepts and normalization in the database.	PO – 3,5, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2	PSO 3	PSO4
CO 1	-	-	1	-	-	2	-	-	3	-	-	-
CO 2	-	-	2	-	-	2	1	-	2	2	3	-
CO 3	-	-	1	-	2	3	2	-	2	1	3	-

CO 4	-	-	2	-	2	2	3	-	3	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Case Study / Lab Assessment	End Semester Examinations
CO1	✓		✓	✓
CO2	✓		✓	✓
CO3	✓	✓	✓	✓
CO4	✓	✓	✓	✓

2. DATA COMMUNICATION

Discipline	COMPUTER SCIENCE
Course Code	UK4DSCCSC201
Course Title	DATA COMMUNICATION
Type of Course	**DSC**
Semester	IV

Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	1 hour	-	4 hours
Pre-requisites	Awareness in basic concepts of digital electronics is necessary.				
Course Summary	To develop an understanding of the various aspects of data communications, fundamentals of signaling and basic transmission concepts.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Data Communication**	**12**
	1	Definition-Characteristics: Delivery, Accuracy, Timeliness, Jitter	
	2	Components: Message, Sender, Receiver, Medium, Protocol	
	3	Modes Of Communication: Simplex, Half duplex, Full Duplex- Bandwidth- Bit rate, Baud rate	
	4	Study of Signals: Analog and Digital, Periodic and Aperiodic Signals, Analog Signals, Time and Frequency Domains, Composite Signals, Digital Signals.	
II		**Transmission Media**	**12**
	5	Guided Transmission Media: Twisted pair cable, Coaxial cable, Fiber optic cable	
	6	Unguided Transmission Media: Radio waves, microwave, Satellite	
	7	Line-of-sight transmission: point to point, Broadcast	
	8	Transmission Impairments: Attenuation, Distortion, Noise - Channel capacity: Nyquist Bandwidth, Shannon's Capacity formula.	
III		**Signal Encoding Techniques**	**12**

	9	Digital Data Digital Signals: NRZ, Multilevel binary, Biphase	
	10	Digital Data Analog Signals: ASK, FSK, PSK	
	11	Analog Data Digital Signals: Sampling theorem, PCM.	
	12	Analog Data Analog Signals: AM, FM, PM.	
IV	**Multiplexing and Spread Spectrum**		**12**
	18	Many to one/one to Many, Frequency division Multiplexing,	
	19	Wavelength division Multiplexing.	
	20	Time division Multiplexing.	
	21	Multiplexing applications.	
	22	Spread Spectrum Techniques:Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS).	
	Mobile System		
V	23	Mobile system -1G, 2G, 3G	**12**
	24	GSM-Introduction,Architecture, Technical Specification, Frame Structure, Characteristics and Features, Applications.	

References

1. Behrouz A. Forouzan, "Data Communications and Networking"
2. Andrew S. Tanenbaum and David J. Wetherall**,** Computer Networks" by Andrew S. Tanenbaum and David J. Wetherall

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basic concept of Data Communication	U	PSO-1,2
CO-2	Differentiate between Guided and Unguided media.	U	PSO-1,2
CO-3	Explain the principles of digital signal encoding techniques.	U	PSO-1. 2
CO-4	Identify various multiplexing and spread spectrum techniques in communication systems.	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA COMMUNICATION

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Summarize the basic concept of Data Communication	PO-1,2,6,7 PSO- 1,2	U	F, C	L	-
2	Differentiate between Guided and Unguided media	PO-1,2,6,7 PSO- 1,2	U	F, C	L	-
3	Explain the principles of digital signal encoding techniques.	PO-1,2,6,7 PSO- 1,2	U	F, C	L	-
4	Identify various multiplexing and spread spectrum techniques in communication systems.	PO-1,2,6,7 PSO- 1,2	U	F, C	L, T	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	-	-	-	2	2	-	2	2	-	-
CO 2	2	1	-	-	-	2	2	-	2	2	-	-
CO 3	2	2	-	-	-	2	2	-	2	1	-	-
CO 4	2	2	-	-	-	2	2	-	2	1	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓	✓	✓

3. ARTIFICIAL INTELLIGENCE

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSCCSC202				
Course Title	ARTIFICIAL INTELLIGENCE				
Type of Course	**DSC**				
Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Awareness in Knowledge representation and reasoning is desirable				
Course Summary	This course aims to give students a brief idea about Artificial Intelligence and its associated concepts and applications.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction**	**12**
	1	What is Artificial Intelligence	
	2	Foundations and History of Artificial Intelligence	
	3	Applications of Artificial Intelligence	
	4	Intelligent Agents	
	5	Structure of Intelligent Agents	
		Search Strategies	**12**
	6	Introduction to Search	
	7	Searching for solutions	
	8	Uninformed search strategies (Breadth First Search, Depth First Search, Depth Limited Search, Uniform Cost Search)	
	9	Informed search strategies (Best First Search, A*, Hill Climbing)	

	10	Local search algorithms and optimistic problems (Travelling Salesman Problem)	
	11	Adversarial Search (Algorithms not needed)	
	12	Current-best-hypothesis search (only basic concept & list of applications)	
II	**Knowledge Representation & Reasoning**		**12**
	13	Overview of Inference, Propositional & Predicate Logic	
	14	Logical Reasoning	
	15	Forward & Backward Chaining	
	16	Resolution	
	17	AI languages and tools - CLIPS	
III	**Problem Solving**		**12**
	18	Formulating problems	
	19	Problem Types	
	20	Solving Problems by Searching	
	21	Heuristic search techniques	
	22	Constraint satisfaction problems (Only basic concepts)	
	23	Stochastic search methods (Simulated Annealing, Genetic Algorithms)	
IV	**Learning**		**12**
	24	Overview of different forms of learning	
	25	Decision trees	
	26	Rule-based learning	
	27	Neural networks	
	28	Reinforcement learning	
		Flexi Module: Not include in End Semester Exams	**12**

V	29	Comparative study of various searching strategies, Introduction to latest AI Tools, Some recent applications of Learning Techniques and its uses	

References

- Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education
- Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill
- E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	U	PSO - 1
CO2	Demonstrate the different searching techniques practised in AI	Ap	PSO - 1, 2, 3
CO3	Use concepts of knowledge representation and reasoning in the context of AI	Ap	PSO - 1, 2
CO4	Illustrate AI Problems and different ways of problem solving	Ap	PSO - 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ARTIFICIAL INTELLIGENCE

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Infer basic ideas about Artificial Intelligence (AI) and Intelligent Agents	PO - 6, 7 PSO - 1	U	F, C	L	-
2	Demonstrate the	PO - 1, 2,	Ap	F, C, P	L	-

	different searching techniques practised in AI	4, 5, 6, 7 PSO - 1, 2, 3				
3	Use concepts of knowledge representation and reasoning in the context of AI	PO - 1, 2, 6, 7 PSO - 1, 2	Ap	F, C, P	L	-
4	Illustrate AI Problems and different ways of problem solving	PO - 1, 2, 6, 7 PSO - 1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**-**	**-**	**-**
CO2	**2**	**1**	**-**	**2**	**1**	**2**	**2**	**-**	**3**	**2**	**1**	**-**
CO3	**3**	**2**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**2**	**-**	**-**
CO4	**2**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**2**	**-**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar/ Quiz *	End Semester Examinations
CO1	✓			✓
CO2	✓		✓	✓
CO3	✓		✓	✓
CO4	✓	✓		✓

4. COMPUTER ORGANIZATION

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSCCSC203				
Course Title	COMPUTER ORGANIZATION				
Type of Course	**DSC**				
Semester	IV				
Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Awareness of essential concepts in computer science is desirable.				
Course Summary	A course on computer organization typically covers the fundamental principles of how computers are structured and how they function at a low level.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**FUNCTIONAL UNITS OF A COMPUTER**	**15**
	1	Data path in Von Neumann model; Instruction execution, Logical structure of a simple personal computer	
	2	Input Devices: Gesture Recognition Devices, Touch and Multi-Touch Screens, Stylus and Pen Input Devices, Wearable Input Devices, Biometric Input Devices, and Brain-Computer Interfaces (BCIs). Output Devices-High-Resolution Displays, Projection Systems, OLED and Micro LED Displays,3D printers.	
	3	ASCII & UNICODE	
II		**MEMORY & BIOS**	**15**
	5	Memory Hierarchy, Primary memory RAM (SRAM, DRAM-DDR3, DDR4)	

	6	External Hard Disk, Solid-State Drive, Memory Cards	
	8	Cache memory: Basic concepts, hit ratio, miss ratio, Cache Mapping Direct. Associative and set associative	
	9	BIOS Purpose. CMOS-How to recover a forgotten BIOS password, Boot process of a computer, BIOS setting concepts.	
III		**THE INSTRUCTION SET**	**15**
	9	OVERVIEW OF THE ISA (Instruction set Architecture) LEVEL Properties of the ISA Level, Memory Models, Registers, Instructions	
	11	Instruction Formats, Types of instructions movement, Procedure call, Loop control, input/output instructions. Dyadic, monadic instruction, comparison and control Branches	
	12	RISC Versus CISC	
IV		**INPUT-OUTPUT ORGANIZATION**	**15**
	13	Bus Structure, Bus Operation: -Synchronous Bus, Asynchronous Bus,	
	14	Arbitration, Interface Circuits -Parallel Interface, Serial Interface.	
	15	Interconnection Standards- PCI Bus, SCSI Bus, SATA, SAS, PCI Express.	
	16	DMA-DMA controller	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	17	An Example ISA: IJVM	
	18	Design of the Microarchitecture level	
	19	Comparison of the I7, OMAP4430, and ATMEGA 168	

References

1. Structured Computer Organization, Sixth Edition Andrew S Tanenbaum and Todd Autin.
2. Computer Organization and Embedded Systems, by Hamacher, Vranesic, Zaky, Manjikian, Edition 6, 2012, McGraw-Hill.
3. Fundamentals of computers, E Balagurusamy.
4. Computer architecture, A quantitative Approach, John Hennessy, David A Patterson
5. Computer Organization and Architectures, Rajaram and Radha Krishnan

Web Resource

Computer architecture and organization - Course (nptel.ac.in)

https://onlinecourses.nptel.ac.in/noc20_cs64/preview

Lab Exercise :(30 Hours)

1. Familiarize yourself with the Booting process

2. Troubleshooting system failures-Primary level.

3. Familiarize yourself with secondary storage devices and memory Partitioning.

4. Desktop Assembling

5. BIOS Setup

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO1	Discuss the functional components and building blocks of a computer.	U	PSO-1,2
CO2	Illustrate memory concepts and setting of BIOS configuration.	Ap	PSO-1,2,3
CO3	Use the different instruction sets.	Ap	PSO-1,2
CO4	Describe input-output organization followed in a computer.	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Discuss the functional components and building blocks of a computer.	PO-6,7 PSO-1,2	U	F, C	L	-

2	Illustrate memory concepts and setting of BIOS configuration.	PO-3,6,7 PSO-1,2,3	Ap	F,C,P	L	P
3	Use the different instruction sets.	PO-6,7 PSO-1,2	Ap	F,C,P	L	P
4	Describe input-output organization followed in a computer.	PO-3,6,7 PSO-1,2	U	F,C,P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	3	2	-	3	1	-	-
CO 2	-	-	3	-	-	3	2	-	2	3	1	-
CO 3	-	-	-	-	-	3	1	-	3	1	-	-
CO 4	-	-	1	-	-	2	1	-	3	2	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓			✓
CO 4	✓	✓		✓

DSE

5. ETHICAL HACKING (Stream: Cyber Security)

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSECSC200				
Course Title	**ETHICAL HACKING**				
Type of Course	**DSE**				
Semester	IV				
Academic Level	2 .				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5 hours

Pre-requisites	Knowledge in basic concepts of computer systems is necessary.
Course Summary	The Ethical Hacking course is designed to introduce the student to the concept og ethical hacking. Throughout the course, students will learn about the fundamentals of ethical hacking, the tools and techniques used by hackers, as well as the legal and ethical considerations associated with hacking.

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Ethical Hacking**	**15**
	1	Define Ethical Hacking? Red Teaming, Blue Teaming , Purple Teaming, Basic Linux Commands, OSI Layer, Encryption and Encoding, IP address classification, HTTP Methods, TCP Handshake, Cyber Kill Chain(Each step in detail) CIA Triad, AAA- Authentication ,Authorization and Accounting, Worms, viruses, Trojans, Spyware, Root kits	
	2	OWASP Top 10 (2021), MITRE Framework	
	3	Information Disclosure, Insecure Direct Object Reference (IDOR)	
	4	Recently Observed Attacks around the world- Log4j Attack, WannaCry Attack	
II		**Types of Attacks and their Common Prevention Mechanisms**	**15**
	5	Ransomware Attack, Keystroke Logging, Denial of Service (DoS /DDoS),Social Engineering, Phishing, Vishing, Attack cross-site scripting (XSS), cross site request forgery (CSRF/XSRF) SQL injection, input parameter manipulation, broken authentication, Broken access control, Security Misconfiguration,	
	6	Waterhole attack, brute force, Password Spray, , phishing, Eavesdropping, Man-in-the-Middle.	
	7	Click jacking, Cookie Theft, URL Obfuscation	
	8	DNS poisoning, ARP poisoning, Identity Theft,	

III	**Ethical Hacking**		**15**
	9	Introduction: Black Hat vs. Gray Hat vs. White Hat (Ethical) hacking, Why is Ethical hacking needed?	
	10	How is Ethical hacking different from security auditing and digital forensics?	
	11	Signing NDA.	
	12	Black box vs. White box vs. Black box	
	13	Vulnerability assessment and Penetration Testing. Difference between Vulnerability Assessment and Penetration Testing	
	14	Planning - Threat Modelling, set up security verification standards	
	15	Set up security testing plan – When, which systems/apps	
	16	understanding functionality, black/gray/white, authenticated vs. unauthenticated	
IV	**Systems Hacking and Applications Hacking**		**15**
	17	Crawling/Spidering	
	18	**Systems hacking** – Windows and Linux –Key logging, Buffer Overflows.	
	19	Network hacking - ARP Poisoning, Password Cracking(Eg Rainbow table attack)	
	20	Wireless Attacks, MAC Spoofing, MAC Flooding.	
V	**Flexi Module**: **Not included in End Semester Exams**		**15**
	21	SMTP/Email-based attacks, VOIP vulnerabilities, Directory traversal, Windows Active Directory and common Attacks	
	22	Netcat Trojan, Wrapping definition, Reverse engineering.	

References

1) Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition,2016

2) CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2007

1) Certified Ethical Hacker: Michael Gregg, Pearson Education,1st Edition, 2013

2) Certified Ethical Hacker: Matt Walker, TMH,2011

3) http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines

4) https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project

5) https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10

Lab Exercises

1. Use Google and Whois for Reconnaissance
2. Use CrypTool to encrypt and decrypt passwords using RC4 algorithm
3. Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords
4. Run and Analyze the output of following commands in Linux – ifconfig, ping, netstat,
5. Perform ARP Poisoning in Windows
6. Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS
7. Use Wireshark (Sniffer) to capture network traffic and analyze
8. Use Nemesy to launch DoS attack
9. Simulate persistent cross-site scripting attack
10. Session impersonation using Firefox and Tamper Data add-on.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the ethics, legality, methodologies and techniques of hacking	U	PSO-1
CO-2	Explain the types of attacks and their common prevention mechanisms	U	PSO-1
CO-3	Apply various tools for hacking in real time machines	Ap	PSO-3
CO-4	Illustrate Systems Hacking and Applications Hacking.	Ap	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ETHICAL HACKING

Credits: 3:0:2 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L) /Tutorial (T)	Practical (P)
CO-1	Describe the ethics, legality, methodologies and techniques of hacking	PO-6, 7, 8 PSO-1	U	F,C	L	-
CO-2	Explain the types of attacks and their common prevention mechanisms	PO- 1,2, 6, 7, 8 PSO-1	U	F,C	L	-
CO-3	Apply various tools for hacking in real time machines	PO-1,2,6,7,8 PSO-1,3	Ap	F,C,P	L	P
CO-4	Illustrate Systems Hacking and Applications Hacking.	PO-1,2,6,7,8 PSO-1	Ap	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	2	2			
CO 2	2	1	-	-	-	2	2	2	2			
CO 3	2	3	-	-	-	2	2	2	2		2	
CO 4	1	2	-	-	-	2	2	2	1			

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

6. PYTHON FOR DATA ANALYTICS (Stream: Data Science)

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSECSC201				
Course Title	PYTHON FOR DATA ANALYTICS				
Type of Course	DSE				
Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	-				
Course Summary	This course is designed to enable students to get familiar with the features of python, its libraries, module creation, implementing various data structures and data visualization .				

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction**	**15**
	1	Data Analytics Lifecycle overview – Discovery, Data Preparation, Model Planning, Model Building, communicate results, operationalize.	
	2	Features of Python, Variables, output, input in Python, Operators ,Control flow statements: Decision making structures, Loops, Nesting of conditional statements and loops, abnormal loop termination	
	3	Functions: uses, syntax, Types – built in and user-defined functions, String functions in python. Recursive function	
	4	Errors and Exception handling	
II		**Data Structures**	**15**
	3	Data Types in Python- Numeric, Dictionary, Boolean, Set, Sequence type	
	4	Modules: In-built modules and user defined modules, import statement, from .... import statement.	
	5	Numpy library for arrays: One-dimensional and multi-dimensional	
III		**Data Processing**	**15**
	6	Pandas library for data processing	
	7	Basics of data frame, import of data, functions of data frame	
	8	Data extraction, Group by functionality	
	9	Creating charts for dataframe, missing values	
IV		**Data Visualization**	**15**
	10	Matplotlib library for visualization: Visualization for categorical variable, visualization of continuous variable.	
	11	Seaborn library for visualization: Visualization for categorical variable, visualization of continuous variable.	

V	**Additional Core Libraries (Not for end semester Examination)**		**15**
	12	SciPy Library for Statistics	
	13	SQLAlchemy Library for SQL	
	14	StatsModels Library for time series models - Introduction	

References

1. Bharti Motwani, Data Analytics using Python,Wiley,2022
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data,EMC Education services Wiley Publication

1. Joel Grus,Data Science from Scratch: First Principles with Python,O'Reilly Media,2015
2. Wes McKinney,Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython,O'Reilly Media,2017
3. Jake VanderPlas,Python Data Science Handbook: Essential Tools for Working with Data,O'Reilly Media,2016
4. Aurélien Géron,Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,O'Reilly Media,2019
5. Python for Data Analysis: 3rd Edition, Wes McKinney ,Publisher(s): O'Reilly Media, Inc.

Lab Exercises

1. Programs using Python strings, lists, tuples, and dictionaries.
2. Read and write data from/to files in Python.
3. Programs to demonstrate creating and handling of modules and packages
4. Programs involving regular expressions
5. Programs to draw simple bar chart, pie chart, histogram and scatter plot
6. Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib.
7. Create a python program to export data (store Data Frame in CSV Format)
8. Create a python program to handle the missing data from a dataset using numpy and pandas.
9. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools
10. Create a python program to handle the missing data from a dataset using numpy and pandas.
11. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools

    (a) Create a python program to draw a Histogram, Column Chart, Box plot chart, Pie Chart, and Scatter plot using pandas and mat plot lib for the following data. The categorical data on 1997 U.S. Health Care Expenditures. The data are in file

healthexpendituresdata.csv.
(b) The monthly data on the total return from the Standard and Poor 500 stock index (with reinvestment of dividends) from 1970 to 2018. The data are in file SandP500stockpricedata.csv. Create a python program to import data from any .csv file and analyze using the statistical functions of pandas tools. Also create a python program to draw different charts.
(c)If at the end of each month, a saver deposited $100 into a savings account that paid 6% compounded monthly, h o w much would he have at the end of 10 years? Create a python program to calculate it?

	A	B
1	Category	Expenditures
2	Hospital	371
3	Physician	218
4	Drugs and Supplies	109
5	Other Personal	92
6	Nursing Home	83
7	Dental	51
8	Admin & Insurance	50
9	Public Health	39
10	Home Health	32
11	Research	18
12	Construction	17
13	Eye and Equipment	14

(d)Draw a pie chart and other charts that shows the amount of subscription generated for Indian Bonds from different categories of Investors. Create a python program for the above problem Use pandas and mat plot lib to draw charts
(e)The share holding pattern of a company WIPRO is given. Create a python program for the above problem. Use pandas and matplotlib to draw charts

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Use Python basics	Ap	PSO-1,2,3
CO-2	Comprehend various Python Data Structures and Modules	Ap	PSO-1,2,3
CO-3	Use Pandas library, data frames, and data extraction methods.	Ap	PSO-1,2,3
CO-4	Experiment with Python libraries Matplotlib and Seaborn for data visualization of both categorical and continuous variables.	Ap	PSO-1, 2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA ANALYTICS USING PYTHON

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Use Python basics	PO-1, 6, 7 PSO-1,2,3	Ap	F, C	L	P
2	Comprehend various Python Data Structures and Modules	PO-1, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
3	Use data processing using Pandas library, data frames, and data extraction methods.	PO-1, 5, 6, 7 PSO-1,2,3	Ap	F, C, P	L	P
4	Experiment with Python libraries Matplotlib and Seaborn for data visualization of both categorical and continuous variables.	PO-1, 5, 6, 7 PSO-1, 2,3	Ap	F,C,P	L	p

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	2	-	-	-	-	2	2	-	2	2	2	-
CO 2	2	-	-	-	-	2	2	-	2	2	2	-

CO 3	2	-	-	-	2	2	2	-	2	2	2	-
CO 4	2	-	-	-	2	2	2	-	2	2	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	Seminar	End Semester Examinations
CO-1	✓	✓	✓	✓	✓
CO-2	✓	✓	✓	✓	✓
CO-3	✓		✓		✓
CO-4	✓		✓		✓

7. KNOWLEDGE REPRESENTATION AND INTELLIGENT AGENTS (Stream: Machine Learning)

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSECSC202				
Course Title	KNOWLEDGE REPRESENTATION AND INTELLIGENT AGENTS				
Type of Course	DSE				
Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 housr	5 hours
Pre-requisites	Nil				
Course Summary	The course delves into representing knowledge effectively and designing intelligent agents for problem-solving in artificial intelligence.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Algorithm Analysis and Techniques**	**12**
	1	Concepts in algorithm analysis – the efficiency of algorithms, average and worst – case analysis, Asymptotic notation, time and space complexity.	
	2	Techniques - brute force, divide and conquer, decrease and conquer, dynamic programming, shortest paths, backtracking	
II		**Heuristic Search Techniques**	**12**

	3	Heuristic search techniques - Generate and test, Hill climbing, Simulated annealing, Problem reduction, AO* algorithm, Constraints satisfaction, Means - Ends analysis. Search Techniques- Graph search, Depth First Search, Breadth First Search, Best first search, A* algorithm.	
III	**Knowledge Representation**		**12**
	4	Knowledge Management; Types of Knowledge; Knowledge Representation; Knowledgebase	
	5	Knowledge Representation structures: First order Logic, Frames, Conceptual Dependency, Scripts, Semantic Network	
IV	**Intelligent Agents**		**12**
	6	Intelligent agents - structure, types of agents, environment, autonomous agents. Nature inspired agents, Planning Agent, PEAS Representation	
V	**Flexi module:- Not included for End Semester Examinations**		**12**
	7	Reasoning: Abductive, Deductive, Inductive, Analogical, Cause-and-Effect, comparative, Conditional and Exemplar Reasoning	

References

1. Vinod Chandra S S, Anand H S, Artificial Intelligence: Principles and Applications, Prentice Hall of India, New Delhi, 2020

2. Kevin Knight, Elaine Rich, Artificial Intelligence, 3rd Edn, Pearson, Chennai

3. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition Prentice Hall of India, New Delhi, 2009

LAB EXERCISES

1. Implementation of brute force algorithm
2. Implementation of divide and conquer algorithm
3. Implementation of decrease and conquer algorithm
4. Implementation of shortest paths algorithm

5. Implementation of Heuristic search techniques
6. Implementation of AO* algorithm
7. Implementation of Depth First Search method
8. Implementation of Breadth First Search method
9. Implementation of Best first search method
10. Implementation of A* algorithm.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Interpret the efficiency of different algorithm design methods	U	PSO- 1
CO2	Apply heuristic search techniques	Ap	PSO- 1, 2, 3
CO3	Represent and manage knowledge effectively using various structures, enhancing problem-solving skills	Ap	PSO- 1, 2
CO4	Distinguish between the types of intelligent agents	U	PSO- 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Interpret the efficiency of different algorithm design methods	PO-1, 6,7 PSO-1	U	F, C	L	-
CO2	Apply heuristic search techniques	PO-1, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

CO3	Represent and manage knowledge effectively using various structures, enhancing problem-solving skills	PO-1, 6, 7 PSO- 1,2	Ap	F, C, P	L	-
CO4	Distinguish between the types of intelligent agents	PO-1, 6, 7 PSO 1, 2	U	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	-	-	-	-	3	3	-	2	-	-	-
CO 2	1	-	-	-	-	3	3	-	2	1	2	-
CO 3	1	-	-	-	-	3	3	-	2	1	-	-
CO 4	1	-	-	-	-	3	3	-	2	1	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓			✓
CO 4	✓	✓		✓

8. WEB SCRIPTING USING JAVASCRIPT (Stream: Web Development)

Discipline	COMPUTER SCIENCE				
Course Code	UK4DSECSC202				
Course Title	WEB SCRIPTING USING JAVASCRIPT				
Type of Course	**DSE**				
Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	1. Basics of Web Design (HTML and CSS)				
Course Summary	This course provides a comprehensive introduction to web scripting using JavaScript, with a focus on building dynamic and interactive web applications using the React JS library. Students will learn fundamental concepts of JavaScript programming, including variables, data types, control structures, functions, and objects. They will also explore the principles of component-based UI development using React JS, including state management, props, event handling, and component lifecycle methods. Through hands-on projects and exercises, students will gain practical experience in building modern web applications with JavaScript and React JS.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**JavaScript : Introduction**	**15**
	1	Introduction to JavaScript, JavaScript Basics: Variables and data types,	
	2	Operators and expressions	
	3	Control Structures: Conditional statements, Loop statements	
	5	Functions: Declaring functions, Parameters and arguments, Returning values	
	6	Dialog boxes: Prompt, Confirm, Alert boxes.	
II		**JavaScript : Arrays, Objects, Events, Form and Exception Handling**	**15**
	5	Arrays and Objects: Working with arrays, Working with objects, Iterating through arrays and objects	
	6	Events: click event, mouse events, key events	
	7	Forms and Form Validation: Working with forms, Client-side form validation	
	8	Exception Handling	
III		**React JS: Introduction**	**15**
	9	Introduction to React JS, Need, Applications, Features, Architecture, Virtual DOM	
	10	Installation: Setting up a React development environment (Node.js, npm, create-react-app)	
	11	JSX**:** JSX syntax, Conditional rendering with if/else and element variables, Ternary operators and logical && in JSX, Expressions in JSX	
	12	Creating and rendering React Components	
	13	Components and Props: Components vs Elements**,** Built in components, Attributes vs props, Types of Components: Function components, Passing and using props	
IV		**React JS: Events, Styles, Forms in React JS**	**15**

	14	Understanding component state, managing state using setState(), Component Life Cycle methods , React Hooks	
	15	Handling Events: Event handling in React, Event Handler Functions, Binding event handlers Functions	
	16	Forms: Controlled vs uncontrolled inputs, Handling form submission and user input	
	17	Styling in React.js CSS in React, Different approaches for styling (CSS, CSS-in-JS, CSS Modules), Inline styles, Styling Libraries, Popular CSS frameworks (Bootstrap, Material-UI)	
V		**Flexi Module: Not included for End Semester Exams**	**15**
		Cookies in JavaScript, Introduction to React Router: Setting up routes in React applications, Navigating between routes, Passing parameters to routes	

References

1. The Complete Reference JavaScript by Fritz Schneider and Thomas A Powell, Second Edition
2. BEGINNING React JS Foundations Building User Interfaces with React JS An Approachable Guide by Chris Minnick
3. Eloquent JavaScript: A Modern Introduction to Programming by Marijn Haverbeke, Fourth Edition
4. Learning React: A Hands-On Guide to Building Web. Applications Using React and Redux by Kirupa Chinnathambi, Addison Wesley
5. React.js Essentials by Artemij Fedosejev
6. Fullstack React: The Complete Guide to ReactJS and Friends by Anthony Accomazzo, Nate Murray, and Ari Lerner

Web Resources

1. https://www.tutorialsteacher.com/javascript
2. https://www.guru99.com/reactjs-tutorial.html

Lab Exercises

Part A (JavaScript)

1. Experiments based on Operators
2. Experiments based on Control Statements
3. Experiments based on Loop statements
4. Experiments based on Functions
5. Experiments based on Dialog boxes
6. Experiments based on Arrays
7. Experiments based on Objects

8. Experiments based on Form validation
9. Experiments based on Events
10. Experiments based on Exception Handling

Part B (React JS)

Develop a simple application using React by integrating concepts learned throughout the course.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Illustrate the basic skills in JavaScript	Ap	PSO-1,2,3
CO-2	Develop the client-side scripts using JavaScript	Ap	PSO-1,2,3
CO-3	Illustrate the main ideas behind React JS	Ap	PSO-1,2,3
CO-4	Create interactive user interfaces using React JS	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: WEB SCRIPTING USING JAVASCRIPT

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial	Practical (P)
1	Illustrate the basic skills in JavaScript	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
2	Develop the client-side scripts using JavaScript	PO – 3,5 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P

3	Illustrate the main ideas behind JSX	PO – 3, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
4	Create interactive user interfaces using React.js.	PO – 3, 5, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	3	-	-	3	3	-	2	1	3	-
CO 2	-	-	3	-	1	3	3	-	2	1	3	-
CO 3	-	-	3	-	-	3	3	-	2	1	3	-
CO 4	-	-	3	-	1	3	3	-	2	1	3	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments

- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

VAC

9. ETHICAL HACKING

Discipline	COMPUTER SCIENCE				
Course Code	UK4VACCSC200				
Course Title	**ETHICAL HACKING**				
Type of Course	**VAC**				
Semester	IV				
Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic awareness on computers is desirable.				
Course Summary	This course is designed to introduce ethical hacking and its various concepts. Throughout the hacking course, students will learn the fundamentals of ethical hacking, including the tools and techniques used by hackers, as well as the legal and ethical considerations associated with hacking.				

Detailed Syllabus:

Module	Unit	Content	Hrs (T+P)
I		**Introduction to Ethical Hacking**	**12**
	1	Define Ethical Hacking? Red Teaming, Blue Teaming ,Purple Teaming, Basic Linux Commands, OSI Layer, Encryption and Encoding, IP address classification, HTTP Methods, TCP Handshake, Cyber Kill Chain(Each step in detail) CIA Triad, AAA- Authentication ,Authorization and Accounting,Worms, viruses, Trojans, Spyware, Root kits	
	2	OWASP Top 10 (2021), MITRE Framework	
	3	Information Disclosure, Insecure Direct Object Reference (IDOR)	
	4	Recently Observed Attacks around the world- Log4j Attack, WannaCry Attack	
II		**Types of Attacks and their Common Prevention Mechanisms**	**12**
	5	Ransomware Attack, Keystroke Logging, Denial of Service (DoS /DDoS),Social Engineering, Phishing, Vishing, Attack cross-site scripting (XSS), cross site request forgery (CSRF/XSRF) SQL injection, input parameter manipulation, broken authentication,Broken access control, Security Misconfiguration,	
	6	Waterhole attack, brute force, Password Spray, , phishing, Eavesdropping, Man-in-the-Middle.	
	7	Click jacking, Cookie Theft, URL Obfuscation	
	8	DNS poisoning, ARP poisoning, Identity Theft,	
III		**Ethical Hacking**	**12**
	9	Introduction: Black Hat vs. Gray Hat vs. White Hat (Ethical) hacking, Why is Ethical hacking needed?	
	10	How is Ethical hacking different from security auditing and digital forensics?	
	11	Signing NDA.	

	12	Black box vs. White box vs. Black box	
	13	Vulnerability assessment and Penetration Testing. Difference between Vulnerability Assessment and Penetration Testing	
	14	Planning - Threat Modelling, set up security verification standards	
	15	Set up security testing plan – When, which systems/apps	
	16	understanding functionality, black/gray/white, authenticated vs. unauthenticated	
IV		**Systems Hacking and Applications Hacking**	**12**
	17	Crawling/Spidering	
	18	**Systems hacking** – Windows and Linux –Key logging, Buffer Overflows.	
	19	Network hacking - ARP Poisoning, Password Cracking(Eg Rainbow table attack)	
	20	Wireless Attacks, MAC Spoofing, MAC Flooding.	
V		**Flexi Module: Not included in End Semester Exams**	**12**
	21	SMTP/Email-based attacks, VOIP vulnerabilities, Directory traversal, Windows Active Directory and common Attacks	
	22	Netcat Trojan, Wrapping definition, Reverse engineering.	

References

1. Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition,2016
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, 2007

Additional References

1. Certified Ethical Hacker: Michael Gregg, Pearson Education,1st Edition, 2013
2. Certified Ethical Hacker: Matt Walker, TMH,2011

Web Resources

1. http://www.pentest-standard.org/index.php/PTES_Technical_Guidelines
2. https://www.owasp.org/index.php/Category:OWASP_Top_Ten_2017_Project
3. https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10
4. https://www.owasp.org/index.php/OWASP_Testing_Guide_v4_Table_of_Contents

5. https://www.owasp.org/index.php/OWASP_Secure_Coding_Practices_-_Quick_Reference_ Guide
6. https://cve.mitre.org/
7. https://access.redhat.com/blogs/766093/posts/2914051

LAB EXERCISES

1. Use Google and Whois for Reconnaissance
2. Use CrypTool to encrypt and decrypt passwords using RC4 algorithm
3. Use Cain and Abel for cracking Windows account password using Dictionary attack and to decode wireless network passwords
4. Run and Analyze the output of following commands in Linux – ifconfig, ping, netstat,
5. Perform ARP Poisoning in Windows
6. Use NMap scanner to perform port scanning of various forms – ACK, SYN, FIN, NULL, XMAS
7. Use Wireshark (Sniffer) to capture network traffic and analyze
8. Use Nemesy to launch DoS attack
9. Simulate persistent cross-site scripting attack
10. Session impersonation using Firefox and Tamper Data add-on.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Describe the ethics, legality, methodologies and techniques of hacking	U	PSO-1
CO-2	Explain the types of attacks and their common prevention mechanisms	U	PSO-1
CO-3	Apply various tools for hacking in real time machines	Ap	PSO-1, 3
CO-4	Illustrate Systems Hacking and Applications Hacking.	Ap	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ETHICAL HACKING

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L) / Tutorial (T)	Practical (P)
CO-1	Describe the ethics, legality, methodologies and techniques of hacking	PO-6,7,8 PSO-1	U	F,C	L	-
CO-2	Explain the types of attacks and their common prevention mechanisms	PO-1,2, 6, 7 PSO-1	U	F,C	L	-
CO-3	Apply various tools for hacking in real time machines	PO-1,2,6,7,8 PSO-3	Ap	F,C,P	L	P
CO-4	Illustrate Systems Hacking and Applications Hacking.	PO-1,2,6,7,8 PSO-1	Ap	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	2	2	3	2	-	-	-
CO 2	2	1	-	-	-	2	2	3	2	-	-	-
CO 3	2	3	-	-	-	2	2	3	-	-	2	-

CO 4	1	2	-	–	-	2	3	3	1	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓			✓
CO2	✓	✓		✓
CO3	✓			✓
CO4	✓	✓	✓	✓

10. SOFTWARE QUALITY MANAGEMENT

Discipline	COMPUTER SCIENCE
Course Code	UK4VACCSC201
Course Title	SOFTWARE QUALITY MANAGEMENT
Type of Course	**VAC**
Semester	IV

Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3 hours
Pre-requisites	Nil				
Course Summary	In this course, Students will understand the importance of software quality management and implement metrics-driven improvement strategies. They will manage testing activities effectively and deploy continuous improvement processes and tools in software development projects to enhance efficiency and product excellence.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Software Quality Management**	**9**
	1	• Definition and importance of software quality • Quality attributes and characteristics • Cost of quality • Quality management principles and practices • ISO standards for software quality	
II		**Software Metrics and Measurement,Software Inspection and Review**	**9**
	2	**Software Metrics and Measurement:** • Metrics in software quality management • Measurement theory and practices • Inspection, review, and walkthrough processes • Formal and informal review techniques	
III		**Software Testing Fundamentals & Quality Standards**	**9**

	3.1	**Software Testing Fundamentals** ● Introduction to software testing ● Testing principles and fundamentals ● Testing types and techniques ● Test planning and execution ● Overview of quality standards (e.g., CMMI, IEEE)	
IV	**Continuous Improvement and Tools**		**9**
	4	● Continuous improvement methodologies (e.g., Six Sigma, Lean, etc.) ● Process improvement frameworks (e.g., PDCA, DMAIC, etc.) ● Quality management tools and software	
V	**Flexi Module: Not to be included for end semester exams**		**9**
	5	● Understanding the role of software quality assurance (SQA) in ensuring compliance with quality standards and regulations. ● Implementing quality assurance processes and procedures to maintain compliance with industry standards (e.g., ISO, CMMI).	

References

1. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman
2. "Software Testing: Principles and Practices" by Srinivasan Desikan and Gopalaswamy Ramesh.
3. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley

Additional References

1. "Lean Software Development: An Agile Toolkit" by Mary Poppendieck and Tom Poppendieck.
2. "Software Quality Assurance: Principles and Practice" by Nina S. Godbole and Sunita S. Godbole

Web Resources

3. https://www.sei.cmu.edu/.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize software quality management concepts, principles.	U	PSO-1
CO-2	Relate knowledge, skills, and tools necessary to implement metrics-driven quality improvement initiatives.	U	PSO-1,2
CO-3	Make use of knowledge, skills, and tools necessary to effectively plan, execute, and manage software testing activities.	Ap	PSO-2
CO4	Identify tools necessary to implement continuous improvement methodologies, process improvement frameworks.	Ap	PSO-2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create
Note: 1 or 2 COs/module
Name of the Course: SOFTWARE QUALITY MANAGEMENT
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO addressed	Cognitive Level	Knowledge Category	Lecture (L)/Practical (P)	Practical (P)
CO-1	Summarize software quality management concepts, principles.	PO-6,7,8 PSO-1,2	U	F, C	L	-
CO-2	Relate knowledge, skills, and tools necessary to implement metrics-driven quality improvement initiatives.	PO -6, 7, 8 PSO-1,2	U	F, C	L	-
CO-3	Make use of knowledge, skills, and tools necessary to effectively plan, execute, and manage software testing activities.	PO -6,7,8 PSO-1,2,3	Ap	F, C, P	L	-

CO-4	Identify tools necessary to implement continuous improvement methodologies, process improvement frameworks.	PO-2,6,7,8 PSO-1,2,3	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	1	-	-	-	1	-	-	3	-	-	-
CO 2	-	1	-	-	-	1	-	-	3	1	-	-
CO 3	-	1	-	-	-	2	-	-	-	2	-	-
CO 4	-	1	-	-	-	2	-	-	-	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4		✓		✓

11. ETHICAL AI AND RESPONSIBLE COMPUTING

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK4VACCSC202</td></tr>
<tr><td>Course Title</td><td colspan="5">ETHICAL AI AND RESPONSIBLE COMPUTING</td></tr>
<tr><td>Type of Course</td><td colspan="5">VAC</td></tr>
<tr><td>Semester</td><td colspan="5">IV</td></tr>
<tr><td>Academic Level</td><td colspan="5">2</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>3</td><td>3 hours</td><td>-</td><td>-</td><td>3 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">None</td></tr>
<tr><td>Course Summary</td><td colspan="5">The course offers a thorough analysis of ethical issues and responsible behaviour related to computing technology and artificial intelligence. Students will study a range of ethical frameworks, rules, and norms pertaining to the creation, application, and management of artificial intelligence systems.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Ethical Artificial Intelligence (AI)**	**9**
		Definitions and concepts - Historical context, Importance of ethical considerations in AI and Computing Privacy and Data Ethics - Ethical considerations in data collection, storage, and usage, Legal and regulatory frameworks for data privacy (e.g., GDPR, CCPA).	
II		**Regulation and Policy in AI**	**9**
		Overview of relevant laws and regulations governing AI technologies, Ethical implications of regulatory frameworks for AI. Case studies on legal and ethical dilemmas in AI governance, Privacy-preserving techniques in AI and computing. Ethical leadership in AI organizations, Ethical considerations in AI consulting and entrepreneurship	
III		**Ethical Leadership and Professional Responsibility**	**9**
		Responsible Computing in Practice – Introduction to Responsible Computing, Overview of responsible computing principles, Understanding the importance of responsible AI development and deployment, Corporate responsibility and AI ethics guidelines. Professional codes of conduct, Ethical responsibilities of AI researchers, developers, and practitioners.	
IV		**Emerging Ethical Challenges**	**9**
		Understanding the impact of AI on society and ethics, Privacy concerns in AI-powered surveillance systems, Ethical challenges in using AI for diagnosing and treating medical conditions Ethical implications of AI in healthcare and criminal justice.	
V		**Flexi Module : Not included for End-Semester Exams**	**9**

		International Initiatives and Collaborations in Ethical AI Emerging Standards and Guidelines for Responsible AI Discussion - Ethical challenge or dilemma in AI or computing	

TEXTBOOKS

1. Artificial Intelligence Foundations by Andrew Lowe and Steve Lawless,2021 Publication.
2. Artificial Intelligence and Software Testing by Rex Black ,2022 Publication.
3. "Ethics of Artificial Intelligence and Robotics" by Vincent C. Müller (Ed.)
4. "Artificial Intelligence: A Guide to Ethical and Human-Centred AI" by Nancy Fulda

REFERENCE

1. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield," The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
2. Patrick Lin, Keith Abney, George A Bekey ," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.
3. "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy" by Cathy O'Neil
4. Relevant academic papers and articles from journals such as Ethics and Information Technology, AI & Society, etc.

WEB RESOURCES

1. https://responsiblecomputing.net
2. https://link.springer.com/journal/43681/volumes-and-issues

<u>Course Outcomes</u>

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize main concepts of AI with a focus on the ethical implications.	U	PSO - 1, 4
CO-2	Relate AI governance issues and outcomes	Ap	PSO -1, 2, 3, 4

CO-3	Explain professional codes of conduct.	U	PSO - 1,2, 4
CO-4	Identify the ethical issues,and standards used in AI.	U	PSO - 1, 2,3, 4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize main concepts of AI with a focus on the ethical implications.	PO-6, 7, 8 /PSO-1, 4	U	F,C	L	-
CO-2	Relate AI governance issues and outcomes	PO-1,5, 6,7, 8 /PSO-1,4	Ap	F,C	L	-
CO-3	Apply professional codes of conduct.	PO - 6,7,8/ PSO - 1,2,3,4	U	F,C	L	-
CO-4	Identify the ethical issues, and standards used in AI.	PO-1, 4, 6, 7,8/ PSO -1,2,3,4	U	F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	3	3	-	-	3
CO 2	1	-	-	-	2	2	2	3	3	2	-	3

CO 3	-	-	-	-	-	2	2-	3	3	2	-	3
CO 4	1	-	-	1	-	2	2	3	3	2	-	3-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2			✓	✓
CO 3	✓	✓		✓
CO 4		✓	✓	✓

12. PREFACE TO CYBER LAWS

Discipline	COMPUTER SCIENCE
Course Code	UK4VACCSC203
Course Title	PREFACE TO CYBER LAWS
Type of Course	**VAC**
Semester	IV

Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3 hours
Pre-requisites	None				
Course Summary	This course provides a comprehensive understanding of cyber law, including its scope and importance in the digital age, alongside an exploration of cyberspace and its evolution. Additionally, students gain insights into various cybercrimes, the legal implications, and the role of digital signatures and encryption in ensuring cybersecurity, while also understanding e-contracts, e-governance models, and the legal framework governing e-commerce.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction to Cyber Law**	**9**
	1	**Understanding the Basics of Law** ● Definition of law and its significance in society. ● Different branches of law (e.g., criminal law, civil law, administrative law). ● The role of law in regulating human behavior and resolving disputes. ● Definition of cyber law and its importance in the digital age. ● Scope of cyber law: regulating activities in cyberspace, protecting digital rights, and addressing cybercrimes. ● Relationship between cyber law and traditional legal frameworks **Exploring Cyberspace** ● Definition and characteristics of cyberspace. ● Evolution of cyberspace and its impact on society. ● Key elements of cyberspace (e.g., internet, digital communication, online platforms).	

II	**IT Act.**		**9**
	2	**Understanding Jurisprudence** ● Concept of jurisprudence and its relevance to cyber law. ● Major schools of jurisprudence (e.g., natural law, legal positivism, legal realism) and their influence on legal interpretation. ● Application of jurisprudential theories in the context of cyber law. **Overview of the Indian Legal System** ● Structure of the Indian legal system: legislature, judiciary, and executive. ● Sources of law in India: constitution, statutes, case law, and customary law. ● Role of various legal institutions (e.g., Supreme Court, High Courts, District Courts) in administering justice. **Introduction to the Information Technology Act 2000** ● Background and objectives of the Information Technology Act (IT Act) 2000. ● Key provisions of the IT Act related to electronic transactions, digital signatures, and cybercrimes. ● Impact of the IT Act on India's digital economy and legal landscape. **Amendments in the IT Act** ● Evolution of the IT Act through subsequent amendments. ● Rationale behind amendments and their implications for addressing emerging challenges in cyberspace. ● Recent amendments to the IT Act and their significance in enhancing cybersecurity and protecting digital rights.	
III	**Introduction to Cyber Crimes & Offenses and Punishments**		**9**
	3	**Introduction to Cyber Crimes** ● Types of Cyber Crimes ● Overview of cybercrimes targeting individuals, institutions, and states. ● Common forms of cybercrimes: hacking, identity theft, cyberbullying, phishing, malware attacks, etc. ● Impact of cybercrimes on individuals, organizations, and national security. **Offenses and Punishments:-**	

		• Classification of cybercrimes based on severity and intent. • Legal consequences for perpetrators of cybercrimes under the IT Act and other relevant statutes. • Challenges in investigating and prosecuting cybercrimes, including jurisdictional issues and the need for international cooperation.	
IV	**Digital Signature and Encryption**		**9**
	4	• Introduction to Digital Signature and Encryption • Concepts of public key and private key cryptography. • Role of digital signatures in verifying the authenticity and integrity of electronic documents and transactions. • Certification authorities: their role in issuing digital certificates and ensuring the security of digital signatures.	
V	**Flexi Module: Not included in End Semester Exams**		**9**
	5	**E-Contracting** • Salient features of e-contracts and their advantages over traditional contracts. • Formation of e-contracts: offer, acceptance, consideration, and legal enforceability. • Types of e-contracts (e.g., click-wrap agreements, browse-wrap agreements) and their validity under the law. **E-Governance Models** • Definition and objectives of e-governance. • Different models of e-governance: G2C (government-to-citizen), G2B (government-to-business), G2G (government-to-government), and G2E (government-to-employee). **E-Commerce** • Salient features of e-commerce and its benefits for businesses and consumers. • Key components of an e-commerce transaction: online shopping platforms, electronic payments, and digital marketing. • Legal and regulatory framework for e-commerce, including consumer protection laws and taxation policies.	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the concepts of cyber laws and cyberspace.	U	PSO-1
CO-2	Outline Information Technology Act 2000, including its amendments,	U	PSO- 1
CO-3	Illustrate various types of cybercrimes, their legal implications.	U	PSO-1
CO4	Explain the concepts of digital signatures.	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: PREFACE TO CYBER LAWS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO addressed	Cognitive Level	Knowledge Category	Lecture (L)/ Practical (P)	Practical (P)
CO-1	Summarize the concepts of cyber laws and cyberspace.	PSO-1 PO-6,7,8	U	F, C	L	-
CO-2	Outline Information Technology Act 2000, including its amendments,	PSO-1 PO-6,7,8	U	F,C	L	-
CO-3	Illustrate various types of cybercrimes, their legal implications.	PSO-1 PO-6,7, 8	U	F,C	L	-
CO-4	Explain the concepts of digital signatures.	PSO-1 PO-6,7,8	U	F,C,P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	1	3-	2	-	-	-
CO 2	-	-	-	-	-	2	1	3	2	-	-	-
CO 3	-	-	-	-	-	2	1	3	2	-	-	-
CO 4	-	-	-	-	-	2	1	3	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓

CO 3	✓	✓		✓
CO 4	✓	✓		✓

SEC

13. CONTENT MANAGEMENT SYSTEM

Discipline	COMPUTER SCEINCE				
Course Code	UK4SECSC201				
Course Title	CONTENT MANAGEMENT SYSTEM				
Type of Course	SEC				
Semester	IV				
Academic Level	2 ·				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic knowledge of web development, HTML, and CSS.				
Course Summary	This course introduces students to the fundamentals of Content Management Systems (CMS) with a focus on WordPress, one of the most widely used platforms for building websites and managing content. Students will learn the essential concepts, techniques, and best practices for creating, customizing, and managing content using WordPress. Through hands-on exercises and projects, students will develop the skills necessary to design, build, and maintain dynamic websites for various purposes.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction to Content Management Systems**	**12**

	1	Overview of Content Management Systems (CMS)	
	2	Importance and benefits of using CMS	
	3	Types of CMS platforms: Open-source vs. proprietary	
	4	Comparison of popular CMS platforms: WordPress, Joomla, Drupal	
II		**WordPress Fundamentals**	**12**
	5	Installation and setup of WordPress	
	6	Exploring the WordPress dashboard and interface	
	7	Understanding WordPress themes and templates	
	8	Customizing WordPress themes using HTML and CSS	
	9	Working with WordPress plugins for added functionality	
	10	Creating and managing user accounts and permissions	
III		**Content Creation and Management**	**12**
	11	Creating and publishing different types of content (posts, pages, media)	
	12	Organizing content with categories and tags	
	13	Utilizing WordPress editor for content creation and formatting	
	14	Incorporating multimedia elements (images, videos, audio) into content	
	15	Managing comments and discussions on WordPress site	
IV		**Advanced WordPress Techniques**	**12**
	16	Implementing custom post types and taxonomies	
	17	Introduction to theme development with WordPress	
	18	Utilizing child themes for customization without affecting core themes	
	19	Introduction to WordPress APIs for extending functionality	
	20	Optimizing WordPress site for performance and security	
V		**Flexi Module**	**12**
	21	Case Studies in WordPress Implementation	

	22	Analyzing real-world examples of websites built with WordPress	
	23	Discussing challenges faced and solutions implemented	
	24	Identifying best practices and lessons learned	
	25	Comparing WordPress with other popular CMS platforms such as Joomla and Drupal	
	26	Evaluating features, ease of use, flexibility, and scalability	
	27	Discussing use cases for different CMS platforms	

References:

1. "Professional WordPress: Design and Development" by Brad Williams, David Damstra, and Hal Stern
2. "WordPress For Dummies" by Lisa Sabin-Wilson
3. "WordPress: The Missing Manual" by Matthew MacDonald
4. "Learning WordPress: A Step by Step Tutorial to Build Your WordPress Website" by John Richards
5. WordPress Codex: https://codex.wordpress.org/
6. https://deanebarker.net/books/squirrel/

List of Experiments

1. **Installation of WordPress**
   - Installation and setup of WordPress
   - Exploring the WordPress dashboard and interface
2. **Adding a New Page:**
   - Experiment with creating a new page in WordPress.
   - Explore different page templates and formats.
3. **Customizing Themes:**
   - Experiment with changing themes in WordPress.
   - Customize colors, fonts, and layout using built-in customization options or CSS.
4. **Installing Plugins:**
   - Experiment with installing and activating different plugins.
   - Test plugins for functionality, such as SEO optimization, contact forms, or image galleries.
5. **Creating Custom Menus:**
   - Experiment with creating custom menus in WordPress.
   - Add, remove, and rearrange menu items to see how it affects site navigation.
6. **Adding Media:**
   - Experiment with adding images, videos, and audio files to your WordPress site.

- Test different file formats and sizes for optimization.

7. **Managing Users:**
   - Experiment with user roles and permissions in WordPress.
   - Create new user accounts with different roles and test their capabilities.
8. **Setting up Widgets:**
   - Experiment with adding widgets to your WordPress site.
   - Test different widgets for sidebar content, footers, or custom widget areas.
9. **Creating and Managing Posts:**
   - Experiment with creating blog posts in WordPress.
   - Test different post formats, categories, and tags.
10. **SEO Optimization:**
    - Experiment with SEO plugins and techniques in WordPress.
    - Test optimizing meta titles, descriptions, and content for better search engine visibility.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Cite the fundamental concepts of Content Management Systems (CMS) and their importance in web development.	U	PSO 1
CO-2	Demonstrate proficiency in installing, configuring, and customizing WordPress for different website requirements.	Ap	PSO 2, 3
CO-3	Develop various types of content such as posts, pages, media, and menus using WordPress.	Ap	PSO 2, 3
CO-4	Use themes and plugins to enhance the functionality and design of WordPress websites.	Ap	PSO 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CONTENT MANAGEMENT SYSTEM

Credits: 2:0:2 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

1	Cite the fundamental concepts of Content Management Systems (CMS) and their importance in web development.	PO 3,6.7 PSO 1	U	F,C	L	-
2	Demonstrate proficiency in installing, configuring, and customizing WordPress for different website requirements.	PO 3,5,6.7 PSO 2,3	Ap	F, C,P	L	P
3	Develop arious types of content such as posts, pages, media, and menus using WordPress.	PO 3,5,6.7 PSO 2,3	Ap	F, C, P	L	P
4	Use themes and plugins to enhance the functionality and design of WordPress websites.	PO 3,5,6.7 PSO 2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	3	-	-	3	3	-	3	1	-	-
CO 2	-	-	3	-	2	3	3	-	3	2	3	-
CO 3	-	-	3	-	3	3	3	-	3	2	3	-

CO 4	-	-	3	-	3	3	3	-	3	2	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

14. COMPUTER HARDWARE MAINTENANCE

Discipline	COMPUTER SCIENCE
Course Code	UK4CSCSEC202
Course Title	COMPUTER HARDWARE MAINTENANCE
Type of Course	SEC

Semester	IV				
Academic Level	2				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic understanding of computer systems and familiarity with operating systems.				
Course Summary	Computer Hardware Maintenance is designed to provide students with the knowledge and skills necessary to maintain, troubleshoot, and repair computer hardware components. The course covers a wide range of topics including hardware installation, upgrading, troubleshooting common hardware issues, preventive maintenance techniques, and safety procedures.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction to Computer Hardware**	**12**
	1	Overview of computer hardware components	
	2	Understanding motherboard, CPU, RAM, storage devices, network cards and peripherals for maintenance and troubleshooting	
	3	Basics of hardware architecture and compatibility	
	4	Safety precautions and best practices in handling hardware components	
II		**Hardware Installation and Upgrading**	**12**
	5	Installing and configuring hardware components (CPU, RAM, hard drives, optical drives and similar components)	
	6	Upgrading hardware components for performance enhancement	
	7	BIOS/UEFI settings and firmware updates	
	8	Compatibility considerations and hardware compatibility lists	
III		**Troubleshooting Hardware Issues**	**12**
	9	Common hardware problems and symptoms	
	10	Diagnostic tools and techniques	

	11	Hardware troubleshooting methodologies	
	12	Repair and replacement of faulty hardware components	
IV	**Preventive Maintenance and Safety**		**12**
	13	Importance of preventive maintenance for hardware longevity	
	14	Cleaning procedures and maintenance schedules	
	15	Thermal management and cooling solutions	
	16	Electrical safety precautions and handling electrostatic discharge	
V	**Flexi Module: Not included for End Semester Exams**		**12**
	17	Overview of emerging trends and technologies in hardware maintenance	
	18	Case studies highlighting innovative approaches to hardware troubleshooting and maintenance	
	19	Discussion on cutting-edge tools, techniques, and methodologies in the field	
	20	Practical demonstrations and hands-on exercises exploring new hardware maintenance solutions	

Reference:

1. Minas, The Complete Pc Upgrade And Maintenance Guide, Wiley India
2. C. Campbell, Computer Hardware Complete Hardware Guide | Troubleshooting | Maintenance
3. Michael Meyers, Mike Meyers, Scott Jernigan, Guide to Managing and Troubleshooting PCs, Sixth Edition, McGraw Hill Education
4. Stephen Bigelow, Troubleshooting, Maintaining & Repairing PCs, McGraw-Hill
5. https://pnsset.ac.in/public/uploads/lres-55.pdf

Assignments:

1. Research and report on the latest advancements in CPU technology.
2. Conduct a hardware compatibility test for a given set of components and prepare a compatibility report.
3. Troubleshoot and document the resolution of a hardware problem encountered in a simulated environment.
4. Create a preventive maintenance schedule for a specific type of computer hardware and justify its importance.

LAB EXERCISES

1. Disassembly and reassembly of a desktop computer
2. Memory module installation and troubleshooting
3. Hard drive installation and partitioning
4. CPU installation and thermal paste application
5. BIOS/UEFI configuration and firmware update
6. Peripheral device installation and configuration (e.g., printer, scanner)
7. Troubleshooting boot problems
8. Diagnosing and replacing a faulty power supply unit
9. Network card installation and configuration
10. Advanced troubleshooting of motherboard issues

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the fundamental principles of computer hardware components.	U	PSO 1
CO-2	Experiment with hardware installation, upgrading, and configuration.	Ap	PSO 1,2,3
CO-3	Develop skills to troubleshoot common hardware problems.	Ap	PSO 1,2,3
CO-4	Apply preventive maintenance strategies to prolong the lifespan and optimize performance of computer hardware.	An	PSO 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial (T)	Practical (P)
CO-1	Outline the fundamental principles of computer hardware components.	PO 6, 7 PSO 1	U	F,C	L	P
CO-2	Experiment with hardware installation, upgrading, and	PO 3,6,7 PSO 1,2,3	Ap	F, C, M	L	P

	configuration.					
CO-3	Develop skills to troubleshoot common hardware problems.	PO 3,6,7 PSO 1,2,3	Ap	F, C, M	L	P
CO-4	Apply preventive maintenance strategies to prolong the lifespan and optimize performance of computer hardware.	PO 3,6,7 PSO 1,2,3	Ap	F, C, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	-	3	-	3	-	-	-
CO 2	-	-	3	-	-	3	3	-	3	2	3	-
CO 3	-	-	3	-	-	3	3	-	3	2	3	-
CO 4	-	-	3	-	-	3	3	-	3	2	3	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/ Seminar
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

LEVEL 3 (Level 300-399)

Semester 5

A. **DSC**

Course Code	**Course Name**	**L (Hrs)**	**P (Hrs)**	**Credits**
UK5DSCCSC300	Programming in Java	3	2	4
UK5DSCCSC301	Data Mining	3	2	4
UK5DSCCSC302	Software Engineering	3	2	4

UK5DSCCSC303	Computer Networks	3	2	4
UK5DSCCSC304	Design Analysis and Algorithms	3	2	4
UK5DSCCSC305	Trends in Computing	4	0	4
UK5DSCCSC306	Statistical Analysis System	4	0	4
UK5DSCCSC307	Information Retrieval	3	2	4
UK5DSCCSC308	Cloud Computing	4	0	4
UK5DSCCSC309	Recommendation Systems	3	2	4

B. **DSE**

Course Code	**Course Name**	**Stream**	**L (Hrs.)**	**P (Hrs.)**	**Credits**
UK5DSECSC300	Cryptography and Network Security	Cyber Security	3	2	4
UK5DSECSC301	Cyber Forensics	Cyber Security	3	2	4

UK5DSECSC302	Data Analytics with R	Data Science	3	2	4
UK5DSECSC303	Data Mining concepts and Techniques	Data Science	3	2	4
UK5DSECSC304	Introduction to Machine Learning	Machine Learning	3	2	4
UK5DSECSC305	Artificial Neural Networks	Machine Learning	3	2	4
UK5DSECSC306	PHP And MySQL	Web Development	3	2	4
UK5DSECSC307	Web Application Development using Django	Web Development	3	2	4

3. SEC

Course Code	**Course Name**	**L (Hrs.)**	**P(Hrs.)**	**Credits**
UK5SECCSC300	Software Testing	2	2	3

UK5SECCSC301	Web Application Development	2	2	3
UK5SECCSC302	Android Programming Using Kotlin	2	2	3

DSC

1. **PROGRAMMING IN JAVA**

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSCCSC300				
Course Title	PROGRAMMING IN JAVA				
Type of Course	**DSC**				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours

Pre-requisites	Basic programming skill is desirable.
Course Summary	This course is designed to provide fundamental concepts and practical applications, equipping students with the skills necessary to develop robust and efficient Java-based applications.

Detailed Syllabus:

<table>
<tr><th>Module</th><th>Unit</th><th>Content</th><th>Hrs (L+P)</th></tr>
<tr><td rowspan="5">I</td><td colspan="2">Introduction to Java</td><td rowspan="5">15</td></tr>
<tr><td>1</td><td>Introduction to OOPS: Paradigms of Programming Languages – Basic concepts of Object-Oriented Programming – Differences between Procedure Oriented Programming and Object-Oriented programming - Benefits of OOPs – Application of OOPs</td></tr>
<tr><td>2</td><td>Introduction to Java, History and Features of Java, Java Virtual Machine (JVM), JDK, Java Runtime Environment, Java Bytecode</td></tr>
<tr><td>3</td><td>Types of Java programs, Java architecture, Program Structure, Creating and executing java programs, Comments</td></tr>
<tr><td>4</td><td>Java Tokens - Keywords, Identifiers, Literals, Operators; data types, variables, type conversions, expressions</td></tr>
</table>

	5	Control Structures- Decision making and iteration statements, break , continue and return statements	
	6	Array in Java: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array	
II		**Classes & Objects**	15
	7	Class and Object in Java: Class fundamentals, creation of objects, instance & static members, defining methods, method overloading, argument passing mechanism, constructors, finalize()	
	8	Inheritance: Defining inheritance –types of inheritance– Overriding methods –super keyword, Final variables, Final classes, Final method, Abstract methods and classes – Visibility Control	
	9	Interfaces: Defining interface – Extending interface - Implementing Interface - Accessing interface variables	
	10	Strings- String class and methods	
	11	I/O Streams: File – Streams – Advantages - The stream classes – Byte streams –Character streams	
		Packages, Exception handling & Multithreading	
	12	Packages: Java API Packages , User defined packages, Creating & Accessing a Package – Adding Class to a Package – Hiding Classes	

III	13	Exception Handling: Advantages of Exception Handling - Types of Errors – Basics of Exception Handling – try blocks – throwing an exception – catching an exception – finally statement	**15**
	14	Multithreading: Creating Threads – Life cycle of a Thread – Defining & Running Thread – Thread Methods – Thread Priority – Synchronization –Implementing Runnable interface	
IV		**Applets & Event Handlers**	**15**
	15	Applets: Introduction – Applet Life cycle – Creating & Executing an Applet –Applet tags in HTML – Parameter tag – Aligning the display - Graphics Class: Drawing and filling lines, Rectangles, Polygon, Circles & Arcs	
	16	AWT Components and Event Handlers: Abstract window tool kit – Event Handlers – Event Listeners – AWT Controls and Event Handling: Labels, Text Component, Buttons, Check Boxes, Layout Managers	
V		**Flexi Module: Not included for End Semester Exams**	
	17	Swing Controls - JLabel, JTextField, JTextArea, JButton,JRadioButton Java Database Connectivity - JDBC Drivers, Connectivity with MySQL	**15**

References

1. E Balagurusamy, “Programming with Java – A Primer”, McGraw Hill, 2017
2. Sagayaraj, Denis, Karthick and Gajalakshmi, “Java Programming for Core and advanced learners”, Universities Press (INDIA) Private Limited 2018
3. Herbert Schildt, “The complete reference Java”, TataMc-Graw Hill, 7 th Edition.
4. Dr. K. Somasundaram, “Programming in Java 2”, Jaico publishing House.
5. Deitel, “Java: How to Program”, Pearson Education.
6. John Hubbard, “Programming with Java”, Schaum Outline Series, Second Edition.

Lab Exercises

The laboratory work will consist of 10-15 experiments

Part A

1. Testing out and interpreting a variety of simple programs to demonstrate the syntax and use of the following features of the language:
    - basic data types
    - operators & expressions
    - selection and iteration statements
    - jump statements
    - arrays
2. Program to demonstrate String Class and methods.
3. Programs to demonstrate Classes & Objects, Constructors.
4. Programs to demonstrate various types of Inheritances.
5. Programs to demonstrate method overloading and overriding.
6. Program to demonstrate abstract class and method.

PART B

7. Program to demonstrate Interface.
8. Program to demonstrate creation and handling of packages, their imports and Class Path.
9. Programs involving a variety of Exception Handling situations.
10. Program involving creating and handling threads.
11. Program to demonstrate File handling.
12. Programs to demonstrate Java applets.
13. Programs to demonstrate AWT controls.
14. Programs to demonstrate Event handling.
15. Programs to demonstrate Layout Managers.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Discuss about the core concepts of Java	U	PSO-1,2,3
CO2	Illustrate advanced features of Java in programming context	Ap	PSO-1,2,3,4
CO-3	List Java methods in Packages, Exception Handling & Multithreading	Ap	PSO-1,2,3,4
CO-4	Use Applets in event handling	Ap	PSO-1,2,3,4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: PROGRAMMING IN JAVA

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture(L)/ Tutorial(T)**	**Practical (P)**
1	Discuss about the core concepts of Java Language	PO - 1,2,3,6,7 PSO-1,2,3	U	F, C, P	L	P
2	Illustrate advanced features of Java in programming context	PO - 1,2,3,6,7 PSO-1,2,3	Ap	F, C, P	L	P
3	List Java methods in Packages, Exception Handling & Multithreading	PO - 1,2,3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Use Applets in event handling	PO - 1,2,3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	-	-	2	2	-	1	2	2	-
CO 2	2	2	2	-	-	2	2	-	2	2	2	2
CO 3	2	2	2	-	1	2	2	-	2	2	2	2
CO 4	2	2	2	-	1	2	2	-	2	3	2	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

2. **DATA MINING**

Discipline	COMPUTER SCIENCE
Course Code	UK5DSCCSC301
Course Title	**DATA MINING**
Type of Course	**DSC**
Semester	V
Academic Level	3

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge of database concepts is desirable.				
Course Summary	This course provides students with a solid foundation in the theory and practice of data mining, preparing them to analyze and extract valuable insights from large datasets across various domains using various data mining algorithms.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I	**Introduction**		**15**
	1	Data, Data Mining, Knowledge, KDD, Need of data mining, Types of Data, Data Mining Functionalities, Application Domain, Major issues in Data Mining	
	2	Attribute Types: Nominal, Binary, Ordinal, Numeric, Discrete versus Continuous Attributes	

	3	Basic Statistical Descriptions of Data: Central Tendency, Mean, Median, Mode, Data Visualization, Measuring Data Similarity and Dissimilarity	
II	**Data Preprocessing and Mining Frequent Patterns**		**15**
	4	Data Preprocessing: Overview, Data Preprocessing Techniques	
	5	Mining Frequent Patterns, Associations, and Correlations: Basic Concepts: Market Basket Analysis	
	6	Frequent Itemset Mining Methods: Apriori Algorithm	
III	**Classification**		**15**
	7	General approach to Classification	
	8	Classification and Prediction	
	9	Decision tree induction	
	10	Bayes Classification method: Naïve Bayesian Classification	
	11	K - Nearest Neighbour method	

	12	Rule–based classification	
IV		**Cluster Analysis Basic Concepts and Methods**	**15**
	13	Definition, Requirements, Characteristics of cluster analysis	
	14	Types of Data in Cluster Analysis	
	15	Overview of Basic Clustering Methods– Partitioning Methods, Hierarchical Methods– Density Based Methods, Grid Based Methods	
	16	K-means and K-Medoids	
	17	Outlier Detection in Cluster Analysis	
		Flexi Module- Not included in End Semester Exams	**15**
V	18	Mining Time series data, Spatial Data Mining, Mining the WWW, Text Mining	

References

1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, Pearson Education.
3. Introduction to Data Mining -Pang-Ning Tan Michael, Steinbach and Vipin Kumar, - Pearson Education Limited 2014

4. . Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten, Eibe Frank, and Mark A. Hall, Second Edition, 2005

Web Resources

1. https://www.javatpoint.com/data-mining
2. https://www.mygreatlearning.com/blog/data-mining-tutorial/
3. https://www.slideshare.net/TeamRebel1/weka190429184259pdf
4. https://www.tutorialspoint.com/weka/weka_quick_guide.htm

Lab Exercises(Using WEKA Tool/ Python)

1. Creating a table using WEKA tool
2. List all the categorical (or nominal) attributes and the real-valued attributes separately
3. Calculate: mean, median, mode
4. Demonstration of data preprocessing on dataset
5. Demonstration of data preprocessing on dataset based on missing values
6. Demonstration of Association rule process on dataset using Apriori Algorithm
7. Demonstration of classification rule process on dataset using decision tree induction
8. Demonstration of classification rule process on dataset using naive bayes algorithm
9. Demonstration of clustering rule process on dataset using various clustering methods
10. Practising outlier detection in clustering on dataset

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize about data mining concepts, applications and usage.	U	PSO-1,2,3

CO-2	Demonstrate data mining techniques and methods in datasets	Ap	PSO-1,2,3
CO-3	Illustrate the concept of classification algorithms and their applications	Ap	PSO-1,2,3
CO-4	Interpret different cluster analysis methods	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA MINING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
1	Summarize about data mining concepts, applications and usage.	PO-6,7 PSO-1,2,3	U	F, C	L	P

2	Demonstrate data mining techniques and methods to datasets	PO-3,5,6,7 PSO-1,2.3	Ap	F, C, P	L	P
3	Illustrate the concept of classification algorithms and their applications	PO-3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P
4	Interpret different cluster analysis methods	PO-3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	-	2	1	-	2	1	1	-
CO 2	-	-	3	-	1	2	3	-	2	1	2	-

CO 3	-	-	3	-	1	2	3	-	2	1	3	-
CO 4	-	-	3	-	1	2	3	-	2	1	3	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓

CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

3. SOFTWARE ENGINEERING

Discipline	Computer Science				
Course Code	UK5DSCCSC302				
Course Title	SOFTWARE ENGINEERING				
Type of Course	**DSC**				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Knowledge of database systems and programming is desirable.				

Course Summary	This course is designed to understand the concepts of Software Engineering, as well as the underlying techniques used for software project development, management, analysis and designing.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I	**Introduction**		
	1	Introduction – Evolution – Software Development projects – Emergence of Software Engineering. Software Life cycle models – Waterfall model – Rapid Application Development – Agile Model – Spiral Model- Comparison of different life cycle models.	**15**
II	**SPM and Software Requirements Specification**		
	2	Software Project Management, Project Planning, Metrics for project size estimations, Project Estimation Techniques, Basic COCOMO model. Basic concepts of CPM, PERT and Gantt Chart. Requirement Analysis and Specification – Gathering and Analysis – SRS-Formal System Specification	**15**
III	**Software Design**		

	3	Software Design – Overview – Characteristics – Cohesion & Coupling -Function Oriented Design – Structured Analysis – DFD – Structured Design Object Modeling using UML – OO concepts – UML – Diagrams – Use case, Class, Activity, State Chart	**15**
IV	**Coding and Testing**		
	4	Coding – code review Testing – Unit testing, Black box testing, white box testing, Integration testing, system testing, Debugging. Software Reliability and quality management- Software reliability, Software quality. Software maintenance- Characteristics of software maintenance.	**15**
V		**Flexi Module: Not included in End Semester Exams**	**15**
	5	DevOps and Continuous Integration/Continuous Delivery, SecOps, Cloud Native Development. Microservices Architecture, Containerization and Orchestration, Serverless Computing, Human-Centric Software Engineering, Low Code/No Code Development, Generative AI for Software Development, Case Study	

References

1. Rajib Mall, “Fundamentals of Software Engineering”, PHI 2018, 5th Edition.
2. Ali Bahrami, “Object Oriented System Development”, McGraw Hill

3. Roger S. Pressman, “Software Engineering - A Practitioner’s Approach”, McGraw Hill 2010, 7th Edition.
4. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Narosa Publishing House.
5. Ian Sommerville, “Software Engineering”, 7th edition, Addison-Wesley.

Web Resources

1. https://www.javatpoint.com/software-engineering
2. https://www.geeksforgeeks.org/software-engineering/
3. https://www.tutorialspoint.com/software_engineering/index.htm
4. https://nptel.ac.in/courses/106105182/

Sample Case Study

1. Study the complete Software Development Life Cycle (SDLC) and analyse various activities conducted as a part of various phases. For each SDLC phase, identify the objectives and summaries outcomes.
2. Identifying the Requirements from Problem Statements
3. Consider any project to be developed in any technology and construct a Software Requirement Specification (SRS) document for the project.
4. Draw a DFD.
5. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios., UML Class Diagrams, UML Activity and State chart diagram.

<u>Course Outcomes</u>

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Identify the software development life cycle models applicable in various project contexts.	U	PSO-1,2
CO-2	Infer the role of software project management and software requirement specification (SRS) document.	Ap	PSO-1,2, 3
CO-3	Illustrate the concepts of structured and object-oriented analysis & design.	Ap	PSO-1,2,3
CO-4	Demonstrate the principles of coding, testing and the need for software quality management and maintenance.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: SOFTWARE ENGINEERING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Identify the software development life cycle models necessary in various project contexts.	PO-1,2,6,7 PSO-1,2	U	F, C	T	-
2	Infer the role of software project management and software requirement specification (SRS) document.	PO-1,2,4,5,6,7 PSO-1,2,3	Ap	F, C, P	T	P
3	Illustrate the concepts of structured and object oriented analysis & design.	PO-1,2,3,6,7 PSO-1,2,3	Ap	F, C, P	T	P

4	Demonstrate the principles of coding, testing and the need for software quality management and maintenance.	PO-1,2,3,4,5, 6,7,8 PSO-1,2,3	Ap	F, C, P	T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	2	2	-	-	-	-	1	-	2	2	-	-
CO 2	2	2	-	2	2	-	-	-	2	2	-	-
CO 3	3	3	3	-	-	-	-	-	2	2	-	-
CO 4	3	3	3	2	2	2	3	2	2	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

4. COMPUTER NETWORKS

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK5DSCCSC303</td></tr>
<tr><td>Course Title</td><td colspan="5">COMPUTER NETWORKS</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/ Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic awareness on computers is necessary.</td></tr>
<tr><td>Course Summary</td><td colspan="5">The course introduces main concepts of networking; application areas; classification, transmission environment; OSI and TCP/IP models, network technologies; network architecture, data transmission techniques, network devices, IP addressing, routing protocols, TCP, UDP and application layer protocols.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Reference Models**	**15**
	1	Definition, Network Criteria, Network topologies, Types of connection: point-to-point and multipoint, Categories of Networks, Internet.	
	2	Reference Models: The OSI Reference Model, TCP/IP Reference Model.	
	3	The Physical Layer: Guided Transmission Media, Wireless Transmission, Communication Satellites.	
	4	Multiplexing: FDM, TDM, WDM.	
II		**Data Link Layer**	**15**
	5	Data Link Layer Design Issues: Framing, Flow Control, Error Control. Error Detection and Correction: LRC, VRC, CRC, Checksum and Hamming Code.	
	6	Stop-and-Wait Protocol, Sliding Window Protocol: Go-Back- N and Selective Repeat.	

	7	Multiple Access: ALOHA, CSMA, CSMA/CD. LAN Standards: Ethernet, Token bus, Token ring.	
	8	Network Devices: Repeater, Bridge, Hub, Switch, Router, Gateway.	
III	**Network and Transport Layer**		**15**
	9	Routing, Types of Routing, Routing Algorithms: Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing.	
	10	Elements of Transport Protocols, Congestion Control: Leaky Bucket Algorithm and Token Bucket Algorithm.	
	11	Transport Layer Protocols: TCP and UDP, Comparison of TCP and UDP.	
	12	Switching Techniques - Circuit, Packet, Message Switching.	
IV	**Application Layer**		**15**
	13	Content Delivery : Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks.	
	14	Streaming Audio and Video : Digital Audio, Digital Video, Streaming Stored Media, Streaming Live Media.	

	15	Application Layer Protocols- HTTP, HTTPS, DNS, File Transfer Protocol (FTP)	
V		**Flexi Module: Not Included for End Semester Exams**	**15**
	16	Session Layer: Functions of Session Layer, Session Management. Presentation Layer: Encryption, Decryption, Compression and Decompression.	
	17	Routing Protocols: OSPF and BGP.	
	18	Delay Tolerant Networking: DTN Architecture, The Bundle Protocol.	

References

1. Andrew S Tanenbaum and David J Wetherall, "Computer Networks", Fifth Edition, Pearson.
2. Behrouz A Forouzan, "Data Communications and Networking", Fourth Edition, McGraw Hill.
3. Achyut S Godbole, "Data communications and networks", Second Edition, McGrawHill.

LAB EXERCISES

The lab contains 10-15 experiments

1. Understand the network settings of a computer.
2. Understand the function ipoconfig.
3. Understand basic network connectivity using the ping utility.
4. Configure IP address of a system.
5. Measure the bandwidth between two computers on a network.
6. Set up a simple HTTP server and access web pages over the network.
7. Configure and test DHCP (Dynamic Host Configuration Protocol).
8. Set up and configure a simple wireless network.

Course Outcomes

No.	pon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the basics of Computer Networks and the role of network reference models.	U	PSO-1
CO-2	Explain error detection, error control and flow control in the link layer.	U	PSO-1, 2
CO-3	Describe the different protocols used in network and transport layer	U	PSO-1, 2
CO-4	Summarize the features and operations of various application layer protocols.	U	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: COMPUTER NETWORKS

Credits: 3:0:2 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Outline the basics of Computer Networks and the role of network reference models.	PO-6, 7 PSO-1	U	F, C	L	P
CO-2	Explain error detection, error control and flow control in the data link layer.	PO-1, 2, 6, 7 PSO-1, 2	U	F, C	L	P
CO-3	Describe the different protocols used in network and transport layer	PO-1, 2, 5, 6, 7 PSO-1, 2	U	F, C	L	L
CO-4	Summarize the features and operations of various application layer protocols.	PO-1, 5, 6, 7 PSO-1, 2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	1	1	-	3	-	-	-
CO 2	1	1	-	-	-	1	1	-	3	1	-	-
CO 3	1	2	-	-	2	1	1	-	3	1	-	-
CO 4	1	-	-	-	2	1	1	-	3	1	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assessment
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	Lab Assessm	End Semester Examination
CO 1	√				√
CO 2	√	√			√
CO 3	√		√		√
CO 4	√	√	√		√

5. DESIGN AND ANALYSIS OF ALGORITHMS

Discipline	COMPUTER SCIENCE
Course Code	UK5DSCCSC304
Course Title	DESIGN AND ANALYSIS OF ALGORITHMS
Type of Course	**DSC**
Semester	V

Academic Level	3					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week	
	4	3 hours	-	2 hours	5 hours	
Pre-requisites	Basic knowledge in Programming Concepts and Data Structures is desirable.					
Course Summary	This course provides a solid background in the design and analysis of the major classes of algorithms.					

Detailed Syllabus:

Module	Unit	Content	Hrs (L+ P)
I		**Foundations**	**15 hrs**
	1	Fundamentals of Algorithmic Problem Solving. Problem Types: Sorting, Searching, String processing, Graph Problems, Combinatorial Problems, Geometric Problems, Numeric Problems.	
	2	Fundamental Data Structures: Linear data structures, Graph, Trees, Sets and Dictionaries.	

	3	The Analysis Framework: Measuring an Input's Size, Units for Measuring Running Time, Orders of Growth, Worst-Case, Best-Case and Average-Case Efficiencies,	
	4	Asymptotic Notations: Big-Oh, Omega and Theta. Using Limits for Comparing Orders of Growth.	
II		**Divide and conquer**	**15**
	5	Exhaustive Search: Travelling Salesman Problem, Knapsack Problem, Assignment Problem.	
	6	Depth-First Search and Breadth-First Search.	
	7	Divide and Conquer: Multiplication of Large Integers, Strassen's Matrix Multiplication, Closest-Pair Problem and Convex-Hull Problem.	
	8	Balanced Search Trees: AVL Tree, 2-3 Trees. Heap and Heapsort.	
III		**Dynamic Programming**	**15**
	9	Warshall Algorithm to find Transitive Closure, Floyd's Algorithm for All Pairs Shortest Path Problem.	
	10	Greedy Technique: Prims Algorithm, Kruskal Algorithm (For Minimum Spanning Tree)	

	11	Djikstra’s Algorithm for Single Source Shortest Path Problem.	
	12	Huffman’s Algorithm: Huffman Trees, Huffman Code.	
IV		**Algorithm Power**	**15**
	13	Back Tracking: N-Queens Problem, Hamiltonian Circuit Problem, Subset-Sum Problem.	
	14	P, NP and NP-Complete Problems, Approximation Algorithms for NP-Hard Problems.	
	15	Algorithms for Solving Nonlinear Equations: Bisection Method, Method of False Position, Newton’s Method.	
V		**Flexi Module: Not included for End Semester Examination**	**15**
	16	Johnson’s Algorithm for Sparse Graphs.	
	17	Linear Programming: Standard and Slack forms, Formulating problems as linear programs.	
	18	Flow Networks, The Maximum-Flow Problem	

REFERENCES

1. Anany Levitin, “Introduction to The Design and Analysis of Algorithms”, Third Edition, Pearson.

2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 2^{nd} Edition, Prentice-Hall India.
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2^{nd} Edition, Orient Longman Universities Press (2008)
4. Sara Baase and Allen Van Gelder ―Computer Algorithms, Introduction to Design and Analysis, 3^{rd} Edition, Pearson Education (2009)

LAB EXERCISES

1. Implement the various Sorting Algorithms
2. Implement the various Searching Algorithms
3. Implement any Greed Algorithm
4. Implement any Backtracking Algorithm
5. Implement Recursion
6. Or any suitable question as per theory syllabus.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Explain the foundational concepts of algorithm analysis.	U	PSO-1, 2
CO-2	Outline various search techniques, divide and conquer methods and the concept of search trees	U	PSO-1, 2
CO-3	Explain various algorithms in dynamic programming	U	PSO-1, 2

CO-4	Describe important algorithmic design paradigms and methods of analysis.	U	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Explain the foundational concepts of algorithm analysis.	PO-2, 6, 7 PSO-1, 2	U	, F, C	L	-
CO-2	Outline various search techniques, divide and conquer methods and the concept of search trees	PO-1, 2, 6, 7 PSO-1, 2,3	U	, F, C, P	L	P

CO-3	Explain various algorithms in dynamic programming	PO-1, 2, 6, 7 PSO-1, 2,3	U	,F,C,P	L	P
CO-4	Describe about important algorithmic design paradigms and methods of analysis.	PO-1, 2, 6, 7 PSO-1, 2	U	, F,C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	1	-	-	-	1	1	-	3	1	-	-
CO 2	2	3	-	-	-	2	1	-	3	3	2	-
CO 3	2	3	-	-	-	2	1	-	3	3	2	-
CO 4	2	3	-	-	-	2	1	-	3	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓

CO 3	✓	✓		✓
CO 4	✓	✓		✓

6. TRENDS IN COMPUTING

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSCCSC305				
Course Title	TRENDS IN COMPUTING				
Type of Course	**DSC**				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4 hours

Pre-requisites	Basic Knowledge of Computer Science Principles, Programming Concepts, Networking
Course Summary	This course provides an overview of current trends, emerging technologies, and future directions in the field of computing.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs(L)**
I		**Grid Computing**	**12**
	1	High Performance Computing, Distributed Computing, Cluster Computing, Grid Computing- Definition, Characteristics, Advantages, Disadvantages, Challenges	
	2	Comparison with Cluster Computing	
	3	Applications of Grid Computing	
II		**Cloud Computing**	**12**
	4	Definition, Characteristics, Comparison with Grid Computing,	
	5	Advantages, Disadvantages, Challenges	

	6	Cloud Types- Based on services provided- SPI model-SaaS, PaaS, IaaS, Other Categories-XaaS-Identity as service (IdaaS), Data as Service (DaaS), Database as a Service (DbaaS), Storage as a Service(STaaS), Function as A Service (FaaS), Security as a Service (SECaaS), Desktop as a Service (DaaS)Communication as a Service (CaaS), Monitoring as a Service(MaaS), advantages and disadvantages of each	
	7	Based on deployment – Public, Private, Community, Hybrid Clouds, characteristics of each	
III		**Fog & Edge Computing**	**12**
	8	Fog Computing-Definition, Fog Computing as extension to cloud computing, Characteristics, Applications-Smart cities, healthcare, transportation, retail	
	9	Edge Computing – Definition, Characteristics, Advantages, Disadvantages	
	10	Fog and Edge Completing (FEC) the Cloud, Applications of FEC	
IV		**Quantum Computing**	**12**
	11	Definition, Characteristics- Braket Notation, Qubits (quantum bits)	

	12	Applications- Cryptography, optimization problems, drug discovery, materials science, Tools for Quantum- Qiskit(basic concepts)	
	13	Quantum Machine Learning – definition, applications (basic concepts only)	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	14	Serverless Computing- Definition, Characteristics and Applications- Web and mobile applications, IoT data processing, batch processing.	
	15	Edge Computing Platforms- EdgeX Foundry, OpenFog. Jungle Computing- Concepts and Applications	
	16	Distributed Ledger Technology-Definition, Characteristics, Applications-Blockchain, cryptocurrencies, supply chain management, digital identity	
	17	Cloud IOT, Quantum Cryptography- basics	

REFERENCES

1. Fran Berman, Geoffrey Fox, Anthony J. G. Hey, Grid Computing: Making the Global Infrastructure a Reality, Wiley, April 2003

2. Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", Wiley January 2019.

3. Umang Singh, San Murugesan, Ashish Seth, Emerging Computing Paradigms: Principles, Advances and Applications, Wiley, July 2022

5. Cloud Computing, A practical approach for learning and implementation, A.Srinivasan& J.Suresh, Pearson, 2017.

6. Rajkumar Buyya, James Broberg, Andrzej, Cloud Computing: Principles and Paradigms, Wiley India Publications, 2011

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Outline on Grid Computing	U	PSO-1
CO-2	Summarize basic concepts on Cloud Computing	U	PSO-1
CO-3	Identify challenges faced in Edge Computing	U	PSO-1,2
CO-4	Explain ideas behind Quantum Computing	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: TRENDS IN COMPUTING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Outline on Grid Computing	PO-6,7 PSO-1	U	F, C	L	-
CO2	Summarize basic concepts on Cloud Computing	PO- 4,6,7 PSO-1	U	F, C	L	-
CO3	Identify challenges faced in Edge Computing	PO-6,7 PSO-1, 2	U	F, C	L	-
CO4	Explain ideas behind Quantum Computing	PO-4,6,7 PSO-1, 2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	**-**	**-**	**-**	**-**	**-**	**2**	**2**		**3**	**-**	**-**	**-**
CO 2	**-**	**-**	**-**	**2**	**-**	**2**	**2**		**3**	**-**	**-**	**-**
CO 3	**-**	**-**	**-**	**-**	**-**	**2**	**2**		**3**	**2**	**--**	**-**
CO 4	**-**	**-**	**-**	**2**	**-**	**2**	**2**		**3**	**2**	**-**	**-**

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Quiz/Assignment**	**Seminar**	**End Semester Examinations**
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4	✓	✓	✓	✓

7. STATISTICAL ANALYSIS SYSTEM

Discipline	**COMPUTER SCIENCE**				
Course Code	UK5DSCCSC306				
Course Title	**STATISTICAL ANALYSIS SYSTEM**				
Type of Course	DSE				
Semester	5				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4

Pre-requisites	1. Basic knowledge on Statistics	
Course Summary	This course will help students to develop proficiency in SAS for data manipulation, analysis, and reporting, applicable across disciplines like business, healthcare, and social sciences.	

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Getting data into SAS**	**12**
	1	Introduction to SAS, Understanding SAS data set, data set structure, Methods of reading data into SAS	
	2	Rules for SAS variable names, Understanding SAS variable types	
	3	Methods of reading data into SAS, Techniques for entering data	
II		**Reading, Writing, and Importing Data**	**12**
	4	Working with SAS libraries and permanent data sets, creating permanent SAS data sets using the windows file name technique	
	5	Creating permanent SAS data sets using SAS library. Creating SAS library using dialog box, code. Using data in permanent SAS data sets.	
	6	Importing data from another program, discovering the contents of SAS data set, Understanding how the data step reads and stores data	
III		**Labelling variables with explanatory names**	**12**
	7	Creating new variables, using if-then else, conditional statement assignments, using drop and keep to select variables, using the set statement to read an existing data set, using proc sort	
	8	Appending and merging data sets, using proc format, finding first and last values	
IV		**Understanding SAS**	**12**
	9	Understanding SAS support statements, understanding **proc** statement syntax, using the **id** statement in a SAS procedure, using the **label** statement in a SAS procedure, using **where statement** in a SAS procedure, using proc print.	
	10	Going deeper: splitting column titles in proc print, common system options	
V	11	Flexy module(Not included in the external Exam)	**12**
		Case sudy	

TEXT BOOK · Alan C. Elliott, Wayne A. Woodward, SAS Essentials, Wiley, Second Edition

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Apply SAS data set structures and methods for efficient data manipulation and analysis.	Ap	1,3
CO2	Create, use and manage permanent SAS data sets and libraries efficiently.	Ap	1,3
CO3	Gain proficiency in importing, reading, and storing data using SAS data step.	Ap	1,3
CO4	Understand and apply SAS support statements, proc statement syntax and common system options to enhance data analysis	Ap	1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: STATISTICAL ANALYSIS SYSTEM
Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Apply SAS data set structures and methods for efficient data manipulation and analysis.	PO: 1, 6, 7 PSO: 1,3	Ap	F, C, P	L	-
CO2	Create, use and manage permanent SAS data sets and libraries efficiently.	PO: 1, 6, 7 PSO1,3	Ap	F, C, P	L	-
CO3	Gain proficiency in importing, reading, and storing data using SAS data step.	PO: 1, 6, 7 PSO1,3	Ap	F, C, P	L	-
CO4	Understand and apply SAS support statements, proc	PO: 1, 6, 7 PSO1,3	Ap	F, C, P	L	-

	statement syntax and common system options to enhance data analysis					

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	-	-	-	-	3	3	-	3	-	3	-
CO 2	1	-	-	-	-	3	3	-	3	-	3	-
CO 3	1	-	-	-	-	3	3	-	3	-	3	-
CO 4	1	-	-	-	-	3	3	-	3	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓

8. INFORMATION RETRIEVAL

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSCCSC307				
Course Title	INFORMATION RETRIEVAL				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge on Web is desirable.				
Course Summary	The Information Retrieval course introduces students to the fundamental principles, techniques, and algorithms used in retrieving relevant information from large collections of unstructured data, such as text documents and web pages. The course covers topics ranging from basic retrieval models to advanced techniques like machine learning for text analysis and web search algorithms.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Overview of text retrieval systems**	**15**
	1	Boolean retrieval, The term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction and compression	
	2	Vector Space Model: TF-IDF Weight, Evaluation in information retrieval	
II		**Query expansion, feedback and Probabilistic models**	**15**
	3	Relevance feedback, Pseudo relevance feedback, Query Reformulation	
	4	Okapi/BM25; Language models; KL-divergence · Smoothing	
III		**Text classification & Text clustering**	**15**
	5	The text classification problem, Naive Bayes text classification, k-nearest neighbours , Support vector Machine , Feature Selection	

	6	Vector-space clustering; K-means algorithm, Hierarchical clustering, DBSCAN algorithm, PAM and PAMK , EM algorithm	
IV	**Web search basics, crawling, indexes, Link analysis**		**15**
	7	Web Characteristic, Crawling, Web As a graph, Page Rank, Hubs and Authorities	
V		**Flexi module- Not included in external evaluation**	**15**
	8	IR Applications: Information extraction, Question answering, Opinion summarization, Social Network	

References

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. http://nlp.stanford.edu/IR-book/information-retrieval-book.html

2. ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

Lab Exercises

1. Boolean Retrieval Implementation
2. TF-IDF Calculation
3. Evaluation Metrics for Information Retrieval
4. Text Classification with Machine Learning
5. Text clustering implementation

6. Web Crawling and Indexing
7. PageRank Algorithm Implementation

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarize Information Retrieval Principles.	U	PSO1
CO2	Use Advanced Retrieval Techniques	Ap	PSO1, 2, 3
CO3	Experiment with text classification and clustering using different techniques.	Ap	PSO1, 2, 3
CO4	Outline on web search	U	PSO1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INFORMATION RETRIEVAL

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Summarize Information Retrieval Principles.	PO1,6, 7 PSO1, 2	U	F, C	L	
CO2	Use Advanced Retrieval Techniques	PO1, 6, 7 PSO1,2, 3	Ap	F, C, P	L	P
CO3	Experiment with text classification and clustering using different techniques.	PO1, 6, 7 PSO1,2,3	Ap	F, C, P	L	
CO4	Outline on web search	PO1, 6, 7, PSO1, PSO2	U	F, C	L	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	-	-	-	-	3	3	-	3	3	-	-
CO 2	1	-	-	-	-	3	3	-	3	3	3	-
CO 3	1	-	-	-	-	3	3	-	3	3	3	-
CO 4	1	-	-	-	-	3	3	-	3	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab AssESSments

- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz/Assignment	Assignment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

9. CLOUD COMPUTING

Discipline	COMPUTER SCIENCE
Course Code	UK5DSCCSC308
Course Title	**CLOUD COMPUTING**
Type of Course	DSC
Semester	V

Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4 Credits	4 Hours	-	-	4 Hours
Pre-requisites	NIL				
Course Summary	This Course provides a comprehensive view on Cloud Computing and provides insights of the key services and players in the industry. The student is acquainted with the architecture of Clouds, challenges faced in the Cloud, and to various applications and tools available in Cloud Computing.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I	**Cloud Computing Foundation**		**12 hrs**
	1	Introduction to Cloud Computing- Basics	

	2	History, importance, Characteristics, Pros and Cons of Cloud computing.	
	3	Types of Cloud – Public and Private Cloud. Cloud Computing infrastructure	
II	**Cloud Architecture- Layers and Models**		**12**
	4	Layers in Cloud Architecture	
	5	Software as a Service (SaaS), features of SaaS and benefits	
	6	Platform as a Service (PaaS), features of PaaS and benefits	
	7	Infrastructure as a Service (IaaS), features of IaaS and benefits	
	8	Cloud Service Providers	
	9	Challenges and risks in cloud adoption	
	10	Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds	
	11	Advantages of Cloud computing.	
III	**Cloud Computing for everyone**		**12**

	12	Centralizing email communications	
	13	Collaborating on schedules	
	14	Cloud computing for community	
	15	Collaborating on group projects and events	
	16	Cloud computing for corporation	
IV		**Virtualization and Cloud Tools for Machine Learning**	**12**
	17	Definition, Adopting Virtualization, Types	
	18	Virtualization and Software, Virtual Clustering	
	19	Virtualization Application, Pitfalls of Virtualization	
	20	Amazon web components and services, Elastic Compute Cloud (EC2), Amazon Storage System and database services	
	21	Microsoft Cloud Services	
	22	Google Cloud Applications	
	23	Cloud based tools for Machine Learning - AWS SageMaker, Azure Machine Learning, Google Cloud AI Platform	

		Data preprocessing, feature engineering, and model training	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	24	Future Trends	
	254	Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud	
	26	Energy Aware Cloud Computing, Jungle Computing	
	27	Deploying Machine Learning Models on the Cloud- Containerization with Docker and Kubernetes Serverless deployment with AWS Lambda or Azure Functions	

Text books

1. Cloud Computing, A practical approach for learning and implementation, A.Srinivasan&J.Suresh, Pearson, 2017
2. Rajkumar Buyya, James Broberg, Andrzej, Cloud Computing: Principles and Paradigms, Wiley India Publications, 2011
3. Barrie Sosinsky, “Cloud Computing Bible”, 1st Edition, Wiley India Pvt. Ltd., New Delhi, 2011.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive	PSO addressed

		Level	
CO-1	Outline the basics of cloud computing	U	PSO-1
CO-2	Differentiate between the various technologies of cloud computing.	Ap	PSO-1,2
CO-3	Recognize the applications of Cloud	U	PSO-1
CO-4	Compare various Cloud Services	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: CLOUD COMPUTING

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**

CO-1	Outline the basics of cloud computing	PO-2,6,7 PSO-1	U	F, C	L	-
CO-2	Differentiate between the various technologies of cloud computing.	PO-2,6,7 PSO-1,2	Ap	F, C	L	-
CO-3	Recognize the applications of Cloud	PO-2,6,7 PSO-1	U	F, C	L	-
CO-4	Compare various Cloud Services	PO-2,5,6,7 PSO-1,2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**

CO 1	-	-	-	-	-	2	2		1	-	-	-
CO 2	-	3-	-	1	1	2	2		2	3	-	-
CO 3	-	3	-	-	-	2	2		2	-	-	-
CO 4	-	3	-	1	1	2	2		2	3	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Discussion	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4	✓	✓	✓	✓

10. RECOMMENDATION SYSTEMS

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSCCSC309				
Course Title	RECOMMENDATION SYSTEMS				
Type of Course	DSE				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial	Practical	Total Hours/Week

			per week	per week	
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Need to be aware of concepts of Machine Learning				
Course Summary	This course introduces the principles, algorithms, and applications of recommendation systems, a key component of modern information retrieval and e-commerce platforms. Students will learn about various recommendation techniques, evaluation m**etrics,** and real-world case studies through lectures, hands-on exercises.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction**	**12 hrs**
	1	Introduction, Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Recommender Systems and Human Computer Interaction, Recommender Systems as a Multi-Disciplinary Field, Emerging Topics and Challenges.	
II		**Data Mining Methods for Recommender Systems**	**12**
	2	Introduction; Data Preprocessing: Similarity Measures, Sampling, Reducing Dimensionality, Denoising	

	3	Classification: Nearest Neighbours, Decision Trees, Rule-based Classifiers, SVM	
	4	Cluster Analysis: k-Means. Alternatives to k-means; Association Rule Mining	
III	**Content-based Recommender Systems**		**12**
	5	Introduction; Basics of Content-based Recommender Systems; State of the Art of Content-based Recommender Systems; Trends and Future Research	
IV	**Collaborative Filtering**		**12**
	6	Introduction; Preliminaries; Matrix factorization models: SVD, SVD++, Time-aware factor model	
		Neighborhood models: Similarity measures, Similarity-based interpolation, Jointly derived interpolation weights.	
V	**Flexi module: Not included for external examination**		**12**
	7	Evaluating Recommendation Systems: Introduction, Experimental Settings, Recommendation System Properties	
	8	Applications of Recommendation systems	

References

1. Francesco Ricci · Lior Rokach · Bracha Shapira · Paul B. Kantor, “Recommender system handbook”, Springer, Third edition, 2022.
2. Charu C Aggarwal, Recommender system:The textbook, Springer, 2016 .

Lab Exercises

1. Implement data preprocessing methods in the recommendation system.
2. Implement different data mining methods in recommendation systems.
3. Implement a content-based recommendation system.
4. Demonstrate Collaborative filtering.
5. Implement matrix factorization models such as SVD and SVD++.
6. Implement a different recommendation system.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarize Recommendation system concepts	**U**	**PSO 1**
CO2	Apply data mining methods	**Ap**	**PSO 1, 2, 3**
CO3	Make use of skills in Content-based Recommender Systems	**Ap**	**PSO 1, 2**
CO4	Explain different techniques for collaborative filtering	**U**	**PSO 1, 2**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: RECOMMENDATION SYSTEMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Summarize Recommendation system concepts	PO-1, 6,7 PSO1	U	F, C	L	P
CO2	Apply data mining methods	PO-1, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO3	Make use of skills in Content-based Recommender Systems	PO-1, 6, 7 PSO-1,2	Ap	F, C, P	L	P
CO4	Explain different techniques for collaborative filtering	PO-1, 6, 7 PSO 1, 2	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**-**	**-**

CO 2	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 3	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**-**	**-**
CO 4	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**-**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓

CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

DSE

7. CRYPTOGRAPHY AND NETWORK SECURITY (Stream: Cyber Security)

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSECSC300				
Course Title	CRYPTOGRAPHY AND NETWORK SECURITY				
Type of Course	**DSE**				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/ Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge in Computer Networks is desirable				

Course Summary	This course equips learners to understand the core principles of cryptography and its significance in ensuring secure communication over networks. Besides the student gains proficiency in different cryptographic techniques, concepts of digital signatures- their role in verifying authenticity and integrity of digital documents

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Concepts of Security**	**12**
	1	Introduction, The Need for Security, Security Approaches and Principles.	
	2	Cryptography Techniques: Basic Terms, Plain Text, Cipher text, Substitution Techniques, Transposition Techniques, Fiestel Cipher.	
	3	Encryption, Decryption, Symmetric and asymmetric key Cryptography.	
	4	Steganography, Possible types of Attacks.	
II		**Cryptography**	**12**
	5	An Overview of Symmetric key Cryptography.	

	6	Data Encryption Standard (DES) and Advanced Encryption Standard (AES).	
	7	History and Overview of Asymmetric Key Cryptography.	
	8	The RSA Algorithm, Digital signatures: Digital Signature Algorithm. ElGamal Algorithm.	
III	**Public Key Infrastructure**		**12**
	9	Digital certificates, Public Key Cryptography Standard.	
	10	The PKIX Model, Transport Layer Security.	
	11	Secure Socket Layer, Crypto Currency and Bitcoin. Message Digest, SHA Algorithm.	
IV	**Authentication Mechanisms**		**12**
	12	Authentication Basics, Passwords, Biometric Authentication	
	13	Key Distribution Center, Security handshake Pitfalls, Attacks on Authentication Schemes.	
	14	Firewalls: Architecture, Generation and Types. Virtual Private Network. Email Security: PGP and S/MIME.	

V		**Flexi Module (Not included for end Semester Examination)**	**12**
	15	**Case Study:** Cryptographic implementations using Java.	

References

1. Kahate, “Cryptography and Network Security”, McGrawHill
2. “Cryptography and Network Security”, ITL Education Solutions Limited, Pearson.
3. William Stallings, “Cryptography and Network security”, Pearson.
4. Dr. Wm. Arthur Conklin, Dr. Gregory White, “Principles of Computer Security Sixth Edition”, McGraw Hill.

LAB EXERCISES

The Lab Experiments will contain 10-15 questions

1. Encryption and Decryption with Caesar Cipher
2. Symmetric Key Encryption using DES
3. Public Key Encryption with RSA
4. Implement Hashing
5. Digital Signature Generation and Verification

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the Basic Concepts of Security	Ap	PSO-1,2,3

CO-2	Explain the working of Cryptographic Algorithms	Ap	PSO-1,3
CO-3	Outline on public key infrastructure in cryptography	Ap	PSO-1,3
CO-4	Select among various Authentication Systems	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CRYPTOGRAPHY AND NETWORK SECURITY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize the Basic Concepts of Security	PO-1,6,7 PSO-1,2,3	Ap	F, C, P	L	P
CO-2	Explain the working of Cryptographic Algorithms	PO-1,6,7,8 PSO-1,3	Ap	F, C, P	L	P

CO-3	Outline on public key infrastructure in cryptography	PO-6,7,8 PSO-1,3	Ap	F, C, P	L	P
CO-4	Select among various Authentication Systems	PO-6,7,8 PSO-1,2,3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	-	-	-	-	1	2	-	1	1	-	-
CO 2	1	-	-	-	-	1	2	2	2	-	1	-
CO 3	-	-	-	-	-	1	2	1	2	-	2	-
CO 4	-	-	-	-	-	1	2	2	1	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments /Case Study
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	Lab Assessment	End Semester Examinations
CO 1	✓		✓	x	✓
CO 2	✓	✓		✓	✓
CO 3	✓		✓		✓
CO 4		✓			✓

8. CYBER FORENSICS (Stream: Cyber Security)

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK5DSECSC301</td></tr>
<tr><td>Course Title</td><td colspan="5">CYBER FORENSICS</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td></td><td>0</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic awareness of cybercrimes and cybersecurity is desirable.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course in Cyber Forensics introduces the student to the concepts of digital forensics, tools and techniques used, furthermore explains about crimes and violations detected.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Title of the Module: Introduction**	**12**
	1	Introduction: Forensic Science, Digital Forensics, Uses of Digital Forensics, Locard's Exchange Principle, Scientific Method, Organizations of Note, Role of the Forensic Examiner in the Judicial System.	
	2	Key Technical concepts: Bits, Bytes, and Numbering Schemes; File Extensions and File Signatures; Storage and Memory; Computing Environments; Data Types; File systems.	
	3	Labs and Tools: Forensic Laboratories- Virtual Labs, Lab Security, Evidence Storage; Policies and Procedures; Quality Assurance-Tool Validation, Documentation; Digital Forensic Tools- Tool Selection, Hardware, Software; Accreditation.	
II		**Title of the Module: Network Forensics and Web Attacks**	**12**
	4	Network Forensics: Introduction, Network Forensics, Log files as Evidence	

	5	Investigating web Attacks: Introduction, Indications of web Attack, Types of Web Attacks, Overview of web logs, Investigating a web attack, Tools for web attack investigation	
III	**Title of the Module**: **Investigating Internet crime**		**12**
	6	Introduction, Internet crimes, Internet Forensics, Goals of investigation, Steps for investigating Internet crimes.	
	7	Tracking E-Mails and E-Mail crimes: Introduction, E-Mail Systems, E-mail Crime, Identity Theft, Chain E-Mails, Phishing, E-Mail Spoofing, Investigating E-mail crimes and violations, Using specialized E-mail Forensic Tools	
IV	**Title of the Module:Data Analysis, Reporting and Investigation**		**12**
	8	Forensics of Windows, Linux, Android, and iOS Systems - Memory Forensics - Router and Email Investigations - Network Traffic Analysis - Computer Forensics Report Preparation	
	9	Investigating Sexual Harassment Incidents: Case Example, Typesof Sexual Harassment, Consequences, Stalking, Compliant Procedures, Investigation process, Sexual Harassment policy, Preventive steps, Indian Law: Sexual Harassment of Women at workplace.	

	10	Investigating Child Pornography: Key terms, People's motive behind Child Pornography, Role of internet, Effects of Child Pornography on Children, Measures to prevent Dissemination of Child Pornography, Challenges in Controlling Child Pornography, Precautions before investigating Child Pornography, Steps for Investigating Child Pornography, Sources of Digital Evidence, Tools, Child's Internet Protection Act(CIPA), Anti-Child-Pornography Organizations	
V		**Flexi Module- Not included for End Semester Exams**	**12**
	11	Investigating Network Traffic, Router Forensics, Investigating DoS Attacks, Investigating Trademark and Copyright Infringement.	

References

1. John Sammons, "The Basics of Digital Forensics-The Primer for Getting Started in Digital Forensics", Elsevier
2. Computer Forensics: Investigating Network Intrusions and Cyber crimes, EC Council Press

LAB EXERCISES

1. Analyze file properties and extract metadata.

   Experiment: Write a Python script to extract metadata (e.g., creation date, author, file type) from a given file (e.g., image, document).

   Tools: Use Python libraries like os, exifread, pyPdf, or python-docx to extract metadata from files.

2. Recover deleted or fragmented files from disk images.

Experiment: Write a Python script to search for file signatures within a disk image and extract recovered files to a separate folder.

Tools: Use Python libraries like binwalk or custom scripts to perform file carving on disk images.

3. Analyze network traffic and extract relevant information from packet captures.

Experiment: Write a Python script to read packet capture files (e.g., pcap) and extract details such as source/destination IP addresses, ports, protocols, and payloads.

Tools: Use Python libraries like pcapy, dpkt, or scapy for reading and parsing packet capture files.

3. Analyze memory dumps for signs of malicious activity.

Experiment: Write a Python script to parse memory dump files (e.g., from volatile memory or hibernation files) and extract information such as running processes, open network connections, and loaded modules.

Tools: Use Python libraries like volatility or pymem for parsing memory dump files and performing memory analysis.

4. Analyze Windows registry hives for evidence of system activity.

Experiment: Write a Python script to parse Windows registry hive files (e.g., SAM, SYSTEM, NTUSER.DAT) and extract information such as user accounts, installed software, and recent activity.

Tools: Use Python libraries like regipy or custom scripts for parsing Windows registry hive files.

5. Extract artifacts from web browser data for forensic analysis.

Experiment: Write a Python script to parse web browser artifacts (e.g., cookies, history, bookmarks) from browser-specific files (e.g., SQLite databases) and extract relevant information.

Tools: Use Python libraries like sqlite3 for database access and custom scripts for parsing browser-specific files.

6. Analyze email messages and extract relevant information for forensic investigation.

Experiment: Write a Python script to parse email message files (e.g., EML, PST) and extract metadata (e.g., sender, recipient, subject), attachments, and content.

Tools: Use Python libraries like email.parser or pyzmail for parsing email message files.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Outline the key concepts in cyber forensics.	Ap	PSO-1,3
CO-2	Summarise network forensics techniques and investigation of cyber attacks.	Ap	PSO-1,3

CO-3	Explain about various kinds of data analysis, reporting and Investigations.	Ap	PSO-1,3
CO-4	Identify various types of violations	Ap	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: CYBER FORENSICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	Outline the key concepts in cyber forensics.	PO-1,2,3,6,7 PSO-1	Ap	F, C, P	L	P
2	Summarise network forensics techniques and investigation of cyber attacks	PO-1,2,3,6,7 PSO-1,2	Ap	F, C, P	L	P

3	Explain about various kinds of data analysis, reporting and Investigations.	PO-1,2,3,6,7 PSO-1	Ap	F, C, P	L	P
4	Identify various types of violations	PO-1,2,3,6,7,8 PSO-1	U	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	1	1	-	-	2	2	1	1	-	-	-
CO 2	2	2	1	-	-	2	2	1	2	3	-	-
CO 3	2	2	1	-	-	2	2	1	2	-	-	-
CO 4	2	2	1	-	-	2	2	2	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Internal Exam
- Lab Assessment
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Quiz	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓	✓
CO 2	✓		✓	✓	✓
CO 3	✓	✓		✓	✓
CO 4		✓		✓	✓

9. DATA ANALYTICS WITH R (Stream: Data Science)

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK5DSECSC302</td></tr>
<tr><td>Course Title</td><td colspan="5">DATA ANALYTICS WITH R</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Basic concepts in Statistics and Probability is desirable</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course provides fundamental concepts of data analytics, R language & data visualization</td></tr>
</table>

Module	Unit	Content	Hrs (L + P)
I		**Introduction to R Programming**	**15**
	1	Basic Interaction with R, Using R as a Calculator, functions, Control Structures, factors, data frames	
	2	Using R as a Calculator, functions, Control Structures, factors, data frames	
	3	Data pipelines, coding and naming conventions.	
	4	Data Manipulation: Reading Data, Manipulating and tidying Data with deplorer	
II		**Visualizing Data**	**15**
	5	Visualizing Data: Basic Graphics, The Grammar of Graphics and the ggplot2 Package	
	6	Figures with multiple plot	
	7	Working with Large Datasets	
	8	Expressions, Basic Data Types, Data Structures, Control Structures, Functions, Recursive Functions	

III	**Advanced R Programming**		**15**
	9	Working with Vectors and Vectorizing Functions	
	10	Advanced Functions, Functional Programming	
	11	Function Operations: Functions as Input and Output, Building an R Package	
	12	Creating an R Package, R oxygen	
IV	**Data analysis using R**		**15**
	13	Exploratory data analysis using R functions –sqrt, range, sort, minimum, maximum, median, average, standard deviation, skewness, variance	
	14	Correlation and covariance between Power tests- Bivariate Analysis-Paired sample t-test, t-test to compare means-one mean and two means	
	15	One factor ANOVA comparing means across several groups, 2-way ANOVA. Simple linear regression.	
V	**Flexi Module -Not included for End semester Examination**		**15**

	16	Supervised Learning: Machine Learning, Supervised Learning, Regression versus Classification, Inference versus Prediction	
	17	Unsupervised Learning: Clustering, k-Means Clustering, Hierarchical Clustering	
	18	Object Oriented Programming: Immutable Objects and Polymorphic Functions, Data Structures, Classes	

References

1. Thomas Mailund, Beginning Data Science in R, Data Analysis, Visualization, and Modelling for the Data Scientist, APress

2. Keen, K. J. . Graphics for statistics and data analysis with R. CRC Press, 2010.

3. Tony Fischetti, Data Analysis with R.

4. Joseph Schmuller, Statistical Analysis with R for dummies.

LAB EXERCISES

1) Find roots of a quadratic equation using the R program.
2) Calculate simple interest by creating function in R program
3) Copy spreadsheet data to clipboard and from clipboard transfer to table. Sort the data in ascending order; find average and standard deviation. [Hint dat <- ead.table("clipboard", header=TRUE)].
4) Read the student name and mark from a text file and store it in a table. Find maximum, minimum, average, median and standard deviation of marks. Display histogram and barplot.

5) Read the salesman name and sales amount from a CSV file. Display the average and standard deviation of sales. Visualize using plot and box plot of the sales amount. Inspect the boxplot and comment on the presence of outliers

6) The profit of a company on five products is given. Find the average profit of the company using the R function. Plot the data using plot, hist and pie graphs. Write the screen output to text files [Hint: use the function sink ()]

7) Create dataset of age of 50 students using rnorm() with n=50, mean=3.1 and sd=0.04 and conduct one sample t-test at significance level of 0.05, to check the validity of the statement " the average age of students joining the play school is 3 years". Display this diagram. Interpret the result.

8) A table contains expenditure and profit of a company. Conduct Pearson correlation test using R to find the correlation of expenditure on profit. Display data using line graph using ggplot()

9) A shopkeeper has data on the sales per day of one month. He introduced a new scheme in the next month. He wants to check whether there are any significant differences in average sales of the current month and the previous month. Display boxplot for both the data and interpret the result [Hint create suitable dataset using rnorm() and conduct 2 Sample t-test].

10) Crop yield and quantity of fertilizer used in an agricultural field is given. Conduct one-way ANOVA test to check whether the quantity of fertilizer used has any impact on the crop yield. Interpret the result.

<u>Course Outcomes</u>

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Demonstrate the basic features used in R Programming	Ap	PSO-1, 3

CO-2	Illustrate the concepts of data visualization and its usage in various scenarios.	Ap	PSO-1, 3
CO-3	Examine different functions used in advanced R Programming	Ap	PSO-1, 3
CO-4	Illustrate different ways of Data Analysis using R	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA ANALYTICS WITH R

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Demonstrate the basic features used in R Programming	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P

CO-2	Illustrate the concepts of data visualization and its usage in various scenarios.	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO-3	Examine different functions used in advanced R Programming	PO-4, 6, 7 PSO-1, 3	Ap	F, C, P	L	P
CO-4	Illustrate different ways of Data Analysis using R	PO-1, 2, 4, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

CO 1	-	-	-	1	-	1	1	-	2	-	1	-
CO 2	-	-	-	1	-	1	2	-	2	-	1	-
CO 3	-	-	-	1	-	2	2	-	2	-	1	-
CO 4	1	1	-	1	-	2	2	-	2	1	1	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examination
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

10. **DATA MINING CONCEPTS AND TECHNIQUES (Stream: Data Science)**

Discipline	COMPUTER SCIENCE
Course Code	UK5DSECSC303
Course Title	**DATA MINING CONCEPTS AND TECHNIQUES**
Type of Course	DSE
Semester	V

Academic Level	3					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week	
	4	3 hours	-	2 hours	5 hours	
Pre-requisites	Nil					
Course Summary	This course, Data Mining Concepts and Techniques, introduces the student to the world of data, the various methods and models used in transforming, classifying and analysing data.					

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Basics of Data Mining**	**15**
	1	Definition of data, Information and Data analysis	
	2	Fundamentals of Data Mining , Data mining s tages.	
	3	Applications of Data mining, Data Pre –processing.	

	4	Need for Pre-processing the Data, Data Cleaning.	
II	**Data Integration and Transformation**		**15**
	5	Data Reduction	
	6	Introduction to data warehouse;	
	7	Business Intelligence.	
III	**Classification Models**		**15**
	9	Classification and Prediction	
	10	Issues Regarding Classification and Prediction.	
	11	Classification by Decision Tree Induction	
	12	KNN, Bayesian Classification	
	13	Neural networks	
	14	Support Vector Machines.	
IV	**Association Rules Mining**		**15**
	15	Mining Frequent Patterns	

	16	Associations and Correlations	
	17	Efficient and Scalable Frequent Item set Mining Methods	
	18	Mining various kinds of Association Rules	
	19	From Association Mining to Correlation Analysis.	
V		**Flezi Module- Not included for End Semester Exams**	**15**
	20	Understanding the Hadoop	
	21	Distributed File System (HDFS) Getting Data into Hadoop	
	22	Understanding Data Processing in Hadoop	

References

- Han, J., Pei, J., & Kamber, M. (2011). *Data mining: concepts and techniques*.Elsevier.
- Hall M, Frank E, Holmes G, P.fahringer B. Reutemann P &Witten, I.H(2009), The WEKA data mining software: an update. *ACM SIGKDD explorations newsletter*, *11*(1), 10-18.
- Gupta, G.K (2014) Introduction to Data Mining with Case Studies, 2014, Prentice Hall India.

Lab Exercises (Using Python/ WEKA Tool)

1. Creating a table
2. List all the categorical (or nominal) attributes and the real-valued attributes separately

3. Calculate: mean, median, mode
4. Demonstration of data preprocessing on dataset
5. Demonstration of data preprocessing on dataset based on missing values
6. Demonstration of Association rule process on dataset using Apriori Algorithm
7. Demonstration of classification rule process on dataset using decision tree induction
8. Demonstration of classification rule process on dataset using naive bayes algorithm
9. Demonstration of clustering rule process on dataset using various clustering methods
10. Practicing outlier detection in clustering on dataset

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Cite the fundamentals of data mining	Ap	PSO- 1,3
CO2	Summarize about pre-processing techniques	Ap	PSO- 1,2, 3
CO3	Illustrate the data integration, transformation and reduction techniques	Ap	PSO- 1,2,3
CO4	Experiment with classification and prediction models.	Ap	PSO- 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA MINING CONCEPTS AND TECHNIQUES

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
1	Cite the fundamentals of data mining	PO-3,6,7 PS0-1,	U	F,C.P	L	P
2	Summarize about preprocessing techniques	PO-3,6,7 PS0-1,2	U	F,C,P	L	P
3	Illustrate the data integration, transformation and reduction techniques	PO-3,5,6,7 PS0-1,2,3	Ap	F,C,P	L	P
4	Experiment with classification and prediction models.	PO-3,5,6,7 PS0-1,2,3	Ap	F,C,P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	3	-	-	3	3	-	2	1	-	-
CO 2	-	-	3	-	-	3	3	-	2	1	-	-
CO 3	-	-	3	-	1	3	3	-	2	1	2	-
CO 4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

11. INTRODUCTION TO MACHINE LEARNING (Stream: Machine Learning)

Discipline	COMPUTER SCIENCE
Course Code	UK5DSECSC304
Course Title	INTRODUCTION TO MACHINE LEARNING

<table>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Knowledge in Python Programming is necessary.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course offers a comprehensive overview of machine learning fundamentals, spanning over supervised, unsupervised, and reinforcement learning techniques. Students will gain practical skills in data preprocessing, visualization, and analysis using Python libraries like NumPy, Pandas, and Scikit-learn. Exploring into, regression and classification algorithms, including linear regression, logistic regression, and decision trees, learners will acquire the ability to interpret and predict data patterns effectively. Advanced topics examine unsupervised learning methods such as clustering and dimensionality reduction, providing students with essential tools for data analysis. Additionally, the flexi module introduces ensemble learning, neural networks, and autoencoders, paving the way for further exploration into artificial intelligence and machine learning applications.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Machine Learning**	**15**
	1	Definition and Importance of Machine Learning:	
	2	Applications across Various Domains	
	3	Supervised Learning:-Definition and Examples, Regression vs. Classification	
	4	Unsupervised Learning:- Definition and Examples,Clustering vs. Dimensionality Reduction	
	5	Reinforcement Learning:- Definition and Examples, Agent-Environment Interaction, Exploration vs. Exploitation Tradeoff	
	6	Understanding data:- numeric variables – mean, median, mode, Measuring spread.	
	7	Introduction to NumPy, Pandas, and Scikit-learn:- Overview of their Features and Capabilities	
II		**Data Preprocessing and Visualization**	**15**

	7	Introduction to Data Preprocessing, Handling Missing Data: Imputation Techniques, Removal Strategies	
	8	Outlier Detection and Treatment: Z-score, IQR, Winsorization	
	9	Feature Scaling and Normalization: Min-Max Scaling, Z-score Normalization, Encoding Categorical Variables: One-Hot Encoding, Label Encoding	
	10	Introduction to Data Visualization:-Overview of Matplotlib and Seaborn Libraries	
	11	Basic Plot Types: Line Plot, Scatter Plot, Bar Plot, Histogram	
	12	Advanced Plot Types: Box Plot, Violin Plot, Heatmap,Multiple Subplots and Figures	
III		**Supervised Learning**	**15**
	12	Regression - Introduction, Types of Regression, Linear Regression, Multiple Linear Regression, Non-Linear Regression (Polynomial Regression)	
	13	Classification –Introduction, Logistic Regression, Decision Trees, Naïve Bayes Classification, Support Vector Machines:- Intuition and Optimization, K-Nearest Neighbours, Random Forest.	

IV	**Unsupervised Learning**		**15**
	19	Categorization of Major Clustering Methods - Partitioning Methods - K-means, K-medoids. Hierarchical Methods - Agglomerative Clustering, Density-based Methods – DBSCAN.	
	20	Principal Component Analysis (PCA): Understanding the PCA algorithm, Calculating principal components and eigenvalues, Reducing dimensionality using PCA, Interpretation of principal components, PCA implementation and applications	
	21	t-Distributed Stochastic Neighbor Embedding (t-SNE):Introduction to t-SNE algorithm, Similarities and differences between PCA and t-SNE	
V		**Flexi Module: Not included for end semester exams**	**15**
	26	Ensemble Learning: Understanding ensemble methods like bagging and boosting.	
	27	Introduction to Neural Networks: Basics of artificial neural networks (ANN), deep learning frameworks (e.g., TensorFlow).	
	28	Introduction to autoencoders, Encoding and decoding processes in autoencoders, Training autoencoders with backpropagation	

		Denoising autoencoders and variational autoencoders, Applications of autoencoders in unsupervised learning and feature learning	

References

- Andreas C. Müller & Sarah Guido, Introduction to Machine Learning with Python" , Shroff./O'Reilly, Grey scale Indian Edition, January 2016
- Sebastian Raschka and Vahid Mirjalili, Python Machine Learning" , Packt Publishing, 2nd Edition, September 2017
- Christopher M. Bishop, Pattern Recognition and Machine Learning" , Springer, 2006
- Kevin P. Murphy. Machine Learning: A Probabilistic Perspective" , MIT Press, August 2012

Lab Exercises

1. Prepare a dataset of customer having the features date, price, product_id, quantity_purchased, serial_no, user_id,user_type, user_class, purchase_week and visualise the data with

a. Plot diagram for Price Trends for Particular User, Price Trends for Particular User Over Time

b. Create box plot Quantity and Week value distribution having parameters of quantity_purchased','purchase_week'

2. **Task:** Conduct exploratory data analysis (EDA) on a designated dataset utilizing NumPy and Pandas.

Description: Select a dataset of choice (e.g., Iris dataset, Titanic dataset, etc.), and load it into a Pandas DataFrame. Leverage NumPy for numerical computations. Compute the mean, median, and mode of numeric variables within the dataset. Assess the data's spread through techniques such as standard deviation, variance, and range calculations. Employ histograms and box plots to visually represent the distribution of numeric variables. Provide insights and interpretations based on the outcomes of the EDA.

3. Task: Utilize Python programming to preprocess the "Titanic" dataset.

Description:Implement data preprocessing steps to handle missing data by employing imputation techniques or removal strategies. Detects and treats outliers using Z-score, IQR, or Winsorization methods.

4. Task: Utilize Python programming feature scaling and normalization on the "Titanic" dataset.

Description:Perform feature scaling and normalization on relevant features, and encode categorical variables using one-hot encoding or label encoding schemes. Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

5. Task: Utilize Python programming visualize on the "Titanic" dataset.

Description: Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

6. Task: Train regression models on the "Boston Housing" dataset to predict house prices based on various features.

Description: Utilize the "Boston Housing" dataset available in the scikit-learn library. Train a linear regression model to predict house prices using features such as area, number of bedrooms, and location. Additionally, implement multiple linear regression to predict sales revenue based on advertising spending across different channels. Explore the application of non-linear regression techniques like polynomial regression to capture more complex data patterns in the dataset. Visualize the regression results to understand the relationships between predictors and the target variable.

7. Task: Employ classification techniques on the "Titanic" dataset to predict survival outcomes based on passenger features.

Description: Use the Titanic dataset to train a logistic regression model to predict survival outcomes based on passenger features.

8. Task: Employ classification techniques on the "MNIST dataset"

Description: Implement a support vector machine classifier to classify handwritten digits using the MNIST dataset.

9. Task: Employ classification techniques on the "iris dataset"

Description: Experiment with k-nearest neighbors and random forest classifiers on iris dataset and MNIST dataset and compare their performance.

10. Task: Apply K-means clustering on the "Online Retail" dataset to segment customers based on their purchasing behavior.

Description: Utilize the "Online Retail" dataset, which contains information about customer transactions, including items purchased and their quantities. Implement K-means clustering to segment customers into distinct groups based on their purchasing patterns. Analyze the characteristics of each cluster to understand the preferences and behaviors of different customer segments. Identify potential marketing strategies tailored to each segment to enhance customer engagement and satisfaction.

Dataset: The "Online Retail" dataset is available from the UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets/Online+Retail).

11. Task: Employ principal component analysis (PCA) on the "Labeled Faces in the Wild" dataset to reduce the dimensionality of facial images.

Description: Utilize the "Labeled Faces in the Wild" dataset, which contains a collection of facial images belonging to various individuals. Implement PCA to reduce the high-dimensional feature space of facial images while preserving essential information. Visualize the principal components to gain insights into the underlying structure of the data. Reconstruct the facial images using a reduced number of dimensions to observe the effectiveness of dimensionality reduction. Analyze the reconstructed images to understand the impact of dimensionality reduction on facial image quality and interpretability.

Dataset: The "Labeled Faces in the Wild" dataset is available from the scikit-learn library (https://scikit-learn.org/stable/modules/generated/sklearn.datasets.fetch_lfw_people.html).

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Summarize the definition and significance of machine learning	U	PSO – 1, 3
CO2	Cite the principles underlying supervised and unsupervised learning methods.	U	PSO – 1, 2, 3
CO3	Use data preprocessing procedures using Python libraries to cleanse and organize datasets efficiently,	Ap	PSO – 1, 2, 3

CO4	Illustrate the effectiveness of machine learning models.	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTRODUCTION TO MACHINE LEARNING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	ractical (P)
1	Summarize the definition and significance of machine learning	PO- 1, 2, 3, 4, 6 PSO – 1, 3	U	F, C	L	P
2	Cite the principles underlying supervised and unsupervised learning methods.	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	U	F, C, P	L	P

3	Use data preprocessing procedures using Python libraries to cleanse and organize datasets efficiently,	PO- 1, 2, 3, 4, 8 PSO – 1, 2, 3,3	Ap	F, C, P	L	P
4	Illustrate the effectiveness of machine learning models.	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	-	2	3-	-	2	2	2	-
CO2	3	3	2	1	-	3	3-	-	3	3	2	-

CO3	**3**	**3**	**2**	**2**	**-**	**3**	**3**	**3**	**3**	**3**	**2**	**-**
CO4	**3**	**3**	**2**	**2**	**-**	**2**	**3**	**-**	**3**	**3**	**2**	**-**

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**

CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

12. ARTIFICIAL NEURAL NETWORK (Stream: Machine Learning)

Discipline	COMPUTER SCIENCE				
Course Code	UK5DSECSC305				
Course Title	ARTIFICIAL NEURAL NETWORK				
Type of Course	DSE				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	4	3 hours	-	2 hours	5 hours

Pre-requisites	Awareness in Artificial Intelligence is desirable
Course Summary	This course provides a comprehensive introduction to artificial neural networks (ANNs), a fundamental concept in machine learning inspired by the structure and function of the human brain. Students will learn about the basic principles, architectures, learning algorithms, and applications of ANNs through lectures, and hands-on exercises.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction**	**15**
	1	Introduction, Why neural network?, Research History, Biological Neuron model, Artificial Neuron model, Notations, Neuron equation.	
	2	Model of Artificial Neuron: Artificial neuron - basic elements, Activation functions – Threshold function, Piecewise linear function, Sigmoidal function, Example	
II		**Neural Network Architectures**	**15**

	3	Neural Network Architectures: Single layer Feed-forward network, Multi layer Feed-forward network, Recurrent networks.	
	4	Learning Methods in Neural Networks- Learning algorithms: Unsupervised Learning - Hebbian Learning, Competitive learning; Supervised Learning : Stochastic learning, Grant descent learning; Reinforced Learning.	
III		**Taxonomy Of Neural Network Systems**	**15**
	5	Popular neural network systems; Classification of neural network systems with respect to learning methods and architecture types.	
	6	Single-Layer NN System Single layer perceptron : Learning algorithm for training Perceptron, Linearly separable task, XOR Problem; ADAptive LINear Element (ADALINE) : Architecture, Training.	
	7	Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem.	
IV		**Self Organizing Maps**	**15**
	8	Introduction; Two basic feature-mapping models; SOM: Competitive process, Cooperative process, Adaptive	

		process; Summary of SOM Algorithm; Properties of feature map.	
	9	Kohonen Self Organizing Maps: Architecture, Algorithm, Application.	
V		**Flexi Module: Not included for end semester exams**	**15**
	10	Applications of Artificial Neural Networks: Pattern Recognition, Medicine, Speech Production, Speech Recognition, Business.	
	11	Deep Neural Networks (Basic Concepts only)	

References

1. Simon Haykin, “Neural Networks and Learning Machines” , Pearson Prentice Hall, Third Edition.
2. Laurene Fausett, “Fundamentals of Neural Networks Architectures, Algorithms and Applications”, Pearson Education India, 2004.

Lab Exercises

1. Implement AND problem.

2. Implement XOR problem.

3. Single-Layer Perceptron Implementation

a. Implement a single-layer perceptron in a programming language of choice (Python recommended).

b. Train the perceptron on a binary classification task using a simple dataset.

c. Visualize the decision boundary and analyze the perceptron's performance.

4. Multi-Layer Perceptron (MLP) Demonstration:

a. Develop a multi-layer perceptron (MLP)

b. Train the MLP on a dataset such as MNIST for handwritten digit classification.

c. Experiment with different architectures, activation functions, and optimization algorithms to optimize performance.

5. Implement Self organizing maps.

6. Implement applications using Neural Network.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Outline neural network fundamentals.	U	PSO – 1, 3
CO2	Demonstrate neural network architectures.	Ap	PSO – 1, 2, 3
CO3	Experiment with various learning methods	Ap	PSO – 1, 2, 3

CO4	Sketch the features and applications of SOM	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ARTICIAL NEURAL NETWORK

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L) / Tutorial (T)	Practical (P)
1	Outline neural network fundamentals.	PO- 6, 7 PSO – 1, 3	U	F, C	L	P
2	Demonstrate neural network architectures.	PO- 1, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
3	Experiment various learning methods	PO- 1, 6,7 PSO – 1, 2, 3	Ap	F, C,P	L	P

4	Sketch the features an applications of SOM	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	-	-	-	-	-	3	3	-	2	-	2	-
CO2	1	-	-	-	-	3	3	-	3	3	3	-
CO3	1	-	-	-	-	3	3	3	3	3	3	-
CO4	1	-	-	-	-	2	3	-	3	3	3	-

Correlation Levels:

Level	**Correlation**
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

13. PHP AND MYSQL (Stream: Web Development)

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK5DSECSC306</td></tr>
<tr><td>Course Title</td><td colspan="5">PHP AND MYSQL</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">V</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Awareness on databases, data storage, data retrieval and knowledge in concepts of OOPS are desirable.</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course on PHP and MySQL typically covers the fundamentals of web development using PHP programming language for server-side scripting and MySQL for database management.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs(L+P)
I		**INTRODUCTION TO PHP**	**15 hrs**
	1	Overview of PHP, Benefits, and drawbacks of running PHP as a Server-Side Script. PHP Language Basics: The building blocks of PHP: variables, global & super global.	
	2	Data types: Set type, typecasting, test type, Operators & Expressions, and Flow control functions in PHP.	
	3	Functions: Defining a function, variable scope, calling a function returning values, setting default values for arguments, passing variable reference, built-in functions.	
II		**ARRAYS AND OOP**	**15**
	4	Arrays: Creating arrays (associative & multidimensional), Array related functions. Working with string functions: Formatting strings, Using Date and Time functions, working with files and directories.	
III		**FORMS**	**15**
	5	Creating a Simple Input Form, Accessing Form Input with User-Defined Arrays, and Combining HTML and PHP Code on a Single Page, Using Hidden Fields to Save State, Redirecting the User, Sending Mail on Form Submission,	

		Creating the Form. Creating the Script to Send the Mail, Concepts File Uploads	
	6	Cookies: Introduction, different types of cookies, setting a cookie with PHP, deleting a cookie, session function overview: starting a session, working with session variables, passing session IDs in the query string, destroying sessions & un-setting variables, Working with images.	
IV		**MYSQL**	**15**
	7	Database concepts: Open-source database software: MySQL features MySQL data types: Numeric, date & time, string Table creation in MySQL: insert, select, where clause, ordering the result, like operator Selecting Multiple tables: using join, using queries Modifying records: update command, replace command, delete command date & time functions in MySQL.	
	8	Interacting with MySQL using PHP: Connecting to MYSQL, executing queries, retrieving error messages, inserting data with PHP, retrieving data with PHP.	
V		**Flexi Module: Not included for end semester exams**	**15**

	9	Design a website using HTML and PHP	
	10	Super global variables and its usage	

References

1. Meloni, J. C. *Sams teach yourself PHP, MySQL and Apache all in one*.
2. Holzner, S. *Complete Reference PHP*.
3. Vaswani, V. *MySQL (LM): The complete reference*. McGraw-Hill Education, Indian Edition

Web resources

1. W3schools.com
2. https://www.w3schools.com/php/php_oop_what_is.asp.

NPTEL COURSE

1. https://onlinecourses.swayam2.ac.in/aic20_sp32/preview

Lab Exercises

Setup WAMP/XAMPP Server or Setup Apache, MySQL, and PHP separately in your PHP Lab. The

laboratory work will consist of 15-20 Experiments.

PART A

● Write, test, and debug simple PHP programs.

● Familiarize the use of Conditional Statements.

● Programs with Loops.

● Programs to handle Strings.

PART B

● Implement programs with Functions, Arrays & Images.

● Read and write data from/to files in PHP.

● Programs to demonstrate OOP concepts.

● Programs to handle forms in PHP.

● Programs to interact with MySQL using PHP.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Discuss features, Basics and building blocks of PHP	U	PSO-1,2
CO2	Outline on object object-oriented paradigms	U	PSO-1,2
CO3	Experiment with web designing using PHP	Ap	PSO-1,2,3
CO4	Develop skills to manage the front end and back end.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: PHP AND MY SQL

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	Discuss features, Basics and building blocks of PHP	PO-2,6,7 PSO-1,2	U	F, C, P	L	P
2	Outline on object object-oriented paradigms	PO-2,6 PSO-1,2	U	F, C, P	L	P
3	Experiment with web designing using PHP	PO-1,2,3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P

4	Develop skills to manage the front end and back end.	PO-1,2,3,5,6,7 PSO-1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	-	1	-	-	-	2	2	-	3	2	-	-
CO 2	-	2	-	-	-	2	-	-	3	2	-	-
CO 3	2	2	3	-	2	2	2	-	3	2		-
CO 4	2	2	3	-	2	2	2	-	3	2	3	

Correlation Levels:

Level	**Correlation**
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

14. WEB APPLICATION DEVELOPMENT (Stream: Web Development)

Discipline	COMPUTER SCIENCE					
Course Code	UK5DSECSC307					
Course Title	**WEB APPLICATION DEVELOPMENT**					
Type of Course	DSE					
Semester	V					
Academic Level	3					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week	
	4	3 hours	-	2 hours	5 hours	
Pre-requisites	Basic understanding of programming concepts (variables, data types, control structures) and familiarity with HTML, CSS, and JavaScript is necessary					
Course Summary	This course introduces students to the fundamentals of web application development using Django, a high-level Python web framework. Students will learn how to design, develop, and deploy dynamic web applications.					

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Web Development**	15
	1	Overview of web development concepts	
	2	Introduction to Django framework	
	3	Setting up development environment	
	4	Basic HTML, CSS, and JavaScript concepts	
	5	Role of Django in creating web applications	
II		**Introduction to Django**	15
	6	Installing Django	
	7	Creating a Django project	
	8	Understanding Django apps	

	9	URL routing in Django	
	10	Basic views and templates in Django	
III		**Models and Views in Django**	**15**
	11	Introduction to Django models	
	12	Defining models and relationships	
	13	Querying the database with Django ORM	
	14	Class-based views in Django	
	15	Using templates to render dynamic content	
IV		**Development Using Django**	**12**
	16	User authentication and authorization	
	17	Handling forms in Django	
	18	Working with static files and media	
	19	Implementing pagination and search functionality	
	20	Deploying Django applications to production servers	
V		**Flexi Module**	
	21	Exploration of emerging trends and techniques in web development with Django	**15**
	22	Case studies of successful web applications developed using Django	
	23	Comparative analysis of Django with other web development frameworks (e.g., Flask, Ruby on Rails)	
	24	Discussion on advanced topics such as Django REST framework, asynchronous views, and scalability	

References:

1. William S Vincent, "Django for Beginners: Build Websites with Python and Django" 2020
2. "Django for APIs: Build web APIs with Python & Django" by William S. Vincent
3. "Two Scoops of Django: Best Practices for Django 1.11" by Audrey Roy Greenfeld and Daniel Roy Greenfeld
4. Joel Sklar, Principles of Web Design, Cengage Learning, 2008

5. Randy Connolly Ricardo Hoar, Fundamentals of Web Development, Pearson
6. https://docs.djangoproject.com/en/5.0/
7. https://www.youtube.com/watch?v=o0XbHvKxw7Y
8. https://www.youtube.com/watch?v=llbtoQTt4qw

Lab Exercises

1. Installation of Django
2. Create a simple project
3. Creating a Model
4. Admin Interface
5. Displaying Data.
6. Adding Forms
7. Editing Data
8. Deleting Data
9. User Authentication
10. Static Files

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the role of Django in creating web applications.	U	PSO-1,2
CO-2	Demonstrate setting up and configuring Django	Ap	PSO- 1, 3
CO-3	Experiment with models that represent data in applications.	Ap	PSO-1, 2, 3

CO-4	Explain about views and templates in Django and their role in rendering dynamic web pages.	U	PSO- 1, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: WEB APPLICATION DEVELOPMENT

Credits: 3:0:2 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO 1	Summarize the role of Django in creating web applications.	PO 6,7 PSO - 1,2	U	F, C	L	P
CO 2	Demonstrate setting up and configuring Django projects and applications.	PO 2,6, 7 PSO - 1, 3	Ap	F, C, P	L	P
CO 3	Experiment with models that represent data in Django applications.	PO 2,3,6,7 PSO - 1,2, 3	Ap	F, C, P	L	P

CO 4	Explain about views and templates in Django and their role in rendering dynamic web pages.	PO 2, 6 7 PSO 1, 3	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	-	-	-	-	-	2	3	-	3	2-	-	-
CO 2	-	2	3	-	-	3	3	-	3	2	3	-
CO 3	-	2	2	-	-	2	3	-	-	2	3	-
CO 4	-	2	-	-	-	2	3	-	3	2	3	-

Correlation Levels:

Level	**Correlation**

-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Lab Assessments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Programming Assignments	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓		✓
CO 2	✓	✓	✓		✓

CO 3	✓		✓		✓
CO 4	✓		✓		✓

C. SEC

15. SOFTWARE TESTING

Discipline	COMPUTER SCIENCE				
Course Code	UK5SECCSC300				
Course Title	SOFTWARE TESTING				
Type of Course	SEC				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	3	2 hours	-	2 hours	4 hours

Pre-requisites	Basic understanding of programming concepts, familiarity with software development lifecycle and knowledge of basic software engineering principles is desirable.
Course Summary	This course provides an introduction to software testing methodologies, techniques, and tools. It covers the fundamentals of testing, including test planning, test case design, and execution. The course also includes an introduction to automation testing using Selenium. Students will learn how to systematically identify, evaluate, and address software defects to ensure the quality and reliability of software applications.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction to Software Testing**	**12**
	1	Overview of software testing	
	2	Testing principles and fundamentals	
	3	Software testing life cycle	
	4	Testing types: Manual, Automation, functional, non-functional, black-box, white-box	

	5	Levels of testing: Unit Testing, Integration Testing, System Testing, User Acceptance Testing	
	6	Testing documentation: test plan, test cases, test reports	
II		**Testing Types and Techniques**	**12**
	7	Types of testing - Regression Testing , Smoke Testing, Database Testing, Usability Testing	
	8	Load Testing, Stress Testing, Performance Testing	
	9	Internationalization Testing, Localization Testing	
	10	Static Testing Techniques : Importance of reviews in STLC, Review Activities, Roles and Responsibilities during Review	
	11	Dynamic Testing Techniques: Specification-based or black-box techniques , Boundary Value Analysis, Decision Table Testing, Equivalence Partitioning	
	12	Experience-based Testing Techniques: Error Guessing, Exploratory Testing	
III		**Test Automation and introduction to Selenium**	**12**
	13	Introduction to test automation	

	14	Overview : major functional and non functional tools, Test management and defect tracking tools	
	15	Overview of Selenium	
	16	Setting up Selenium environment	
	17	Introduction to Selenium Components	
IV		**Testing Using Selenium**	**12**
	19	Create Selenium commands	
	20	Handling different elements : textboxes, radio buttons, check boxes	
	21	Keyboard, mouse actions	
	22	Developing test cases and test suits with Selenium	
	23	Working with a case study	
V		**Flexi Module- Not included for End Semester Exams**	**12**
	24	Introduction to emerging techniques in software testing	
	25	Comparative analysis of different testing tools and frameworks	

	26	Case studies highlighting successful implementation of Selenium in real-world projects	
	27	Exploring advanced topics such as AI-driven testing, machine learning in test automation, and shift-left testing methodologies	
	28	Interactive sessions, discussions, and hands-on exercises based on the latest trends and industry developments	

References:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill Education.

2. Rex Black, "Foundations of Software Testing", Cengage Learning.

3. Dorothy Graham et al., "Experiences of Test Automation: Case Studies of Software Test Automation", Addison-Wesley Professional.

4. Alan Richardson, "Selenium WebDriver: From Foundations to Framework", Leanpub.

5. "Learn Selenium" , Unmesh Gundech and Carl Cocchiaro

6. https://www.tutorialspoint.com/selenium/index.htm

7. https://greenstechnologys.com/Selenium%20Full%20Material%20Updated%20Greens.pdf

Lab Exercises

1. Installation of Selenium
2. Testing Web Page Loading

3. Form Submission Testing
4. Testing Navigation
5. Testing Element Interactions
6. Testing Element Visibility
7. Testing Error Handling
8. Testing Cross-Browser Compatibility
9. Testing Responsiveness
10. Testing Performance

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Outline the fundamental concepts of software testing and its importance in software development.	U	PSO- 1
CO2	Identify different testing techniques and methodologies and apply them to real-world scenarios.	U	PSO- 1, 2
CO3	Use Selenium environment.	Ap	PSO- 1,2,3
CO4	Develop test cases using Selenium	Ap	PSO- 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: SOFTWARE TESTING

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/ PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical(P)**
CO1	Outline the fundamental concepts of software testing and its importance in software development.	PO-6,7 PSO-1	U	F, C	L	-
CO2	Identify different testing techniques and methodologies and apply them to real-world scenarios.	PO - 2,6, 7 PSO - 1, 2	U	F, C	L	-

CO3	Use Selenium environment.	PO-2,3,6,7 PSO -1,2,3	Ap	F, C, P	L	P
CO4	Develop test cases using Selenium	PO-2,3,6.7 PSO -1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	-	-	-	-	-	3	3	-	3	-	-	-

CO 2	-	2	-	-	-	3	3	-	3	3	-	-
CO 3	-	2	3	-	-	2	3	-	3	2	3	-
CO 4	-	2	3	-	-	2	3	-	3	2	3	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Programming Assignments / Lab Assessments	End Semester Examinations

CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

16. WEB APPLICATION DEVELOPMENT

Discipline	COMPUTER SCIENCE				
Course Code	UK5SECCSC301				
Course Title	WEB APPLICATION DEVELOPMENT				
Type of Course	SEC				
Semester	V				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic understanding of programming concepts (variables, data types, control structures) and familiarity with HTML, CSS, and JavaScript is desirable.				
Course Summary	This course introduces students to the fundamentals of web application development using Django, a high-level Python web framework. Students will learn how to design, develop, and deploy dynamic web applications.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I	**Introduction to Web Development**		**12**
	1	Overview of web development concepts	
	2	Introduction to Django framework	
	3	Setting up development environment	
	4	Basic HTML, CSS, and JavaScript concepts	
	5	Role of Django in creating web applications	

II	**Introduction to Django**		**12**
	6	Installing Django	
	7	Creating a Django project	
	8	Understanding Django apps	
	9	URL routing in Django	
	10	Basic views and templates in Django	
III	**Models and Views in Django**		**12**
	11	Introduction to Django models	
	12	Defining models and relationships	
	13	Querying the database with Django ORM	
	14	Class-based views in Django	
	15	Using templates to render dynamic content	
IV	**Development Using Django**		**12**
	16	User authentication and authorization	

	17	Handling forms in Django	
	18	Working with static files and media	
	19	Implementing pagination and search functionality	
	20	Deploying Django applications to production servers	
V	**Flexi Module: Not included for End Semester Exams**		
	21	Exploration of emerging trends and techniques in web development with Django	**12**
	22	Case studies of successful web applications developed using Django	
	23	Comparative analysis of Django with other web development frameworks (e.g., Flask, Ruby on Rails)	
	24	Discussion on advanced topics such as Django REST framework, asynchronous views, and scalability	

References:

1. William S Vincent, "Django for Beginners: Build Websites with Python and Django" 2020
2. "Django for APIs: Build web APIs with Python & Django" by William S. Vincent

3. "Two Scoops of Django: Best Practices for Django 1.11" by Audrey Roy Greenfeld and Daniel Roy Greenfeld

4. Joel Sklar, Principles of Web Design, Cengage Learning, 2008

5. Randy Connolly Ricardo Hoar, Fundamentals of Web Development, Pearson

6. https://docs.djangoproject.com/en/5.0/

7. https://www.youtube.com/watch?v=o0XbHvKxw7Y

8. https://www.youtube.com/watch?v=llbtoQTt4qw

Lab Exercises

1. Installation of Django
2. Create a simple project
3. Creating a Model
4. Admin Interface
5. Displaying Data.
6. Adding Forms
7. Editing Data
8. Deleting Data
9. User Authentication
10. Static Files

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize basics of web development and role of Django in creating web applications.	U	PSO- 1
CO-2	Illustrate setting up and configuring Django projects and applications.	Ap	PSO- 1, 3
CO-3	Develop models in Django applications.	Ap	PSO-1, 2, 3
CO-4	Build dynamic webpages	Ap	PSO- 1, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: WEB APPLICATION DEVELOPMENT

Credits: 2:0:2 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)

CO-1	Summarize basics of web development and role of Django in creating web applications.	PO-6,7 PSO -1	U	F, C, P	L	P
CO-2	Illustrate setting up and configuring Django projects and applications.	PO -2,6,7 PSO -1, 3	Ap	F, C, P	L	P
CO-3	Develop models in Django applications.	PO-2,3,6,7 PSO -1, 2, 3	Ap	F, C, P	L	P
CO-4	Build dynamic webpages	PO- 2, 6,7 PSO- 1, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	3	-	3	-	-	-
CO 2	-	2	3	-	-	3	3	-	3	-	3	-
CO 3	-	2	-	-	-	3	3	-	-	2	3	-
CO 4	-	2	-	-	-	2	3	-	3	-	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam

- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Programming Assignments	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

17. ANDROID PROGRAMMING USING KOTLIN

Discipline	COMPUTER SCIENCE
Course Code	UK5SECCSC302
Course Title	ANDROID PROGRAMMING USING KOTLIN
Type of Course	SEC
Semester	V

Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/ Week
	3	2 hours	-	2 hours	4 hours
Pre-requisites	Basic computer knowledge and awareness of programming concepts is necessary.				
Course Summary	This course will help a student to develop Android applications using Kotlin beginning from scratch.				

Detailed Syllabus

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**The Kotlin Ecosystem**	**12 hrs**
	1	Kotlin overview, Android Ecosystem Basic Programming terms: Package, Class, Object, Object Oriented Programming	
	2	Function or Method, Argument/Parameter	
	3	Environment setup in Android studio	

	4	Kotlin: Installing JDK, Installing Android Studio, Creating new project in android studio, Android studio interface	
II		**Introduction to Programming inKotlin**	**12**
	5	Fundamentals of Kotlin: First Kotlin Program, Variables, Data types, Type Conversions	
	6	Arrays , Array list,Set,Map	
	7	Operators in Kotlin:Arithmetic, Assignment, Unary, Equality and Relational Operators, Conditional Operators	
	8	Operator precedence in Kotlin, the rangeTo() function and in operator, Console input	
	9	Control Flow Statements in Kotlin: If ..Else, If Else….If Ladder ,Nested If ;Loops in Kotlin: For and For Each Loop,Do-While Loop	
		Working with Kotlin	**12**
III	10	Functions in Kotlin: Declarations and Calling of Functions, Function Types, Function Return types	
	11	Object Oriented Programming: Object and Class in Kotlin	

	12	Access Modifiers, Constructor, Encapsulation, Inheritance, Function Overriding, Abstract Classes,Interfaces	
IV		**Android App Development**	**12**
	13	Introduction to Android App Development: Installing Android Virtual Device, Enabling Virtualization	
	14	Installing Genymotion Emulator , General Information about Gradle Build system	
	15	Manifest File in Android app development , Introduction to Resources(Strings ,Drawables); Android Components: Layouts, Constraint Layouts, Text view, Image view…	
	16	User Interactions in Android app development: Toast Messages, Snackbar Message, Dialog Message; Lists and views	
	17	Intent and Life Cycles Shared Preferences and Data Saving	
V		**Flexi Module- Not included for End Semester Exams**	**12**
	18	Device Compatibility in android app development, Publishing the app on Google Play, Project: Android app development	

References

1. Kotlin in-Depth , Aleksei Sedunov, bpb Publications 2-nd Ed
2. Android Application Development with Kotlin, Hardik Trivedi bpb Publications
3. Head First Kotlin: A Brain-Friendly Guide,Dawn Griffiths, O'Reilly Publications

Lab Exercises

1. Programs implementing various aspects of Kotlin- usage of variables, control structures, arrays etc.

Course Outcomes

No	Upon Completion of the course the graduate will be able to	Cognitive Level	PSO
CO-1	Explain about the Kotlin ecosystem	U	PSO-1, 2
CO-2	Experiment with the basics of Kotlin with emphasis on control structures, data types and operators.	Ap	PSO-1, 2, 3
CO-3	Demonstrate comprehensive knowledge of Functions and Object Oriented Programming concepts in Kotlin.	Ap	PSO-1, 2, 3
CO-4	Develop Android applications	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ANDROID PROGRAMMING USING KOTLIN

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Explain about the Kotlin ecosystem	PO - 6,7 PSO - 1	U	F, C	L	-
CO-2	Experiment with the basics of Kotlin with emphasis on control structures, data types and operators.	PO – 4, 6, 7, 8 PSO - 1,2. 3	Ap	F, C, P	L	P
CO-3	Demonstrate comprehensive knowledge of Functions and Object Oriented Programming concepts in Kotlin.	PO – 4, 6, 7, 8 PSO- 1,2, 3	Ap	F, C, P	L	P

CO-4	Develop Android applications	PO -4, 6,7,8 PSO- 1,2,3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	3	-	3	-	-	-
CO 2	-	-	-	2	-	3	3	1	3	3	3	-
CO 3	-	-	-	2	-	3	3	1	3	3	3	-
CO 4	-	-	-	2	-	2	3	1	3	3	3	-

Correlation Level

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

ssessment Rubrics:

- Quiz / Assignment/Discussion / Seminar
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics

	Internal Exam	Assignment	Discussion / Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓		✓	✓

Semester 6

1. DSC

Course Code	Course Name	L (Hrs.)	P (Hrs.)	Credits
UK6DSCCSC300	Machine Learning	3	2	4
UK6DSCCSC301	Object Oriented Analysis And Design	3	2	4
UK6DSCCSC302	Cryptography and Network Security	3	2	4
UK6DSCCSC303	Operating Systems	4	0	4
UK6DSCCSC304	Functional Programming	3	2	4
UK6DSCCSC305	Internet of Things	3	2	4

2. DSE

Course Code	Course Name	Stream	L (Hrs.)	P (Hrs.)	Credits
UK6DSECSC300	Image Security	Cyber Security	3	2	4
UK6DSECSC301	Mobile & Wireless Security	Cyber Security	3	2	4

UK6DSECSC302	Data Visualisation	Data Science	3	2	4
UK6DSECSC303	Big Data Technologies using Hadoop	Data Science	3	2	4
UK6DSECSC304	Recommendation Systems	Machine Learning	3	2	4
UK6DSECSC305	Deep Learning	Machine Learning	3	2	4
UK6DSECSC306	Mobile Application Development	Web Develop ment	3	2	4
UK6DSECSC307	Emerging Trends in Web Development	Web Develop ment	4	0	4

3. SEC

Course Code	**Course Name**	**L (Hrs.)**	**P (Hrs.)**	**Credits**
UK6SECCSC300	Mobile Application Development	3	2	4
UK6SECCSC301	Game application Development	3	2	4

UK6SECCSC302	Image Processing and Applications	3	2	4
UK6SECCSC303	Entrepreneurship in IT	4	0	4

DSC

1. MACHINE LEARNING USING PYTHON

Discipline	**COMPUTER SCIENCE**				
Course Code	**UK6DSCCSC300**				
Course Title	**MACHINE LEARNING USING PYTHON**				
Type of Course	DSC				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Knowledge in Python Programming is essential				

Course Summary	This course offers a comprehensive overview of machine learning fundamentals, spanning supervised, unsupervised, and reinforcement learning techniques. Students will gain practical skills in data preprocessing, visualization, and analysis using Python libraries like NumPy, Pandas, and Scikit-learn. Delving into regression and classification algorithms, including linear regression, logistic regression, and decision trees, learners will acquire the ability to interpret and predict data patterns effectively. Advanced topics explore unsupervised learning methods such as clustering and dimensionality reduction, providing students with essential tools for data analysis. Additionally, the flexi module introduces ensemble learning, neural networks, and autoencoders, paving the way for further exploration into artificial intelligence and machine learning applications.

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15 hrs**
	1	Definition and Importance of Machine Learning:	
	2	Applications across Various Domains	

	3	Supervised Learning: Definition and Examples, Regression vs. Classification	
	4	Unsupervised Learning: Definition and Examples, Clustering vs. Dimensionality Reduction	
	5	Reinforcement Learning: Definition and Examples, Agent-Environment Interaction, Exploration vs. Exploitation Tradeoff	
	6	Understanding data: numeric variables – mean, median, mode, Measuring spread.	
	7	Introduction to NumPy, Pandas, and Scikit-learn: Overview of their Features and Capabilities	
II	**Data Preprocessing and Visualization**		**15**
	8	Introduction to Data Preprocessing, Handling Missing Data: Imputation Techniques, Removal Strategies	
	9	Outlier Detection and Treatment: Z-score, IQR, Winsorization	
	10	Feature Scaling and Normalization: Min-Max Scaling, Z-score Normalization, Encoding Categorical Variables: One-Hot Encoding, Label Encoding	

	11	Introduction to Data Visualization: Overview of Matplotlib and Seaborn Libraries	
	12	Basic Plot Types: Line Plot, Scatter Plot, Bar Plot, Histogram	
	13	Advanced Plot Types: Box Plot, Violin Plot, Heatmap, Multiple Subplots and Figures	
III	**Supervised Learning**		**15**
	14	Regression - Introduction, Types of Regression, Linear Regression, Multiple Linear Regression, Non-Linear Regression (Polynomial Regression)	
	15	Classification –Introduction, Logistic Regression, Decision Trees, Naïve Bayes Classification, Support Vector Machines: Intuition and Optimization, K-Nearest Neighbours, Random Forest.	
IV	**Unsupervised Learning**		**15**
	16	Categorization of Major Clustering Methods - Partitioning Methods - K-means, K-medoids. Hierarchical Methods - Agglomerative Clustering, Density-based Methods – DBSCAN.	
	17	Principal Component Analysis (PCA): Understanding the PCA algorithm, Calculating principal components and eigenvalues, Reducing dimensionality using PCA,	

		Interpretation of principal components, PCA implementation and applications	
	18	t-Distributed Stochastic Neighbour Embedding (t-SNE): Introduction to t-SNE algorithm, Similarities and differences between PCA and t-SNE	
V		**Flexi Module: Not included for end semester exams**	**15**
	19	Ensemble Learning: Understanding ensemble methods like bagging and boosting.	
	20	Introduction to Neural Networks: Basics of artificial neural networks (ANN), deep learning frameworks (e.g., TensorFlow).	
	21	Introduction to autoencoders, Encoding and decoding processes in autoencoders, Training autoencoders with backpropagation Denoising autoencoders and variational autoencoders, Applications of autoencoders in unsupervised learning and feature learning	

References

Core:

- Introduction to Machine Learning with Python" by Andreas C. Müller & Sarah Guido
- Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili

- Pattern Recognition and Machine Learning" by Christopher M. Bishop
- Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy

Lab Exercises

1. Prepare a dataset of customer having the features date, price, product_id, quantity_purchased, serial_no, user_id,user_type, user_class, purchase_week and visualise the data with

   a. Plot diagram for Price Trends for Particular User, Price Trends for Particular User Over Time

   b. Create box plot Quantity and Week value distribution having parameters of quantity_purchased','purchase_week'

2. Task: Conduct exploratory data analysis (EDA) on a designated dataset utilizing NumPy and Pandas.

   Description: Select a dataset of choice (e.g., Iris dataset, Titanic dataset, etc.), and load it into a Pandas DataFrame. Leverage NumPy for numerical computations. Compute the mean, median, and mode of numeric variables within the dataset. Assess the data's spread through techniques such as standard deviation, variance, and range calculations. Employ histograms and box plots to visually represent the distribution of numeric variables. Provide insights and interpretations based on the outcomes of the EDA.

3. Task: Utilize Python programming to preprocess the "Titanic" dataset.

   Description:Implement data preprocessing steps to handle missing data by employing imputation techniques or removal strategies. Detects and treats outliers using Z-score, IQR, or Winsorization methods.

4. Task: Utilize Python programming feature scaling and normalization on the "Titanic" dataset.

Description:Perform feature scaling and normalization on relevant features, and encode categorical variables using one-hot encoding or label encoding schemes. Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

5. Task: Utilize Python programming visualize on the "Titanic" dataset.

Description: Utilize Matplotlib and Seaborn libraries to visualize the preprocessed dataset, creating basic plots such as Line Plot, Scatter Plot, Bar Plot, and Histogram, as well as advanced plots like Box Plot, Violin Plot, and Heatmap

6. Task: Train regression models on the "Boston Housing" dataset to predict house prices based on various features.

Description: Utilize the "Boston Housing" dataset available in the scikit-learn library. Train a linear regression model to predict house prices using features such as area, number of bedrooms, and location. Additionally, implement multiple linear regression to predict sales revenue based on advertising spending across different channels. Explore the application of non-linear regression techniques like polynomial regression to capture more complex data patterns in the dataset. Visualize the regression results to understand the relationships between predictors and the target variable.

7. Task: Employ classification techniques on the "Titanic" dataset to predict survival outcomes based on passenger features.

Description: Use the Titanic dataset to train a logistic regression model to predict survival outcomes based on passenger features.

8. Task: Employ classification techniques on the "MNIST dataset"

Description: Implement a support vector machine classifier to classify handwritten digits using the MNIST dataset.

9. Task: Employ classification techniques on the "iris dataset"

Description: Experiment with k-nearest neighbors and random forest classifiers on iris dataset and MNIST dataset and compare their performance.

10. Task: Apply K-means clustering on the "Online Retail" dataset to segment customers based on their purchasing behavior.

Description: Utilize the "Online Retail" dataset, which contains information about customer transactions, including items purchased and their quantities. Implement K-means clustering to segment customers into distinct groups based on their purchasing patterns. Analyze the characteristics of each cluster to understand the preferences and behaviors of different customer segments. Identify potential marketing strategies tailored to each segment to enhance customer engagement and satisfaction.

Dataset: The "Online Retail" dataset is available from the UCI Machine Learning Repository (https://archive.ics.uci.edu/ml/datasets/Online+Retail).

11. Task: Employ principal component analysis (PCA) on the "Labeled Faces in the Wild" dataset to reduce the dimensionality of facial images.

Description: Utilize the "Labeled Faces in the Wild" dataset, which contains a collection of facial images belonging to various individuals. Implement PCA to reduce the high-dimensional feature space of facial images while preserving essential information. Visualize the principal components to gain insights into the underlying structure of the data. Reconstruct the facial images using a reduced number of dimensions to observe the effectiveness of dimensionality reduction. Analyze the reconstructed images to understand the impact of dimensionality reduction on facial image quality and interpretability.

Dataset: The "Labeled Faces in the Wild" dataset is available from the scikit-learn library (https://scikit-learn.org/stable/modules/generated/sklearn.datasets.fetch_lfw_people.html)

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Outline the definition and significance of machine learning	**U**	**PSO – 1, 3**
CO2	Summarize the principles underlying supervised and unsupervised learning methods.	**U**	**PSO – 1, 2, 3**
CO3	Use Python libraries.	**Ap**	**PSO – 1, 2, 3**
CO4	Demonstrate the effectiveness of machine learning models.	**Ap**	**PSO – 1, 2,**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MACHINE LEARNING

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture(L)/ Tutorial(T)**	**Practical (P)**
1	Outline the definition and significance of machine learning	PO- 1, 2, 3, 4, 6 PSO – 1, 3		F, C	L	P
2	Summarize the principles underlying supervised and unsupervised learning methods.	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	U	F, C, P	L	P
3	Use Python libraries.	PO- 1, 2, 3, 4, 8	Ap	F, C, P	L	P

		PSO – 1, 2, 3				
4	Demonstrate the effectiveness of machine learning models.	PO- 1, 2, 3, 4, 6 PSO – 2	Ap	F,C.P	L	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	2	1	1	-	2	-	-	2	2	2	2
CO2	3	3	2	1	-	3	-	-	3	3	2	1
CO3	3	3	2	2	-	-		3	3	3	2	2
CO4	3	3	2	2	-	2	-	-	3	3	2	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓

CO4	✓	✓	✓	✓

2. OBJECT ORIENTED ANALYSIS AND DESIGN

Discipline	COMPUTER SCIENCE				
Course Code	UK6DSCCSC301				
Course Title	OBJECT ORIENTED ANALYSIS AND DESIGN				
Type of Course	DSC				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				

Course Summary	This course delivers an overview on the Object-oriented approach used in analysis and design of System/Subsystem/Functional units based on the given specifications through UML Diagrams.

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**INTRODUCTION TO UML**	**15**
	1	Introduction to UML: Importance of modelling, Principles of modelling, Object oriented modelling.	
	2	Conceptual model of the UML, Architecture, Software development life cycle	
	3	Classes, relationships, Common mechanisms and diagrams.	
	4	CASE Tools	
II		**ADVANCED BEHAVIORAL MODELING**	**15**
	5	Advanced classes, Advanced relationships	

	6	Interfaces, types and roles, packages, terms, concepts.	
	7	Class and Object Diagrams: Terms, concepts	
	8	Common modelling techniques for class and object diagrams	
III		**ARCHITECTURAL MODELING**	**15**
	9	Interaction diagrams	
	10	Use cases	
	11	Use case Diagrams	
	12	Activity Diagrams	
IV		**ADVANCED BEHAVIORAL MODELING**	**15**
	13	Events and signals	
	14	State machines, processes and threads	
	15	Tme and space, state chart and state chart diagrams	
	16	Case study: The next gen POS system	
	17	Component diagrams & Deployment diagrams	

V		**Flexi Module: Not included for End Semester Exams**	**15**
	18	Advanced UML diagrams	

References

1. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Pearson Education, 2nd Edition, 2004.

2. Craig Larman, “Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development”, Pearson Education, 3rd Edition, 2005.

3. MeilirPage-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education, 1st Edition, 2006.

4. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, “UML 2 Toolkit”, WILEY-Dreamtech India Pvt. Ltd., Pearson Education, 3rd Edition, 2005.

Web References:

1. **https://www.tutorialspoint.com/uml/uml_overview.html**
2. **https://www.utdallas.edu/~chung/OOAD/M03_1_StructuralDiagrams.ppt**
3. **https://onedrive.live.com/download?cid=99CBBF765926367**

E-Text Books:

1. **https://www.utdallas.edu/UML2.0/Rumbaugh**
2. **https://www.utdallas.edu/~chung/SP/applying-uml-and-patterns.pdf**

Lab Exercises

Draw standard UML diagrams using an UML modelling tool for a given case study and map design to code and implement a 3 layered architecture.

Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.

4. Document the Software Requirements Specification (SRS) for the identified system.

5. Identify use cases and develop the Use Case model.

6. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.

7. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams

8. Draw relevant State Chart and Activity Diagrams for the same system.

9. Implement the system as per the detailed design

10. Test the software system for all the scenarios identified as per the usecase diagram

11. Improve the reusability and maintainability of the software system by applying appropriate design patterns.

12. Implement the modified system and test it for various scenarios

1. Case Tools

2. Passport automation system 3.

3. Book bank

4. .Exam Registration

5. Stock maintenance system

6. Online course reservation system
7. Airline/Railway reservation system
8. Software personnel management system
9. Credit card processing
10. E-book management system
11. Recruitment system
12. Foreign trading system
13. Conference Management System
14. BPO Management System
15. Library management system
16. Student information system

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	List the importance of basic principles in object oriented modelling for appropriate analysis and design of given scenarios.	U	PSO-1

CO-2	Make use of building blocks and different views for creating conceptual model architectural view of system in Unified Software Development Life cycle.	Ap	PSO-1,2,3
CO-3	Demonstrate static and dynamic aspects of the system through UML diagrams for specifying structure and interaction of objects during runtime.	Ap	PSO-1,2,3
CO-4	Identify basic building blocks for visualizing artifacts of an Object Oriented System.	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: OBJECT ORIENTED ANALYSIS AND DESIGN

Credits: 3:0:1(Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

CO 1	List the importance and use of basic principles in object oriented modelling for appropriate analysis and design of given scenarios.	PO-6,7 PSO-1	U	**F, C**	**L**	**-**
CO 2	Make use of building blocks and different views for creating conceptual model architectural view of system in Unified Software Development Life cycle.	PO-6,7 PSO-1,2,3	Ap	**F, C, P**	**L**	**P**

CO 3	Demonstrate static and dynamic aspects of the system through UML diagrams for specifying structure and interaction of objects during runtime.	PO-6,7 PSO-1,2,3	Ap	**F, C, P**	**L**	**P**
CO 4	Identify basic building blocks for visualizing artifacts of an Object-Oriented System.	PO-6,7 PSO-1	U	**F, C**	**L**	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**	**-**

CO 2	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**2**	**-**
CO 3	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**2**	**-**
CO 4	**-**	**-**	**–**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**	**-**

Correlation Levels:

Level	**Correlation**
-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Project Evaluation**	**End Semester Examinations**

CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓

3. CRYPTOGRAPHY AND NETWORK SECURITY

Discipline	Computer Science				
Course Code	UK6DSCCSC302				
Course Title	CRYPTOGRAPHY AND NETWORK SECURITY				
Type of Course	DSC				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week

	4	4 hours	-	-	4 hours

Pre-requisites	Basic knowledge in Computer Networks is desirable.
Course Summary	This course equips learners to understand the core principles of cryptography and its significance in ensuring secure communication over networks, gain proficiency in different cryptographic techniques and to learn the concepts of digital signatures and their role in verifying the authenticity and integrity of digital documents.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Concepts of Security**	**12**
	1	Introduction, The Need for Security, Security Approaches and Principles.	
	2	Cryptography Techniques: Basic Terms, Plain Text, Cipher text, Substitution Techniques, Transposition Techniques, Fiestel Cipher.	
	3	Encryption, Decryption, Symmetric and asymmetric key Cryptography.	

	4	Steganography, Possible types of Attacks.	
II	**Cryptography**		**12**
	5	An Overview of Symmetric key Cryptography.	
	6	Data Encryption Standard (DES) and Advanced Encryption Standard(AES).	
	7	History and Overview of Asymmetric Key Cryptography.	
	8	The RSA Algorithm, Digital signatures: Digital Signature Algorithm. ElGamal Algorithm.	
III	**Public Key Infrastructure**		**12**
	9	Digital certificates, Public Key Cryptography Standard.	
	10	The PKIX Model, Transport Layer Security.	
	11	Secure Socket Layer, Crypto Currency and Bitcoin. Message Digest, SHA Algorithm.	
IV	**Authentication Mechanisms**		**12**
	12	Authentication Basics, Passwords, Biometric Authentication	

	13	Key Distribution Center, Security handshake Pitfalls, Attacks on Authentication Schemes.	
	14	Firewalls: Architecture, Generation and Types. Virtual Private Network. Email Security: PGP and S/MIME.	
V		**Flexi Module (Not included for end Semester Examination)**	**12**
	21	Case Study : Cryptographic implementations using Java.	

References

Core

- **Kahate, "Cryptography and Network Security", McGrawHill**
- **"Cryptography and Network Security", ITL Education Solutions Limited, Pearson.**
- **William Stallings, "Cryptography and Network security", Pearson.**
- **Dr. Wm. Arthur Conklin, Dr. Gregory White, "Principles of Computer Security Sixth Edition", McGraw Hill.**

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize the Basic Concepts of Security	U	PSO-1,2

CO-2	Illustrate the working of Cryptographic Algorithms	Ap	PSO-1,3
CO-3	Interpret about public key infrastructure in cryptography	Ap	PSO-1,3
CO-4	Choose over various Authentication Systems	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: CRYPTOGRAPHY AND NETWORK SECURITY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture(L)/ Tutorial (T)**	**Practical (P)**
CO-1	Summarize the Basic Concepts of Security	PO-1,6,7 PSO-1,2	U	F, C	L	**-**
CO-2	Illustrate the working of Cryptographic Algorithms	PO-1,7 PSO-1,3	U	F, C, P	L	**-**

CO-3	Interpret about public key infrastructure in cryptography	PO-6,7 PSO-1,3	U	F, C, P	L	**-**
CO-4	Choose over various Authentication Systems	PO-6, 7,8 PSO-1,2,3	U	F, C	L	**-**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**	**1**	**-**	**-**
CO 2	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**-**	**1**	**-**
CO 3	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**2**	**-**	**2**	**-**
CO 4	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**1**	**2**	**2**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments /Case Study
- · Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓

CO 4		✓		✓	

4. OPERATING SYSTEM

Discipline	**COMPUTER SCIENCE**					
Course Code	**UK6DSCCSC303**					
Course Title	**OPERATING SYSTEM**					
Type of Course	**DSC**					
Semester	**VI**					
Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	4	**4 hours**	**-**		**4 hours**	
Pre-requisites	Basic awareness of Computer systems is desirable					

Course Summary	This course provides a comprehensive exploration of fundamental concepts and practices governing modern computer operating systems. Topics include process management, memory allocation, file systems, concurrency, and deadlock handling. Through theoretical study and practical application, students gain insights into OS design principles and algorithms.

Detailed Syllabus: OPERATING SYSTEM

Module	**Unit**	**Content**	**Hrs**
I		**Introduction**	**12 hrs**
	1	Introduction: What Operating System Do, Computer System Organization, Computer System Architecture.	
	2	Operating System Structure, Distributed Systems.	
	3	Operating System Services, User Operating System Interface, System Calls.	
	4	The Process, Process states, Process Control Block, Threads.	
II		**Process Management**	**12**

	5	Process Scheduling, Operations on Processes, Interprocess Communication, CPU Scheduler, Preemptive and Non-Preemptive Scheduling, Dispatcher, Scheduling Criteria.	
	6	Scheduling Algorithms: FCFS, SJF, Priority Scheduling and Round-Robin Scheduling.	
	7	Synchronization: The Critical-Section Problem, Semaphores, Monitors.	
	8	Deadlocks: Deadlock Charecterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery from Deadlock.	
III		**Memory Management**	**12**
	9	Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation.	
	10	Paging and Segmentation.	
	11	Virtual Memory Management: Background, Demand Paging, Thrashing.	
	12	Page Replacement: FIFO, LRU and Optimal Page Replacement.	
IV		**Storage Management**	**12**

	13	File System Structure, File System Implementation, File Allocation Methods.	
	14	Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN and LOOK Scheduling.	
V	**Flexi Module (Not included for End Semester Examination)**		**12**
	15	Distributed Operating System: Motivation, Types of Distributed Operating Systems.	
	16	Distributed File Systems: Naming and Transparency, Remote File Access.	
	17	Real Time Systems: System Characteristics, Features of Real-Time Kernels.	

References

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating Systems Principles", Wiley India Edition, 2018.
2. Gary Nutt, Nabendu Chaki, Sarmistha Neogy, "Operating Systems", Third Edition,Pearson.
3. Andrew S Tanenbaum, Albert S Woodhull, "Operating Systems Design and Implementation", Eastern Economy Edition, PHI.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basic functions and services of operating system.	U	PSO-1
CO-2	Compare various process scheduling methods and to demonstrate deadlock handling.	Ap	PSO-1,2
CO-3	Demonstrate the memory management techniques and page replacement algorithms	Ap	PSO-1,2
CO-4	Sketch file allocation methods and disk scheduling.	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: OPERATING SYSTEM

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

CO-1	Summarize the basic functions and services of operating system.	PO-1,6,7 PSO-1	U	F, C	L	-
CO-2	Compare various process scheduling methods and to demonstrate deadlock handling.	PO-1,6,7 PSO-1,2	Ap	F, C, P	L	-
CO-3	Demonstrate the memory management techniques and page replacement algorithms	PO-1,6,7 PSO-1,2	Ap	F,C,P	L	-
CO-4	Sketch file allocation methods and disk scheduling.	PO-1,6,7 PSO-1,2	Ap	F, C,P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	-	1	2	-	-
CO 2	1	-	-	-	-	2	2	-	2	2	-	-
CO 3	1	-	-	-	-	2	2	-	2	2	-	-
CO 4	1	-	-	-	-	2	2	-	2	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- **Quiz / Assignment/ Quiz/ Discussion / Seminar**
- **Midterm Exam**
- **Programming Assignments**
- **Final Exam**

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Quiz	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

4. FUNCTIONAL PROGRAMMING

Discipline	Computer Science				
Course Code	UK6DSCCSC304				
Course Title	FUNCTIONAL PROGRAMMING				
Type of Course	**DSC**				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Basic knowledge in Mathematics and Artificial Intelligence is desirable.				
Course Summary	This course introduces students to functional programming concepts and languages, emphasizing the benefits of immutability, higher-order functions, and declarative programming. Students will learn to write concise, elegant, and scalable code using functional programming techniques.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Functional programming**	**15 hrs**
	1	Functional programming: Functions and types; Functional composition	
	2	The Haskell Platform, Environment setup	
	3	Expressions, types and values: A session with GHCi, Names and Operators-sections and lambda expressions-Evaluation; Types and type classes, Printing values, Modules, Haskell layout	
II		**Numbers and Lists**	**15**
	4	**Numbers**: The type class Num, Other numeric type classes, Computing floors, Binary Search, Natural Numbers,	
	5	**List**: Notation; Enumerations; List Comprehensions; Some basic operations; Concatenation; concat, map and filter; zip and zipWith; Common words	
III		**Proofs and Efficiency**	**15**
	6	**Proofs**: Induction over Natural Numbers; Induction over lists-Induction over partial lists, Induction over infinite lists; The	

		function foldr-Fusion, Variant; The function foldl; The function scanl; The maximum segment sum	
	7	**Efficiency**: Lazy evaluation; Controlling space- Two more application operators; Controlling time; Analysing Time; Accumulating parameters; Sorting-Merge sort, Quick sort	
IV	**Imperative Functional Programming**		**15**
	8	**IO monad**: IO Monad-do-notation; Monad Laws; The state Monad; The ST Monad; Mutable arrays- Hash table; Immutable Arrays	
V		**Flexi Module: Not included in End Semester Exams**	**15**
	9	**A simple Equational calculator**-Basic considerations; Expressions; Laws; Calculations; Rewrites; Matchings; Substitutions; Testing the calculator	

References

Core

1. Richard Bird, “Thinking functionally with Haskell”, Cambridge University Press, 2015.

Additional

1. Graham Hutton, Programming in Haskell, 1e, Cambridge University Press, 2007.
2. KeesDoets and Jan van Eijck, The Haskell Road to Logic, Maths and Programming, 2e, College Publications, 2004.

3. Greg Michaelson, an Introduction to Functional Programming through Lambda Calculus, 1e, Dover Publications, 2011
4. Chris Okasaki, Purely Functional Data Structures, 1e, Cambridge University Press, 1999.

LAB EXERCISES

1. Program to find common words in a text.
2. Program to write numbers as words.
3. Program to calculate values of regular expression.
4. Implement Numbers.
5. Implement List.
6. Implement induction over natural numbers.
7. Implement induction over infinite lists.
8. Implement the functions foldr, foldl and scanl.
9. Implement maximum segment sum.
10. Implement Merge sort.
11. Implement Quick sort.
12. Implement IO Monad.
13. Implement Mutable arrays.
14. Implement immutable arrays.
15. Develop A simple Equational calculator.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Discuss the foundational concepts in Functional Programming	U	PSO-1
CO2	Explain about Numbers and Lists in Functional Programming	U	PSO-1,3
CO3	Infer the relevance of proofs and efficiency through various methods	U	PSO-1,3
CO4	Summarize the concepts in Imperative Functional Programming	U	PSO-1, 2, 3,

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: FUNCTIONAL PROGRAMMING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)

CO1	Discuss the foundational concepts in Functional Programming	PO-6,7 PSO-1, 3	U	F, C, P	L	P
CO2	Explain about Numbers and Lists in Functional Programming	PO-6,7 PSO-1, 3	U	F, C, P	L	P
CO3	Infer the relevance of proofs and efficiency through various methods	PO-3, 6, 7 PSO-1, 3	U	F, C, P	L	P
CO4	Summarize the concepts in Imperative Functional Programming	PO-2, 3, 4, 5, 6, 7 PSO-1, 2, 3	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO 1	-	-	-	-	-	3	3	-	3	-	3	-
CO 2	-	-	-	-	-	3	3	-	3	-	3	-
CO 3	-	-	1	-	-	3	3	-	3	-	3	-
CO 4	-	2	2	3	1	3	3	-	3	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Quiz/Seminar/Assignment	Lab Assignments	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

6. INTERNET OF THINGS

Discipline	**COMPUTER SCIENCE**					
Course Code	**UK6DSCCSC305**					
Course Title	**INTERNET OF THINGS**					
Type of Course	**DSC**					
Semester	**VI**					
Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	4	**3 hours**	**-**	**2 hours**	**5 hours**	
Pre-requisites	Knowledge on Computer Networks is desirable					
Course Summary	This course provides an introduction to Internet of Things (IoT), covering fundamental concepts, technologies, applications, and challenges associated with interconnected devices.					

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**

			(L+P)
I		**Introduction to IOT**	**15 hrs**
	1	IoT Definition, characteristics of IoT, IoT Elements	
	2	Genesis of IoT; Convergence of IT and OT; Challenges	
	3	Engineering IoT Networks: Sensors Actuators and Smart Objects; Sensor Networks, Wireless Sensor Networks.	
II		**IoT Network Architecture and Design**	**15**
	4	Drivers Behind New Network Architectures; One M2M IOT Standardized Architecture; IOT World Forum Standardization Architecture	
	5	A Simplified IoT Architecture; The Core IoT Functional Stack; IoT Data Management and Compute Stack	
III		**IOT Hardware, Software**	**15**
	6	Overview of IoT hardware platforms (Arduino, Raspberry Pi)	
	7	Basics of Arduino, Arduina hardware, Arduino IDE	
	8	Introduction to IoT operating systems (Linux, FreeRTOS)	

	9	Programming languages for IoT development (e.g., Python, C/C++)	
	10	IoT development frameworks and tools (Real Time Innovations, AWS IoT, WATSON IoT platform); Open IoT	
IV	**Domain specific IoT**		**15**
	11	Connected roadways: Vehicle Tracking system based on GPS and GSM	
	12	IoT Applications for Smart home: IOT based Smart Doorbell system	
	13	Smart City: Smart Parking system; Smart Street light	
	14	IoT for environment: IoT based Air quality Monitoring system; Smart water management	
	15	IoT for healthcare: Smart walking stick for visually impaired	
V		**Flexi Module- Not Considered for End Semester Exams**	**15**

	16	Data link Layer: IEEE 802.15.4, Bluetooth Low Energy, ZigBee Smart Energy; Network layer: IP- Version 4 and 6, 6LoWPAN,6TiSCH, RPL; Transport layer: TCP, UDP, DCCP; Session Layer: HTTP, CoAP, MQTT; Service Layer - one M2M, ETSI M2M; Security in IoT Protocols - MAC 802.15.4, 6LoWPAN, Application Layer	

References

1. David Hanes, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", Cisco Press, Pearson, 2017.
2. Mayur Ramgir, "Internet of Things: Architecture, Implementation and security"
3. Margolis, Michael. "Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects", O'Reilly Media, Inc.", 2011.

Additional References

1. Raj Kamal, "Internet of Things", 2nd Edition, 2022.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

Lab Exercises

1. Prepare a report of various IOT components
2. Analyse various IOT architectures and prepare the list of protocols used in each layer.
3. Familiarize various IOT hardware, software Operating system.
4. Prepare an IOT architecture for various applications in IOT.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Restate the basic characteristics, elements and challenges faced in IoT (Ap)	U	PSO-1
CO2	Compare different IOT Network Architecture and Design	Ap	PSO-1,2,3
CO3	Illustrate the role of various hardware and Software components in IOT	Ap	PSO-1,2,3
CO4	Outline the role of IOT in major domains through Domain specific IOT applications	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: INTERNET OF THINGS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)

CO 1	Restate the basic characteristics, elements and challenges faced in IoT (Ap)	PO-2, 6,7 PSO-1, 2, 3	Ap	F, C	L	-
CO 2	Compare different IOT Network Architecture and Design	PO-2,6, 7 PSO-1, 2, 3	Ap	F, C, P	L	-
CO 3	Illustrate the role of various hardware and Software components in IOT	PO-2,6,7 PSO-1,2,3	Ap	F, C, P	L	P
CO 4	Outline the role of IOT in major domains through Domain specific IOT applications	PO-2, 5,6,7 P PSO-1, 2, 3	U	F, C	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**-**	**-**	**-**
CO 2	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**3**	**1**	**-**
CO 3	**-**	**2**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**3**	**1**	**-**
CO 4	**-**	**3**	**-**	**-**	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**

Correlation Levels:

Level	Correlation
-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam

- Lab Assignme**nts**
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Quiz**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓

DSE

7. IMAGE SECURITY

Discipline	**COMPUTER SCIENCE**
Course Code	**UK6DSECSC300**
Course Title	**IMAGE SECURITY**

Type of Course	**DSE**					
Semester	**VI**					
Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	4	**3 hours**	**-**	**2 hours**	**5 hours**	
Pre-requisites	Basic Knowledge on images and cryptography is desirable					
Course Summary	This course aims to introduce the main concepts and techniques of image security and applications.					

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**

I		**Introduction**	**12**
	1	Basic concepts: Pixel, Intensity, Types- Binary, Grayscale and colour images, Image representation	
	2	Image security tools: GIMP, Image Maick, Exif tool, OpenPuff, Steghide	
	3	Basics of secret sharing: Shamir's secret sharing scheme	
II		**Visual Cryptography**	**12**
	4	Introduction; Visual Cryptography; Applications: Trojan-Free Secure Transaction, Authentication, Access Control, Transaction Tracking, Watermarking	
	5	Preliminaries; Fundamental Principles of Visual secret sharing: Pixels Expansion Contrast, Basis Matrices, Concept of Black and White Pixels in Visual Cryptography	
	6	Formation of A basis matrix: Observations Related to The Basis Matrix, Creation Approach of Naor and Shamir, Essential Conditions for a Basis Matrix	
III		**Digital Watermarking**	**12**

	7	Introduction: Significance of the Word “Watermark”, Importance of Watermarking; Applications: Proof of Ownership, Ownership Identification, Broadcast Monitoring, Content Authentication, Tamper Recovery, Transaction Tracking, Copy Control, Device Control	
	8	Classification of Watermarking Techniques: Based on Visibility-Visible watermarking, Invisible/hidden watermarking, Based on Degree of Resistance to Attacks, Robust watermark, Fragile watermark, Semi-fragile watermark, Dual watermarking; Based on Watermark Detection/Extraction: Non-blind/Non-oblivious watermarking, Semi-blind watermarking, Blind/oblivious watermarking	
	9	Properties of watermarks: Robustness, Fragility, Imperceptibility, Capacity, Security, Computational Cost	
	10	Attacks: Types of Attacks - Intentional attack, Unintentional attack, Example of Attacks in the Watermarking System: Removal attack, Addition attack, Cryptographic attacks, Copy paste attack, Print scan attack, Geometric attack	
IV	**Steganography**		**12**

	11	Introduction: Watermarking vs. Steganography, Need for Steganography; Applications: Positive Applications, Negative Applications Properties: Fidelity, Embedding Capacity, Embedding Effectiveness, Blind Extraction, Statistical Undetectability, Robustness, Security, Computation Cost Addition	
	12	Performance measures; Approaches: Embedding Capacity, Imperceptibility, False Positive and False Negative, Computation Cost; Mathematical notation and terminology: Steganalysis-Passive Steganalysis, Active Steganalysis, Malicious Steganalysis Detection: Blind Steganalysis, Targeted Steganalysis	
V		**Flexi module(Not for External Examination)**	**12**
	13	Emerging Technologies: Zero Knowledge proof, Tamper Evident Sensors, Multi factor authentication	
	14	Applications	

References

1. Shivendra Shivani, Suneeta Agarwal, Jasjit S. Suri, Handbook of Image-Based Security Techniques, CRC Press
2. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Third Edition

LAB EXERCISES

1. Demonstrate basic concepts of images
2. Analyse an image security tool.
3. Implement a secret sharing scheme.
4. Implement visual cryptography schemes.
5. Implement digital watermarking methods
6. Demonstrate Stegnography methods.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Demonstrate the fundamental concepts of images and security.	U	PSO-1
CO-2	Illustrate the concepts of visual cryptography and its applications	Ap	PSO-1, 2, 3
CO-3	Experiment with digital watermarking	Ap	PSO-1,2,3
CO-4	Demonstrate the principles and techniques of stegnography	Ap	PSO-1, 2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: IMAGE SECURITY

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
CO-1	Demonstrate the fundamental concepts of images and security.	PO-6,7 PSO-1, 3	Ap	F, C	L	-
CO-2	Illustrate the concepts of visual cryptography and its applications.	PO6, 7 PSO-1,2,3	Ap	F, C	L	-
CO-3	Experiment with digital watermarking.	PO6, 7 PSO-1, 2,3	Ap	F, C	L	-

CO-4	Demonstrate the principles and techniques of steganography.	PO6, 7 PSO-1, 2,3	Ap	F, C	L	**-**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**-**	**2**	**-**
CO 2	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**3**	**-**
CO 3	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**3**	**-**
CO 4	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**3**	**-**

Correlation Levels:

Level	**Correlation**

-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment/ Quiz**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

8. MOBILE AND WIRELESS SECURITY

<table>
<tr><td>Discipline</td><td colspan="5">Computer Science</td></tr>
<tr><td>Course Code</td><td colspan="5">UK6DSECSC301</td></tr>
<tr><td>Course Title</td><td colspan="5">MOBILE AND WIRELESS SECURITY</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">VI</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td>-</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Awareness of concepts in Computer Networks and Security</td></tr>
<tr><td>Course Summary</td><td colspan="5">Security has been a concern in Wired and Wireless Networks. In this course an introduction to various security aspects in mobile and wireless networks are given.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Mobile and Wireless Security**	**15 hrs**
	1	Introduction to Mobile Communication, Security - Wired and Wireless	
	2	Security issues in Wireless and Mobile Communications. Need for Security in Wireless and Mobile Communications	
	3	Threats to Wireless and Mobile Devices - Data Theft, Device Control and System Access.	
	4	Security for Mobile Applications. Advantages and Disadvantages of Application-Level Security	
II		**Security at Device, Network and Server Levels**	**15**
	5	Mobile Devices' Security Requirements	
	6	Mobile Wireless Network Level Security	
	7	Server Level Security	
III		**Application-Level Security in Wireless Networks**	**15**
	8	Application of WLANS, Wireless Threats	

	9	Vulnerabilities and Attack methods over WLANs. Information Security Standards.	
	10	Security for 1G Wi-Fi and 2G Wi-Fi applications. Recent Security schemes for Wi-Fi applications	
	11	Recent Security Schemes for Wi-Fi Applications	
IV		**Security in MANETs and Ubiquitous Computing**	**15**
	12	MANETs - Introduction, Application and Features	
	13	Security challenges in MANETs. Security attacks on MANETs	
	14	External and Internal Threats for MANET Applications	
	15	Some of the Security Attacks on Ubiquitous Computing Networks and its solutions	
V		**Flexi Module: Not included in End Semester Exams**	**15**
	16	Introduction. Heterogeneous Wireless Network Architecture	
	17	Heterogeneous Network Application in Disaster Management	
	18	Security Problems and Attacks in Heterogeneous Wireless Networks	

	19	Security Solution for Heterogeneous Wireless Networks.	

Text Books

1. Pallapa Venkataram, Sathish Babu B, “Wireless and Mobile Network Security”, TMH 2010
2. Jim Doherty, “Wireless and Mobile Device Security”, Jones and Bartlett Publishers, Inc., 2nd Edition.
3. Wolfgang Osterhage, “Wireless Network Security”, CRC Press, 2nd Edition.
4. https://www.cisco.com/c/en/us/products/wireless/what-is-wi-fi-security.html

Course Outcomes

No	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	List the security threats in Mobile and Wireless Networks.	**U**	**PSO-1**
CO-2	Explain the different security measures in Mobile and Wireless Networks.	**U**	**PSO-1,2**

CO-3	Identify the various advantages and disadvantages of different security measures.	**U**	**PSO-1,2**
CO-4	Explain the various types of security issues in wireless networks.	**U**	**PSO-1,2,3**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MOBILE AND WIRELESS SECURITY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture(L)/ Tutorial (T)**	**Practical (P)**
1	List the security threats in Mobile and Wireless Networks.	PO- 1, 2, 6,7 PSO- 1	U	F, C	L	**-**

2	Explain the different security measures in Mobile and Wireless Networks.	PO- 1, 2, 3, 6,7 PSO- 1, 2	U	F, C	L	-
3	Identify the various advantages and disadvantages of different security measures.	PO- 2,6,7 PSO- 1, 2	U	F, C	L	-
4	Explainthe various types of security issues in wireless networks.	PO- 1, 3, 6,7 PSO -1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	**2**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**-**	**-**	

CO 2	**1**	**2**	**1**	**-**	**-**	**3**	**2**	**-**	**3**	**3**	**-**	
CO 3	**-**	**2**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**2**	**-**	
CO 4	**1**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**3**	**3**	**2**	

Correlation Levels:

Level	Correlation
-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓

CO 3	✓	✓		✓
CO 4		✓		✓

9. MOBILE APPLICATION DEVELOPMENT

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK6DSECSC306</td></tr>
<tr><td>Course Title</td><td colspan="5">MOBILE APPLICATION DEVELOPMENT</td></tr>
<tr><td>Type of Course</td><td colspan="5">SEC</td></tr>
<tr><td>Semester</td><td colspan="5">VI</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>3</td><td>2 hours</td><td>-</td><td>2 hours</td><td>4 hours</td></tr>
</table>

Pre-requisites	Basic knowledge of programming concepts and familiarity with object-oriented programming languages is desirable**.**
Course Summary	This course provides an introduction to mobile application development using Flutter, a popular open-source UI software development kit created by Google. Students will learn the fundamentals of mobile app development, the process involved in creating mobile applications, and practical implementation through developing a simple mobile app using Flutter.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to Mobile App Development**	**12 hrs**
	1	Overview of mobile application development	
	2	Types of mobile applications (Native, Web, Hybrid)	
	3	Introduction to Flutter and its advantages	
	4	Basics of UI/UX design for mobile applications	
II		**Mobile App Development Process**	**12**

	5	Understanding the mobile app development lifecycle	
	6	Understanding user requirements and market analysis	
	7	Wireframing and prototyping	
	8	Development methodologies (Waterfall, Agile)	
	9	Testing and quality assurance	
III		**Introduction to Flutter**	**12**
	10	Introduction to Dart programming language	
	11	Setting up Flutter environment	
	12	Understanding Flutter architecture and components	
	13	Widgets and their usage in Flutter	
	14	State management in Flutter applications	
IV		**Developing an App in Flutter**	**12**
	15	Hands-on coding exercises to develop a basic Flutter app	

	16	Implementing UI components, navigation, and state management in Flutter	
	17	Integrating APIs and handling data in Flutter apps	
	18	Debugging and troubleshooting common issues in Flutter development	
	19	Deploying Flutter apps to Android and iOS devices	
V	**Flexi Module: Not included for End Semester Exams**		**12**
	20	Exploration of emerging trends and techniques in mobile app development	
	21	Case studies of successful mobile apps developed using Flutter	
	22	Comparative analysis of Flutter with other mobile app development frameworks	
	23	Discussion on advanced topics such as performance optimization, responsive design, and accessibility in Flutter apps	

References:

1. Erric Windmill, “Flutter in Action”, Manning Publications
2. "Learning Flutter: A Hands-On Guide to Building Native iOS and Android Apps with Dart" by Rae Hoyt, Jody Alkema, and Brian E. Long

3. Flutter Documentation" - Available online at https://flutter.dev/docs
4. "Mobile App Development: 101 Guide" by John Smith
5. "Agile Development with Flutter: Building Mobile Apps Using Flutter" by Paul Taylor
6. "UI/UX Design for Mobile Developers" by Jessica Brown
7. https://digilib.stekom.ac.id/assets/dokumen/ebook/feb_3872ce7467cbdc7beedfcdc12b2b607b0ba36429_1649057575.pdf
8. https://www.techaheadcorp.com/wp-content/uploads/2019/10/mobile-application-development-guide-pdf.pdf
9. https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf
10. https://docs.flutter.dev/cookbook

LAB EXERCISES

1. Hello World App: Create a simple Flutter app that displays "Hello, World!" on the screen.
2. Counter App: Build a Flutter app with a button and a counter displayed. Each button press increases the counter by one.
3. Basic Layouts: Experiment with arranging elements on the screen using Row and Column widgets.
4. Styling Text and Buttons: Explore changing the style of text and buttons in your Flutter app.
5. Simple Navigation: Implement basic navigation between two screens using Flutter's Navigator widget.
6. Creating Lists: Learn to display a list of items in your app using ListView widget.
7. User Input: Allow users to input text through text fields and display the input on the screen.
8. Fetching Data: Fetch data from a public API (e.g., weather forecast) and display it in your app.
9. Managing State: Experiment with updating the UI dynamically using setState.
10. Local Storage: Store and retrieve data locally on the device, like a simple to-do list.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline the fundamentals of mobile applications and their significance in the current digital landscape.	U	PSO- 1
CO-2	Demonstrate the mobile app development process from ideation to deployment, including design considerations, development stages, and testing.	Ap	PSO- 1,2,3
CO-3	Experiment in Flutter framework, its architecture, widgets, and features.	Ap	PSO- 1, 2, 3
CO-4	Develop a basic mobile application using Flutter.	Ap	PSO -1,2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: MOBILE APP DEVELOPMENT

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Outline the fundamentals of mobile applications and their significance in the current digital landscape.	PO- 6, 7 PSO- 1	U	F	L	-
CO-2	Demonstrate the mobile app development process from ideation to deployment, including design considerations, development stages, and testing.	PO- 6, 7 PSO- 1,2,3	Ap	F, C, P	L	P

CO-3	Experiment in Flutter framework, its architecture, widgets, and features.	PO- 2, 3, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO-4	Develop a basic mobile application using Flutter.	PO- 2, 3 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	3	-	3	-	-	-
CO 2	-	-	-	-	-	3	3	-	3	3	3	-
CO 3	-	3	3	-	-	3	3	-	2	3	3	-
CO 4	-	3	3	-	-	3	3	-	1	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Programming Assignments	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

10. EMERGING TECHNOLOGIES IN WEB DEVELOPMENT

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK6DSECSC307</td></tr>
<tr><td>Course Title</td><td colspan="5">EMERGING TECHNOLOGIES IN WEB DEVELOPMENT</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">VI</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td>0</td><td>4 hours</td></tr>
</table>

Pre-requisites	Nil
Course Summary	This course cover cutting-edge tools, frameworks, and methodologies that are shaping the future of web development.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction**	**12**
	1	Types of Websites: Static Website, Dynamic Website; Scripting: Server-side scripting, Client side scripting	
	2	Web publishing Fundamentals: Electronic Publishing	
	3	Web Hosting Service: History, Classification: Smaller hosting services, Larger hosting services, Shared Web Hosting Service	
	4	Website Testing: Web Application performance tool, Web security testing, Software testing; Testing Approach	
II		**Progressive Web Apps**	**12**
	5	Progressive Web Apps(PWA): Definition, History, Making a Progressive Web App, PWA Market Impact, PWA and App stores	

	6	Web App Manifest files: Save to Home screen, Making a web App Installable, Anatomy of Web App Manifest files	
	7	Service Workers: Introducing service workers	
III		**Web Assembly**	**12**
	8	Web Assembly; What problems does it solve? How does it work?	
	9	Structure of a WebAssembly module; How is WebAssembly secure? Languages for creating a WebAssembly module	
	10	WebAssembly modules: Known Sections, Custom Sections	
IV		**GraphQL**	**12**
	11	GraphQL; Queries and mutations- Fields, Arguments, Aliases, Fragments	
	12	Using variables inside fragments, Operation name, Variables, Variable Definitions, Default variables, Directives	
	13	Mutations: Multiple fields in mutations, Inline Fragments, Meta fields	
V		**Flexi module:- Not included for End Semester Exams**	**12**

	15	WebVR, WebRTC	
	16	Web Performance Optimization	

References

1. Er. V. K. Jain, “Advanced Programming in Web Designing”, Cyber Tech Publications, 2018. (Module 1)
2. John M. Wargo, “Learning Progressive Web Apps: Bring a Native App Experience to the Web” (Module 2)
3. Gerard Gallant, “WebAssembly in Action” (Module 3)
4. Samer Buna, "GraphQL in Action" (Module 4)

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Summarize the fundamentals of web hosting and publishing	U	PSO 1

CO2	Develop Progressive Web Apps (PWAs) integrating Web App Manifest and Service Workers effectively.	Ap	PSO 1, 2, 3
CO3	Develop secure WebAssembly modules, comprehending its structure, languages, and known sections	Ap	PSO 1, 2, 3
CO4	Make use of skills in GraphQL effectively.	Ap	PSO 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: EMERGING TECHNOLOGIES IN WEB DEVELOPMENT

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
CO1	Summarize the fundamentals of web hosting and publishing	PO-1, 6,7 PSO1	U	F, C	L	-

CO2	Develop Progressive Web Apps (PWAs) integrating Web App Manifest and Service Workers effectively.	PO-1, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	-
CO3	develop secure WebAssembly modules, comprehending its structure, languages, and known sections	PO-1, 6, 7 PSO- 1,2, 3	Ap	F, C, P	L	-
CO4	Make use of skills in GraphQL querying, mutations, and directives, applying variables, fragments, and meta fields effectively.	PO-1, 6, 7 PSO 1, 2,3	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

CO 1	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**-**	**-**	**-**
CO 2	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 3	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 4	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**

Correlation Levels:

Level	Correlation
-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓

18. DATA VISUALIZATION

Discipline	**COMPUTER SCIENCE**
Course Code	**UK6DSECSC302**
Course Title	**DATA VISUALIZATION**
Type of Course	**DSE**
Semester	**VI**

Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	4	**3 hours**	**-**	**2 Hours**	**5 hours**	
Pre-requisites	Basic Knowledge of visualization, Data and Image Models Design and Data Analysis is necessary					
Course Summary	This course helps the student to visualize data using various techniques.					

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Value of visualization**	**15**
	1	What is visualization? , Why create visualizations?	
	2	Conveying information to others– Telling stories with data – Data checking and verification.	
	3	Data Maps – Time series – Graphical excellence.	

II	**Data and Image Models**		**15**
	4	Visualization reference model – data: physical and abstract types– metadata, semantics.	
	5	Conceptual data – properties of images – conceptual model – relational data model – statistical data model.	
	6	Dimensions and measures – Roll-up and Drill- down	
	7	Visual encoding and sign systems - Multidimensional Data -Large design space.	
III	**Design of Visualization**		**15**
	9	Visual encodings, mapping data to image – Design criteria, expressiveness, effectiveness.	
	10	Data transformation –Presentation, titles, captions, annotations legend and grid lines- Testing designs.	
	11	Graphical integrity– Charting, Bar chart, Line chart, Dot plot, Tables	
	12	Heat-maps - Data-based grids – Multi-functioning labels	
IV	**Exploratory Data Analysis**		**15**

	13	EDA Vs Classical Data analysis – Goals of EDA	
	14	Assumptions– Data diagnostics – Statistical models into graphics	
	15	Confirmatory analysis – Hypothesis formulation	
	16	Testing procedure, significance – Graphical inference.	
V		**Flexi Module: Not Included for End Semester Exams**	**15**
	17	Text data; documents, SMS, tweets, logs, tags	
	18	Word clouds, word trees and tagclouds	
	19	Theme visualization – Topic modeling –Seriation, Quantification	

References

1. Tufte, E(2005). *Envisioning Information*, E. Tufte. Graphics Press,2005.

2. Tamara Munzner, Visualization Analysis and Design, CRC Press,2014.

3. Nathan Yau, Visualize This- The Flowing Data Guide to Design, Visualization, and Statistics, Wiley, 2011.
4. Scott Murray, Interactive Data Visualization for the Web, O'Reilly,2013.
5. Colin Ware, Visual Thinking for Design, Morgan Kaufman,2008.

LAB EXERCISES

1. Introduction to Matplotlib
2. Bar Chart Visualization
3. Scatter Plot Visualization
4. Histogram Visualization
5. Pie Chart Visualization
6. Box Plot Visualization
7. 3D Plot Visualization

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Differentiate between physical and abstract types	U	PSO-1,2,3
CO-2	Make use of visualization techniques, data maps, time series and text visualization	Ap	PSO-1,2,3
CO-3	Apply design for visualization	Ap	PSO-1,2,3
CO-4	Compare different data and image models	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DATA VISUALIZATION

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
1	Differentiate between physical and abstract types	PO-3,6,7 PSO-1,2,3	U	F,C,P	L	
2	Make use of visualization techniques, data maps, time series and text visualization	PO-3,6,7 PSO-1,2,3	Ap	F,C,P	L	**P**
3	Apply design for visualization	PO-3,5,6,7 PSO-1,2,3	Ap	F,C,P	L	**P**

4	Compare different data and image models	PO-3,5,6,7 PSO-1,2,3	Ap	F,C,P	L	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 2	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 3	**-**	**-**	**3**	**-**	**1**	**3**	**3**	**-**	**2**	**1**	**2**	**-**
CO 4	**-**	**-**	**3**	**-**	**1**	**3**	**3**	**-**	**2**	**1**	**2**	**-**

Correlation Levels:

Level	**Correlation**
-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Project Evaluation**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

19. BIG DATA TECHNOLOGIES USING HADOOP

Discipline	COMPUTER SCIENCE
Course Code	UK6DSECSC303
Course Title	BIG DATA TECHNOLOGIES USING HADOOP

Type of Course	DSE					
Semester	VI					
Academic Level	3					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week	
	4	3 hours	-	2 hours	5 hours	
Pre-requisites	UK3DSECSC201: Data Science Fundamentals					
Course Summary	The Course Big Data Technologies using Hadoop course is designed to introduce students to the concepts, tools, and technologies for processing and analyzing large-scale datasets commonly referred to as Big Data. The course focuses on Hadoop, an open-source framework that provides distributed storage and processing capabilities for handling massive volumes of data across clusters of commodity hardware. Students will learn the fundamentals of Hadoop ecosystem components and how to leverage them to solve real-world big data challenges.					

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction**	15
	1	Big Data: Definition, Properties, Applications; Hadoop: Introduction, Understanding the Hadoop Distributed File System (HDFS) Getting Data into Hadoop, Understanding Data Processing in Hadoop	
II		**Advanced Map Reduce Concepts**	15
	2	Advanced Map Reduce API Concepts, Introduction to Apache Pig, Advanced Pig Usage, Introduction to Apache Hive, Advanced Hive Usage YARN Administration.	
III		**SQL and Cluster management**	15
	3	SQL on Hadoop Overview, The Hadoop Ecosystem, Cluster Management using Apache Ambari, Scaling Hadoop, Advanced Cluster Configuration, the Hadoop User Environment (HUE).	
IV		**Advanced concepts in Hadoop**	15
	4	Advanced HDFS, Securing Hadoop, Troubleshooting Hadoop, Integrating Hadoop into the Enterprise, Hadoop in the Cloud, Introduction to NoSQL, Introduction to Apache Spark.	

References

1. **Jeffrey Aven, Hadoop In 24 Hours Sams Teach Yourself, 2018.**

Lab Exercises

1. Installation of Hadoop.
2. Implementation of Map reduce in Hadoop.
3. Demonstrate SQL queries in Hadoop.
4. Implement a word count program using map reduce concepts.
5. Implement cluster management in hadoop.
6. Implement NoSQL programs in MongoDB.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarise map reduce concepts	U	**PSO- 1**
CO2	Implement data processing in Hadoop and apply Hive to YARN administration	Ap	**PSO- 1,2**
CO3	Develop cluster management system using Apache Ambari	Ap	**PSO-1,2**

CO4	Restate HDFS, NoSQL and Apache Spark	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: BIG DATA TECHNOLOGIES USING HADOOP

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
CO 1	Summarise map reduce concepts	**PO -6, 7** **PSO- 1**	**U**	**F, C**	**T**	**P**
CO 2	Implement data processing in Hadoop and apply Hive to YARN administration	**PO- 6, 7** **PSO- 1, 3**	**Ap**	**F, C, P**	**T**	**P**

CO 3	Develop cluster management system using Apache Ambari	**PSO- 6, 7** **PO- 1, 3**	**Ap**	**F, C, P**	**T**	**P**
CO 4	Restate HDFS, NoSQL and Apache Spark	**PSO- 6,7** **PO -1,3**	**U**	**F, C, P**	**T**	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	3	3	-	2	-	2	-
CO 2	-	-	-	-	-	3	3	-	2	-	2	-
CO 3	-	-	-	-	-	3	3	-	2	-	2	-
CO 4	-	-	-	-	-	3	3	-	2	-	2	-

Correlation Levels:

Level	Correlation

-	**Nil**
1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- **Quiz / Assignment/ Discussion / Seminar**
- **Midterm Exam**
- **Lab Assignments**
- **Final Exam**

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Quiz/Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

20. RECOMMENDATION SYSTEMS

Discipline	**COMPUTER SCIENCE**				
Course Code	**UK6DSECSC304**				
Course Title	**RECOMMENDATION SYSTEMS**				
Type of Course	**DSE**				
Semester	**VI**				
Academic Level	**3**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**
	4	**3 hours**	**-**	**2 hours**	**5 hours**

Pre-requisites	Need to be aware of concepts of Machine Learning
Course Summary	This course introduces the principles, algorithms, and applications of recommendation systems, a key component of modern information retrieval and e-commerce platforms. Students will learn about various recommendation techniques, evaluation m**etrics,** and real-world case studies through lectures, hands-on exercises.

Detailed Syllabus:

Module	Unit	Content	Hrs (l+P)
I		**Introduction**	15
	1	Introduction, Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Recommender Systems and Human Computer Interaction, Recommender Systems as a Multi-Disciplinary Field, Emerging Topics and Challenges.	
II		**Data Mining Methods for Recommender Systems**	15
	2	Introduction; Data Preprocessing: Similarity Measures, Sampling, Reducing Dimensionality, Denoising	
	3	Classification: Nearest Neighbours, Decision Trees, Rule-based Classifiers, SVM	

	4	Cluster Analysis: k-Means. Alternatives to k-means; Association Rule Mining	
III		**Content-based Recommender Systems**	**15**
	5	Introduction; Basics of Content-based Recommender Systems; State of the Art of Content-based Recommender Systems; Trends and Future Research	
IV		**Collaborative Filtering**	**15**
	6	Introduction; Preliminaries; Matrix factorization models: SVD, SVD++, Time-aware factor model	
		Neighborhood models: Similarity measures, Similarity-based interpolation, Jointly derived interpolation weights.	
V		**Flexi module: Not included for external examination**	**12**
	7	Evaluating Recommendation Systems: Introduction, Experimental Settings, Recommendation System Properties	
	8	Applications of Recommendation systems	

References

1. Francesco Ricci · Lior Rokach · Bracha Shapira · Paul B. Kantor, "Recommender system handbook", Springer, Third edition, 2022.
2. Charu C Aggarwal, Recommender system:The textbook, Springer, 2016 .

<u>Lab Exercises</u>

1. Implement data preprocessing methods in the recommendation system.
2. Implement different data mining methods in recommendation systems.
3. Implement a content-based recommendation system.

4. Demonstrate Collaborative filtering.
5. Implement matrix factorization models such as SVD and SVD++.
6. Implement a different recommendation system.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarize Recommendation system concepts	**U**	**PSO 1**
CO2	Apply data mining methods	**Ap**	**PSO 1, 2, 3**
CO3	Make use of skills in Content-based Recommender Systems	**Ap**	**PSO 1, 2**
CO4	Explain different techniques for collaborative filtering	**U**	**PSO 1, 2**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: RECOMMENDATION SYSTEMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO 1	Summarize Recommendation system concepts	PO-1, 6,7 PSO1	U	F, C	L	P
CO 2	Apply data mining methods	PO-1, 6, 7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO 3	Make use of skills in Content-based Recommender Systems	PO-1, 6, 7 PSO-1,2	Ap	F, C, P	L	P
CO 4	Explain different techniques for collaborative filtering	PO-1, 6, 7 PSO 1, 2	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO 1	1	-	-	-	-	3	3	-	2	-	-	-
CO 2	1	-	-	-	-	3	3	-	2	1	2	-

CO 3	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**-**	**-**
CO 4	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**1**	**-**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

21. Deep Learning

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK6DSECSC305</td></tr>
<tr><td>Course Title</td><td colspan="5">DEEP LEARNING</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">VI</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial
per week</td><td>Practical
per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">UK101DSECSC: Introduction to Machine Learning</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course provides an in-depth exploration of deep learning, a subfield of machine learning focused on algorithms inspired by the structure and function of the brain's neural networks. Students will delve into neural network architectures, training algorithms, optimization techniques, and applications across various domains</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15 hrs**
	1	Introduction; Applications; Deep Learning Process; Artificial Neural Network: neurons, activation functions, layers, and architectures; Types of Deep Learning Network; Limitations	
II		**Deep Neural Networks**	**15**
	2	Deep Neural Networks: Deep Feedforward Networks, Example: XOR problem; Gradient Based learning: Cost functions, Output Units: Linear, Sigmoid, Softmax; Hidden Units: Rectified Linear Units; Bagging; Boosting ; Optimization strategies: Batch Normalization	
	3	Python packages for Deep Learning: TensorFlow, Keras	
III		**Convolutional Neural Networks**	**15**
	4	Convolutional Neural Networks: Introduction, Convolution operation, Pooling, Batch Normalisation, CNN architecture; Convolutional Networks and the History of Deep Learning	
IV		**Sequence Modeling**	**15**
	5	Recurrent Neural Networks; Bidirectional RNNs; Encoder-Decoder Sequence to sequence architecture; Deep Recurrent Neural Network; Recursive Neural Networks; Long Short-Term Memory; Deep Generative models: Boltzmann Machines	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	6	Computer Vision; Natural Language Processing; Speech Recognition; Medical Data Processing	

Reference Books

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press 2016
2. Aurelien Geron, .Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition, October 2022
3. Adam Gibson and Josh Patterson, “Deep Learning: A Practitioner’s Apprach”, O'Reilly Media, First Edition, 2017
4. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, O'Reilly Media, Second Edition, 2019
5. Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision", First Edition, 2018.

<u>Lab Exercises</u>

1. Implement basic functions in Keras and Tensorflow.
2. Implement a deep neural network using Keras
3. Implement a CNN using Keras.
4. Implement a RNN.
5. Implement LSTM.
6. Implement MNIST handwritten digits classification.
7. Implement object classification.
8. Implement classification in different scenarios.

<u>Course Outcomes</u>

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**

CO1	Summarize the concepts of deep learning	**U**	**PSO-1, 2,**
CO2	Apply deep neural networks in various real world problems	**Ap**	**PSO-1, 2, 3**
CO3	Use various methods in convolutional neural networks	**Ap**	**PSO- 1, 2, 3**
CO4	Illustrate the working various learning methods	**Ap**	**PSO-1, 2, 3**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Deep Learning

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO1	Summarize the concepts of deep learning	**PO- 2, 5, 6, 7** **PSO- 1**	**U**	**F, C, P**	**L**	**P**
CO2	Apply deep neural networks in various real world problems	**PO- 2,5, 6, 7** **PSO- 1, 2, 3,**	**Ap**	**F, C, P**	**L**	**P**

CO3	Use various methods in convolutional neural networks	**PO- 2, 5, 6, 7** **PSO- 1, 2, 3,**	**Ap**	**F, C, P**	**L**	**P**
CO4	Illustrate the working various learning methods	**PO-2, 5, 6, 7** **PSO- 1, 2, 3**	**Ap**	**F, C, P**	**L**	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO 1	-	2	-	-	1	3	3	-	3	-	-	-
CO 2	-	2	-	-	1	3	3	-	3	2	3	-
CO 3	-	2	-	-	1	3	3	-	3	2	3	-
CO 4	-	2	-	-	1	3	3	-	3	2	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Quiz/Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

SEC

22. MOBILE APP DEVELOPMENT

Discipline	**COMPUTER SCIENCE**
Course Code	**UK6SECCSC300**

Course Title	**MOBILE APP DEVELOPMENT**				
Type of Course	**SEC**				
Semester	**VI**				
Academic Level	**3**				
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**
	3	**2 hours**	**-**	**2 hours**	**4 hours**
Pre-requisites	Basic knowledge of programming concepts and familiarity with object-oriented programming languages is necessary.				
Course Summary	This course provides an introduction to mobile application development using Flutter, a popular open-source UI software development kit created by Google. Students will learn the fundamentals of mobile app development, the process involved in creating mobile applications, and practical implementation through developing a simple mobile app using Flutter.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction to Mobile App Development**	**12**
	1	Overview of mobile application development	
	2	Types of mobile applications (Native, Web, Hybrid)	
	3	Introduction to Flutter and its advantages	
	4	Basics of UI/UX design for mobile applications	
II		**Mobile App Development Process**	**12**
	5	Understanding the mobile app development lifecycle	
	6	Understanding user requirements and market analysis	
	7	Wireframing and prototyping	
	8	Development methodologies (Waterfall, Agile)	
	9	Testing and quality assurance	
III		**Introduction to Flutter**	**12**
	10	Introduction to Dart programming language	
	11	Setting up Flutter environment	
	12	Understanding Flutter architecture and components	
	13	Widgets and their usage in Flutter	
	14	State management in Flutter applications	
IV		**Developing an App in Flutter**	**12**
	15	Hands-on coding exercises to develop a basic Flutter app	

	16	Implementing UI components, navigation, and state management in Flutter	
	17	Integrating APIs and handling data in Flutter apps	
	18	Debugging and troubleshooting common issues in Flutter development	
	19	Deploying Flutter apps to Android and iOS devices	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	20	Exploration of emerging trends and techniques in mobile app development	
	21	Case studies of successful mobile apps developed using Flutter	
	22	Comparative analysis of Flutter with other mobile app development frameworks	
	23	Discussion on advanced topics such as performance optimization, responsive design, and accessibility in Flutter apps	

References:

1. Erric Windmill, “Flutter in Action”, Manning Publications
2. "Learning Flutter: A Hands-On Guide to Building Native iOS and Android Apps with Dart" by Rae Hoyt, Jody Alkema, and Brian E. Long
3. Flutter Documentation" - Available online at https://flutter.dev/docs
4. "Mobile App Development: 101 Guide" by John Smith
5. "Agile Development with Flutter: Building Mobile Apps Using Flutter" by Paul Taylor
6. "UI/UX Design for Mobile Developers" by Jessica Brown
7. https://digilib.stekom.ac.id/assets/dokumen/ebook/feb_3872ce7467cbdc7beedfcdc12b2b607b0ba36429_1649057575.pdf
8. https://www.techaheadcorp.com/wp-content/uploads/2019/10/mobile-application-development-guide-pdf.pdf
9. https://www.tutorialspoint.com/flutter/flutter_tutorial.pdf
10. https://docs.flutter.dev/cookbook

LAB EXERCISES

1. Hello World App: Create a simple Flutter app that displays "Hello, World!" on the screen.
2. Counter App: Build a Flutter app with a button and a counter displayed. Each button press increases the counter by one.
3. Basic Layouts: Experiment with arranging elements on the screen using Row and Column widgets.
4. Styling Text and Buttons: Explore changing the style of text and buttons in your Flutter app.

5. Simple Navigation: Implement basic navigation between two screens using Flutter's Navigator widget.
6. Creating Lists: Learn to display a list of items in your app using ListView widget.
7. User Input: Allow users to input text through text fields and display the input on the screen.
8. Fetching Data: Fetch data from a public API (e.g., weather forecast) and display it in your app.
9. Managing State: Experiment with updating the UI dynamically using setState.
10. Local Storage: Store and retrieve data locally on the device, like a simple to-do list.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Summarize about mobile applications and their significance in the current digital landscape.	**U**	**PSO 1**
CO2	Outline the mobile app development process from ideation to deployment, including design considerations, development stages, and testing.	**U**	**PSO 1**
CO3	Use Flutter framework, its architecture, widgets, and features.	**Ap**	**PSO 1, 2, 3**
CO4	Apply the acquired knowledge and skills to develop a basic mobile application using Flutter.	**Ap**	**PSO 2, 3**

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Credits: 2:0:2 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/ PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**

CO1	Summarize about mobile applications and their significance in the current digital landscape.	PO-6, 7 PSO-1	U	F, C, P	L	P
CO2	Outline the mobile app development process from ideation to deployment, including design considerations, development stages, and testing.	PO- 6, 7 PSO-1	U	F, C,P	L	P
CO3	Use Flutter framework, its architecture, widgets, and features.	PO- 2, 3, 6, 7 PSO-1, 2, 3	Ap	F,C, P	L	P
CO4	Apply the acquired knowledge and skills to develop a basic mobile application using Flutter.	PO- 2, 3 6, 7 PSO-1, 2, 3	Ap	F,C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	3	-	3	-	-	-
CO 2	-	-	-	-	-	3	3	-	3	-	-	-
CO 3	-	3	3	-	-	3	3	-	2	3	3	-
CO 4	-	3	3	-	-	3	3	-	1	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

23. GAME DEVELOPMENT

Discipline	**COMPUTER SCIENCE**

Course Code	**UKCSC304SEC**					
Course Title	**GAME DEVELOPMENT**					
Type of Course	**SEC**					
Semester	**VI**					
Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	3	**2 hours**	**-**	**2 hours**	**4 hours**	
Pre-requisites	Basic understanding of programming concepts and familiarity with computer systems and software usage is necessary.					
Course Summary	This course introduces students to the fundamentals of game design and development using Unity as the primary tool. It covers various aspects of game creation, from conceptualization to implementation, focusing on both theoretical and practical elements.					

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)

I		**Introduction to Game Design**	**12**
	1	Understanding the concept of game design	
	2	History and evolution of game design	
	3	Elements of game design: mechanics, dynamics, aesthetics	
	4	Principles of game design: immersion, balance, feedback	
	5	Tools used in game design	
II		**Fundamentals of Game Design**	**12**
	6	Game genres and classifications	
	7	Gameplay mechanics and dynamics	
	8	Storytelling in games	
	9	Player psychology and engagement	
III		**Stages of Game Development Process**	**12**
	10	Conceptualization and idea creation	
	11	Pre-production: game design documents, prototyping	
	12	Production: asset creation, coding, testing	
	13	Post-production: debugging, polishing, release	

IV	**Game Development using Unity**		**12**
	14	Overview of Unity interface and workspace	
	15	Basic game development concepts in Unity	
	16	Creating scenes, game objects, and scripts	
	17	Implementing basic gameplay mechanics in Unity	
V	**Flexi Module: Not included for End Semester Exams**		**12**
		Exploration of emerging trends and techniques in game development	
		Case studies of innovative games and development processes	
		Comparison of different game engines and development tools	
		Introduction to virtual reality (VR) and augmented reality (AR) in game development	

References:

1. K. Patinson, Game Development : Gaming Design & Programming Paperback – 1 January 2021.
2. Nicolas Alejandro Borromeo, Hands-On Unity 2022 Game Development - Third Edition Paperback – Import, 31 October 2022
3. Schell, J. (2019). The Art of Game Design: A Book of Lenses. CRC Press.
4. Fullerton, T., Swain, C., & Hoffman, S. (2014). Game Design Workshop: A Playcentric Approach to Creating Innovative Games. CRC Press.
5. https://www.coursera.org/specializations/game-design-and-development
6. Unity Technologies. (n.d.). Unity Documentation. Retrieved from https://docs.unity3d.com/Documentation/

LAB EXERCISES

Experiment 1: Installation and Familiarization

- Installation: Download and install Unity Hub and the latest version of Unity. Follow the instructions provided on the Unity website.
- Project Creation: Create a new 2D/3D project in Unity Hub.
- Interface Tour: Familiarize yourself with the Unity interface by exploring different panels such as Hierarchy, Scene, Game, Inspector, Project, and Console.

Experiment 2: Creating Objects and Manipulating Transformations

- Create Objects: Create primitive objects like cubes, spheres, and cylinders in the scene.
- Transformations: Experiment with moving, rotating, and scaling objects using the Transform component in the Inspector panel.

Experiment 3: Applying Materials and Textures

- Materials: Create basic materials and apply them to objects to change their appearance.
- Textures: Import textures and apply them to materials to add details to objects.

Experiment 4: Lighting and Shadows

- Directional Light: Add a directional light to the scene and observe how it affects the lighting and shadows.
- Point Light: Experiment with point lights and their effects on the scene.

Experiment 5: Scripting Basics

- Basic Scripting: Write a simple script to move an object based on user input (e.g., arrow keys or mouse input).
- Script Attachments: Attach the script to an object and observe the behavior in the game.

Experiment 6: Physics and Colliders

- Rigidbody: Add a Rigidbody component to an object and observe how it interacts with physics.
- Colliders: Experiment with different types of colliders (e.g., BoxCollider, SphereCollider) and their interactions.

Experiment 7: User Interface (UI) Elements

- Canvas Creation: Create a UI Canvas and add UI elements like buttons, text, and images.
- Button Interaction: Write scripts to handle button clicks and perform actions in the game.

Experiment 8: Particle Effects

- Particle System: Create a simple particle system (e.g., fire, smoke, sparks) and adjust its properties like emission rate and color.

Experiment 9: Audio Integration

- Audio Sources: Add audio sources to objects and play sounds (e.g., background music, footsteps) using scripts.

Experiment 10: Building and Deployment

- Building the Game: Build the game for different platforms (e.g., PC, mobile) using Unity's build settings.
- Testing: Test the built game on various devices and platforms to ensure compatibility and functionality.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize the principles of game design and development.	U	PSO-1

CO-2	Outline the fundamentals of designing interactive and engaging gameplay experiences.	U	PSO- 1
CO-3	Relate with the stages of the game development process.	Ap	PSO- 1,2, 3
CO-4	Use Unity for game creation and development.	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: Game Development

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize the principles of game design and development.	**PO- 2, 6, 7** **PSO- 1**	**U**	**F, C**	**L**	**P**
CO-2	Outline the fundamentals of designing interactive and engaging gameplay experiences.	**PO- 2, 6, 7** **PSO- 1**	**U**	**F, C, P**	**L**	**P**

CO-3	Relate with the stages of the game development process.	**PO- 3, 6, 7** **PSO-1, 2, 3**	**Ap**	**F, C, P**	**L**	**P**
CO-4	Use Unity for game creation and development.	**PO- 2, 3, 5, 6, 7** **PSO-1, 2, 3**	**Ap**	**F, C, P**	**L**	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	2	-	-	-	2	3	-	3	-	-	-
CO 2	-	2	-	-	-	2	3	-	3	3	-	-
CO 3	-	-	3	-	-	2	3	-	1	2	3	-
CO 4	-	2	3	-	2	2	3	-	1	3	3	-

Correlation Levels:

Level	Correlation
-	Nil

1	**Slightly / Low**
2	**Moderate / Medium**
3	**Substantial / High**

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO 1	✓	✓		✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

24.IMAGE PROCESSING AND ITS APPLICATIONS

Discipline	**COMPUTER SCIENCE**
Course Code	**UK6SECCSC302**

Course Title	**IMAGE PROCESSING AND ITS APPLICATIONS**					
Type of Course	**SEC**					
Semester	**VI**					
Academic Level	**3**					
Course Details	**Credit**	**Lecture per week**	**Tutorial per week**	**Practical per week**	**Total Hours/Week**	
	3	**2 hours**	**-**	**2 hours**	**4 hours**	
Pre-requisites	Basic knowledge on images and python is desirable					
Course Summary	This course provides an introduction to the fundamental concepts, techniques, and applications of image processing. Students will learn about various image processing operations, including image preprocessing, segmentation, and feature extraction, and how these techniques are applied in diverse fields such as healthcare, satellite imaging, and computer vision.					

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
	Introduction		**12**
	1	Fundamentals of Image Processing; Applications of Image Processing; Human Visual Perception: Human Eyes; Components of an Image Processing System: Digital Camera	

I	**2**	Image Preprocessing: Image scaling, Normalization, Noise Removal, Image Rotation, Image Translation	
	3	Image Segmentation: Preliminaries; Edge Detector: Edge, Line, and Point Detection (Basic Concepts only); Image Thresholding Techniques (Basic concepts only)	
	4	Introduction to OpenCV in Python: Functions for image preprocessing and segmentation	
II	**Morphological and Colour Image Processing**		**12**
	5	Morphological Image Processing: Preliminaries; Erosion and Dilation; Opening and Closing	
	6	OpenCV functions for Morphological Image processing	
	7	Colour Image Processing: Colour Fundamentals, Colour Models, Pseudocolour Image Processing, Basics of Full-Colour Image Processing	
III	**Image Mining and Content-Based Image Retrieval**		**12**
	8	Introduction; Image Mining; Image Features for Retrieval and Mining: Colour Features, Texture Features, Shape features, Topology, Multidimensional Indexing, Results of a Simple CBIR System	
	9	Recognition of Image Patterns: Introduction, Decision Theoretic Pattern Classification, K-Nearest-Neighbour Classification; Unsupervised Classification Strategies – clustering-K-Means Clustering Algorithm	
	10	Feature Extraction, classification, clustering functions in OpenCV	

IV	**Biometric And Biomedical Image Processing**		**12**
	11	Biometric Pattern Recognition: Feature Selection, Extraction of Front Facial Features, Extraction of side facial features, Face Identification; Signature Verification, Preprocessing of Signature Patterns	
	12	Biomedical Image Analysis: Microscopic Image Analysis, Macroscopic Image Analysis	
	13	Biomedical Imaging Modalities: Magnetic Resonance Imaging (MRI), Computed Axial Tomography, Nuclear and Ultrasound Imaging	
V	**Flexi Module (Not included for end semester exam)**		**12**
	14	Applications: Satellite image processing, Biomedical image processing, Object classification, Object Detection, Scene Understanding	

REFERENCES

1. **Tinku. K. Acharya and Ajay. K. Ray, " Image Processing: Principles and Applications", WILEY Inderscience publishers**
2. **Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson.**

3. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision (4th ed.). Cengage Learning.

4. Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.

5. OpenCV Documentation and Tutorials: https://opencv.org

LAB EXERCISES (Using OpenCV)

1. **I**mplement image loading and displaying functions

2. Implement image preprocessing operations such as Image scaling, Normalization, Noise Removal, Image Rotation, Image Translation.
3. Implement image thresholding.
4. Implement image segmentation.
5. Implement morphological image processing.
6. Implement image feature extraction methods.
7. Implement image classification problems.
8. Implement clustering.
9. Implement face recognition.
10. Implement a simple project on medical image processing.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO 1	Apply Image basic concepts and Preprocessing Techniques	Ap	PSO 1, 3
CO 2	Demonstrate morphological and colour image processing techniques	Ap	PSO 1, 3
CO 3	Use Image Mining and Content-Based Image Retrieval methods.	Ap	PSO 1, 3

CO 4	Use Image Processing Techniques in Biometric and Biomedical Contexts	Ap	PSO 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course:

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Apply Image basic concepts and Preprocessing Techniques	**PO-5,6,7** **PSO- 1, 3**	**Ap**	**F, C, P**	**L**	**P**
CO2	Demonstrate morphological and colour image processing techniques	**PO-5,6,7** **PSO- 1, 3**	**Ap**	**F, C, P**	**L**	**P**
CO3	Use Image Mining and Content-Based Image Retrieval methods.	**PO-5,6,7** **PSO- 1, 3**	**Ap**	**F, C, P**	**L**	**P**

CO4	Use Image Processing Techniques in Biometric and Biomedical Contexts	**PO-5,6,7** **PSO- 1, 2, 3**	**Ap**	**F, C, P**	**L**	**P**

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO 1	-	-	-	-	1	2	2	-	3	-	3	-
CO 2	-	-	-	-	1	2	2	-	3	-	3	-
CO 3	-	-	-	-	1	2	2	-	3	-	3	-
CO 4	-	-	-	-	1	2	2	-	3	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓

18. ENTREPRENEURSHIP IN IT

Discipline	**COMPUTER SCIENCE**
Course Code	**UK6SECCSC303**
Course Title	**ENTREPRENEURSHIP IN IT**
Type of Course	**SEC**
Semester	**VI**
Academic Level	**3**

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 hours	-		3 hours
Pre-requisites	General foundations in computer science is desirable**.**				
Course Summary	This course is a launchpad for aspiring student entrepreneurs. It equips the student with the principles, concepts and emerging IT trends supporting Entrepreneurship.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Entrepreneurship**	**12**
	1	Understanding Entrepreneurship- Concept, Relevance, Role of Entrepreneurship in growth of economy- economic growth, job creation, new Industry formation	
	2	Nature of Entrepreneurship startups- Risks and Entrepreneurship venture, Characteristics of Entrepreneurship	
	3	History of Entrepreneurship Revolution, Emergence of Entrepreneurship Class in India- Ancient Period, Early Pre-Independence period, Late Pre -Independence period, Post-Independence Entrepreneurship period,	

	4	Role of IT in business development- Tools used – Asana, Jira, Trello Current Entrepreneurial Trends -Digital anonymity, Return on domestic manufacturing and crafts, Data Analysis, Big Data, Mobile Computing and Commerce, IT virtualization, Social Media, Cloud Computing, IOT, AI, Role of SaaS, Principles, Data driven Decision making, Remote work and Collaboration Tools, Lean startup Movement, Minimum Viable Product, Lean vs DevOps vs Agile, Examples of Lean Startup Companies.	
II	**Paths to Entrepreneurship**		**12**
	5	Categories of Entrepreneurs-Pure and Non pure Entrepreneurs, Home based Entrepreneur, Serial or portfolio Entrepreneur, Nonprofit Entrepreneur, Corporate Entrepreneur, Qualities of an Entrepreneur	
	6	Qualities of an Entrepreneur	
	7	What is an Enterprise? Features of an Enterprise, Challenges and Opportunities of Entrepreneurship, Problems faced- Economic, Non-Economic and barriers	
	8	Theories of Entrepreneurship- Schumpter's Theory of innovation, Peter Drucker Theory of Entrepreneurship	
III	**Preparing for Entrepreneurship**		**12**
	9	Preparing to become and Entrepreneur- Find a mentor, Build a Professional Network, Learn about Entrepreneurs, Understand Personal and Business preferences, Improve or acquire critical skills, Study an Industry,	
	10	Understanding Business Environment, Creativity, Innovation and value Creation	
	11	Process of setting up a new business, Problems of a new venture- Marketing Problems, Production problems, Financial problems,	

		Managerial and Administerial problems, selection of a viable project- strengths and weaknesses	
	12	New venture Action Plan- Significance of writing a business plan	
	13	Role of IT in Entrepreneurship-Entrepreneurial Opportunities in IT -E- commerce, Graphics designing, 3D animaton, Web designer, Medical Transcription, Enabled Services Call Centres, Geographical Information systems, Networking, Data Mining & Warehousing, System software Companies, e-Education	
	14	Indian Start Up Ecosystem	
	15	Starup India Initiative	
	16	Raising Funds for startups- Means and sources of Finances	
	17	Venture Capital- meaning, Role, Significance	
IV	**Protecting Startup Assets**		**12**
	18	Intellectual Property Rights, Trademarks, Trade secrets, Copyrights	
	19	The Digital Millenium Copyright Act, Obtaining Copyright Protection	
	20	Patents, Inventions and patents, Patent types, Patent Process, Patent infringement	
	21	Intellectual Property Strategy	
	22	Relevant case studies	

<table>
<tr><td rowspan="4">V</td><td colspan="2">Flexi Module: Not included for End Semester Exams</td><td rowspan="4">12</td></tr>
<tr><td>23</td><td>Lean Startup Methodology Case Study- e.g. Dropbox, Uber, Spotify, Airbnb, General Electric, Qualcomm, Intuit</td></tr>
<tr><td>24</td><td>Business Incubators- Types- Academic Institutions, Non-Profit development corporations, For profit property development ventures, , Venture Capital Firms, Regional Incubators, Business Incubators vs Business Acclerators.</td></tr>
<tr><td>25</td><td>Contemporary Role Models- E.g.-Case 1-Flipkart Online Services
Case 2- Absolute Sports Pvt Ltd
Case 3- Narayana Hrudayalaya Pvt Ltd
Case 4- MittiCool Clay Creations</td></tr>
</table>

References

1. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, CengageLearning, 2016.

2. Sangeeta Sharma, Entrepreneurship Development, PHI Learning Pvt. Ltd, 2021.

3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha, Entrepreneurship, 11^{th} Edition, 2020, McGraw Hill

4. Ramesh Parihar, Chandra Sharma, Entrepreneurships and Start ups, Shree Ram Publications, 2023

5. Peter Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Crown Currency, 1!e, 2014

6. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown publisher, 2011

Web Resources

1. https://www.startupindia.gov.in/

2. https://www.makeinindia.com/

3. https://skillindia.gov.in/

4. htt https://msme.gov.in/ps://www.india.gov.in/website-ministrycommerce-and-industry

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize basic concepts of Entrepreneurship	U	PSO-1
CO-2	Categorize entrepreneurs and features of enterprises	U	PSO-1
CO-3	Explain the principles and tools that support building a startup	U	PSO-1
CO-4	Identify concepts that provide legal protection to startups and enterprises	U	PSO-1

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Entrepreneurship in IT

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**

CO-1	Summarize basic concepts of Entrepreneurship	PO-6,7 PSO-1	U	F, C	L	-
CO-2	Categorize entrepreneurs and features of enterprises	PO-6,7 PSO-1	U	F, C	L	
CO-3	Explain the principles and tools that support building a startup	PO-6,7 PSO-1	U	F, C	L	--
CO-4	Identify concepts that provide legal protection to startups and enterprises	PO-6,7 PSO-1	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	2	2	-	2	-	-	-
CO 2	-	-	-	-	-	2	2	-	2	-	-	-
CO 3	-	-		-	-	2	2	-	2	-	-	-
CO 4	-	-	--	-	-	2	2	-	-2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- **Quiz / Assignment/ Quiz/ Discussion / Seminar**
- **Midterm Exam**
- **Programming Assignments**
- **Final Exam**

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓		✓

LEVEL 4 (Level 400-499)

Semester 7

DSC

Course Code	Course Name	L(Hrs)	P(Hrs)	Credits	Remarks	Stream
UK7DSCCSC400	Research Methodology	4	0	4		
UK7DSCCSC401	Academic Writing and Publishing	3	2	4		
UK7DSCCSC402	Natural Language Processing	3	2	4		
UK7DSCCSC403	Cloud Computing	4	0	4		
UK7DSCCSC404	Block Chain Technologies	4	0	4		
UK7DSCCSC406	Prompt Engineering	3	2	4		

UK7DSCCSC407	Theory of Computation	4	0	4		
UK7DSCCSC408	Wireless Data Communication	4	0	4		
UK7DSCCSC409	Advanced DBMS	3	2	4		
UK7DSCCSC410	Bioinformatics	3	2	4		
UK7DSCCSC411	Image Processing and its applications	3	2	4		
UK7DSCCSC413	Soft Computing	4	0	4		
UK7DSCCSC414	Big Data Technologies using Hadoop	3	2	4	Vocational	Data Science
UK7DSCCSC415	Social Media analytics	4	0	4	Vocational	Data Science
UK7DSCCSC416	Text Mining	3	2	4	Vocational	Data Science

UK7DSCCSC418	Deep Learning	3	2	4	Vocational	Machine Learning
UK7DSCCSC419	Computer Vision	3	2	4	Vocational	Machine Learning
UK7DSCCSC420	Artificial Neural Networks	3	2	4	Vocational	Machine Learning
UK7DSCCSC422	Medical Transcription and Telemedicine	4	0	4	Vocational	Health Computing
UK7DSCCSC423	Medical Image Processing	3	2	4	Vocational	Health Computing
UK7DSCCSC424	Bioinformatics	3	2	4	Vocational	Health Computing

DSE

Course Code	**Course Name**	**Stream**	**L**	**P**	**C**
UK7DSECSC400	Cloud Security	Cyber Security	4	0	4
UK7DSECSC401	Social Media Analytics	Data Science	4	0	4

UK7DSECSC402	Computer Vision	Machine Learning	3	1	4
UK7DSECSC403	Full Stack Development	Web Development	3	1	4

1. RESEARCH METHODOLOGY

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSCCSC400</td></tr>
<tr><td>Course Title</td><td colspan="5">RESEARCH METHODOLOGY</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td>0</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Nil</td></tr>
</table>

Course Summary	This course provides a comprehensive awareness on types of research, design techniques involved, data processing strategies, formats of thesis and ethical considerations in research.

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Objectives and types of research**	**12**
	1	Motivation, objectives – Research Methods vs Methodology	
	2	Types of Research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empirical	
	3	Research Formulation – Defining and formulating the research problem, Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem	
	4	Literature review, Critical literature review, Identifying gap areas from literature review	
II		**Research Design and methods**	**12**
	5	Research Design-Basic principles, need of research design, Features of good design, Important concepts relating to research design	

	6	Developing a research plan – Exploration, Description, Diagnosis, Experimentation	
	7	Data collection and analysis- Sources of data-primary, secondary, tertiary	
	8	Methods of data collection – Observation, Interview, Questionnaires, Schedule and some other methods, Sampling methods – Probability, non-probability samples	
III	**Data Processing Strategies and Hypothesis**		**12**
	9	Editing, Coding, Classification tabulation, Graphical representation	
	10	Hypothesis – meaning and importance of hypothesis, sources of hypothesis, Types of hypotheses, Development of working hypothesis	
IV	**Reporting and thesis writing**		**12**
	11	Structure and components of scientific reports, Types of report, technical reports and thesis	
	12	Different steps in the preparation – Layout, structure and language of typical reports	
	13	Illustrations and tables, Bibliography, referencing and footnotes	

	14	Oral presentation, Planning, Preparation, Practice, Making presentation, Use of visual aids	
V		**Application of results and ethics**	**12**
	15	Environmental impacts – Ethical issues, Ethical committees	
	16	Commercialisation, copyright, royalty, intellectual property rights and patent law	
	17	plagiarism, citations and acknowledgement.	

References

1. Bhanwar Lal Garg, Renu Kavdia, Sulochana Agarwal, and Umesh Kumar Agarwal, An Introduction to Research Methodology, RBSA Publishers, 2015.
2. C R Kothari, Research Methodology: Methods and Techniques, New Age International (P) Ltd. Publishers, Second Edition 2004.
3. Anil K Dhiman, and Suresh C Sinha, Research Methodology, Ess Ess Publications, 2008
4. Arlene Fink, Conducting Research Literature Reviews: From the Internet to Paper, Fifth Edition, Sage Publications, 2019.
5. Barbara Gastel, and Robert A. Day, How to Write and Publish a Scientific Paper, Eighth Edition, Santa Barbara, California: Grenwood, 2016.

<u>Course Outcomes</u>

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize about research methods	U	PSO-1,2,
CO-2	Demonstrate competency in various methods of data collection, such as observation, interviews, questionnaires, schedules, and others, and apply them according to the research objectives.	Ap	PSO-1,2, 3
CO-3	Demonstrate proficiency in editing raw data, coding variables, classifying data into meaningful categories, and tabulating data for analysis.	Ap	PSO-1,2,3
CO-4	Develop skills in the various steps involved in preparing scientific reports, including layout, structure, and language considerations.	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: RESEARCH METHODOLOGY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Summarize about research methods	PO-1,6,7 PSO-1,2	U	F, C	L	-
CO2	Demonstrate competency in various methods of data collection, such as observation, interviews, questionnaires, schedules, and others, and apply them according to the research objectives.	PO-1,6, 7 PSO-1,2, 3	Ap	F, C	L	-

CO3	Demonstrate proficiency in editing raw data, coding variables, classifying data into meaningful categories, and tabulating data for analysis.	PO-1,6,7 PSO-1, 2,3	Ap	F, C	L	-
CO4	Develop skills in the various steps involved in preparing scientific reports, including layout, structure, and language considerations.	PO-1,6,7 PSO-1, 2, 3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	3	-	-	-	-	3	3	-	2	3	-	-
CO 2	3	-	-	-	-	3	3	-	2	3	-	-

CO 3	3	-	-	-	-	3	3	-	2	3	-	-
CO 4	3	-	-	-	-	3	3	-	2	3	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓

CO 3	✓		✓	✓
CO 4	✓	✓		✓

2. **ACADEMIC WRITING AND PUBLISHING**

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC401				
Course Title	**ACADEMIC WRITING AND PUBLISHING**				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	**Nil**				

Course Summary	The course introduces philosophy of science and ethics, research integrity, publication ethics, indexing and citation in databases, open access publications, research metrics, plagiarism tools, LaTeX software for creating presentations, academic writings and typesetting.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Ethics with respect to research and publications**	**15**
	1	**Ethics with respect to science and research**-Intellectual honesty and research integrity	
	2	Publication Ethics-Definition, introduction and importance, Intellectual Property Right, Principles of Transparency and Best Practice in Scholarly Publishing: COPE, WAME	
	3	Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)- types	
	4	Redundant publications: Duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data	

	5	Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals	
II	**Open access publication initiatives, software tools, Research metrics**		**15**
	6	Open access publications and initiatives- SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies,	
	7	UGC-CARE list of journals, Journal finder/journal suggestion tools - JANE, Elsevier Journal Finder, Springer Journal Suggester.	
	8	Software tools- Use of reference management software (Mendeley, Zotero) and anti-plagiarism software (Turnitin, Urkund) Databases -indexing databases, Citation databases: Web of Science, Scopus.	
	9	Research Metrics -Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score Metrics: h-index, g-index, i-10 index, altmetrics, Eigenfactor score	
III	**LaTeX for Academic Writing**		**15**

	10	Latex Editors, Online latex editors, Commands to basic layout of a latex file, preamble, Simple typesetting – spaces, quotes, dashes, special symbols, text positioning ,type style Sections.	
	11	Document Class - Font Size, paper size, Page Formats, Page Style, Page Numbering, formatting length, Parts of a document-Title, abstract, header and footer	
	14	Sectioning commands-\Part, \chapter, \section, \subsection, \susbsubsection, \paragraph, \subparagraph	
	15	Emphasizing words with \emph, \texttt, \textsl, \textit, \underline ,	
	16	Basic environments like enumerate, itemize, description, flushleft, flusuright	
	17	Adding footnotes, Table of Contents, Simple equations and adding reference	
	18	Tables : preparing a table and floating it, the longtable environment	
	19	Figures : Including graphics with graphicx package, controlling width, height etc, adding captions typesetting mathematics : basic symbols, equations, operators, the equation environment and reference to it.	

IV		**Advanced features of LaTeX**	**15**
	20	Creating Simple charts	
	20	Bibliography and citation commands, Bibliographic database commands, table of content, Index and Glossary commands, List of tables and figures	
	21	Creating slides with slide layouts, colors, fonts, and animations for presentation using document class beamer	
	22	Creating posters	
V		**Flexi Module_ Not included for End Semester Exams**	**15**
		Creating Bibliography file- types of bibliographic entries, URLs and DOIs in citations,TikZ package for drawing diagram	

Textbooks

1. Kerry Lynn Macintosh, Ethics and Integrity in Research: A Primer ,Oxford University Press
2. Rafael Ball,An Introduction to Bibliometrics- New Development and Trends , Chandos Publishing
3. Adil E. Shamoo and David B. Resnik,Responsible Conduct of Research ,Oxford University Press
4. Charles Lipson,Doing Honest Work In College – How to Prepare Citations, Avoid Plagiarism, and Achieve Real Academic Success, Chicago Guides to Academic Life

5. Tobias Oetiker, Hubert Partl, Irene Hyna and Elisabeth Schlegl Short, Introduction to LATEX 2e, Samurai Media Limited (or available online at https://mirror.niser.ac.in/ctan/info/lshort/english/lshort.pdf)
6. Leslie Lamport. LATEX: A Document Preparation System, Addison-Wesley, Reading, Massachusetts, second edition, 1994

Web Resources:

1. www:clarivate.com
2. TeXstudio : user manual, http://texstudio.sourceforge.net/manual/current/usermanual_en.html
3. Han Lin Shang,Writing posters with beamerposter package in LATEX (https://tug.org/pracjourn/2012-1/shang/shang.pdf)
4. The beamer class User Guide for version 3.71. (https://tug.ctan.org/macros/latex/contrib/beamer/doc/beameruserguide.pdf)

References

1. Measuring Scholarly Impact: Methods and Practice" edited by Ying Ding, Ronald Rousseau, and Dietmar Wolfram, Springer

Lab Exercises

1. Design and typeset a books incorporating chapters, sections, figures and referencing
2. Design and typeset a books incorporating Table of Content, chapters, sections, figures and referencing
3. Design and typeset two column article incorporating Abstract, sections, tables, and citations. Include list of tables and Table of contents.
4. Design and typeset two column article with formatting requirements such as double-spacing, graph, and citation.

5. Design and typeset a books using LaTeX and customize chapter headings, header and footer page layouts, and typography.
6. Design and typeset books using LaTeX and customize chapter headings, sections subsection, page layouts, and typography.
7. Design and typeset books using LaTeX and customize chapter headings, sections subsection and figure. Include list of figures
8. Design a professional resume or curriculum vitae (CV) using LaTeX.
9. Design and typeset professional letters using LaTeX.
10. Design scientific posters for a conference or presentation using LaTeX.
11. Design and typeset question papers in your field of stududy using LaTeX
12. Design and type set a two column research papers in your field of study, including sections such as abstract, introduction, methodology, results, discussion, and references.
13. Design and type set a dummy project report in your field of study, including sections such as abstract, introduction, methodology, results, discussion, and references.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Identify ethical considerations in research including matters of falsification, fabrication, plagiarism and the principles of transparency in scholarly publishing,	U	PSO-1
CO-2	Explain open access initiatives, familiarise with software tools for reference management and anti-plagiarism.	U	PSO-1,2

CO-3	Prepare academic documents using latex editors using document class, sectioning, environment, basic type setting commands, tables and figure	Ap	PSO-1,2
CO-4	Produce documents having charts, index, bibliography & citation, presentation slides and posters	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ACADEMIC WRITING AND PUBLISHING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
1	Identify ethical considerations in research including matters of falsification, fabrication, plagiarism and the principles of transparency in scholarly publishing.	PO-1,2, 3, 4,6,7, 8 PSO-1	U	F, C	L	

2	Explain open access initiatives, familiarise with software tools for reference management and anti-plagiarism.	PO-31, 2, 4, 6,7, 8 PSO-1, 2	U	F, C	L	
3	Prepare academic documents using latex editors using document class, sectioning, environment ,basic typesetting commands, tables and figure	PO-1, 2, 3, 4, 6,7 PSO-1, 2	Ap	F, C, P	L	P
4	Produce documents having charts, index, bibliography & citation, presentation slides and posters	PO-1, 2, 3, 4, 6,7 PSO-1, 2	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	-	-	2	2	1	1	2	-	-
CO 2	2	2	1	-	-	2	2	1	2	3	-	-
CO 3	2	2	1	-	-	2	2	1	2	2	-	-
CO 4	2	2	1	-	-	2	2	2	2	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4	✓		✓	✓

3. NATURAL LANGUAGE PROCESSING

Discipline	COMPUTER SCIENCE
Course Code	UK7DSCCSC402
Course Title	NATURAL LANGUAGE PROCESSING
Type of Course	DSC
Semester	VII
Academic Level	4

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3hrs		2 hrs	5 hours
Pre-requisites	Knowledge in Python Programming is desirable				
Course Summary	This course provides an introduction to the field of natural language processing, which focuses on the interaction between computers and human through natural language. Students will learn from fundamental concepts, techniques, applications of NLP, syntactic and, semantic analysis, to Information retrieval.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to NLP**	**15**
	1	Overview, What is NLP?. Origins of NLP, Language and Knowledge	
	2	The challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Successful Early NLP Systems	

	3	Language Modelling: Introduction, Language Models- Ngram character models, Ngram word models, Smoothing, Entropy, Hidden Markov Models (HMM)	
	4	Word Level Analysis-Overview, Introduction, Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Classes, Part of Speech Tagging, English word classes, Tag sets for English	
II		**Syntactic Analysis**	**15**
	5	Syntactic Analysis: Introduction, Context Free Grammar,	
	6	Semantic Analysis-Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation	
III		**Text Classification**	**15**
	7	Text Classification – Classification by data compression	
	8	Naïve Bayes Text Classification	
	9	Support Vector Machine (SVM)	
IV		**Retrieval**	**15**

	10	Information Retrieval – The Page rank Algorithm, Hyperlink Induced Topic Search (HITS) rank Algorithm Finite state automata for information extraction Probabilistic model for information extraction	
	11	Other Applications: Introduction, Automatic Text Summarization, Question Answering System	
	12	Case Study : Automated Voice Assistants, Chat Bots	
V	**Flexi Module- Not included in End Semester Exam**		**15**
		Emerging Trends and Innovations in NLP	
		WordNet, FrameNet, PropBank	

References

1. Tanveer Siddiqui, U.S Tiwary Natural Language Processing and Information Retrieval,Oxford University Press,2008.
2. Daniel Jurafsky and James H Martin,"Speech and Language Processing:An Introduction to Natural Language Processing,Computational Linguistics and Speech Recognition",2nd Edition,Prentice Hall,2009.
3. Anne Kao and Stephen R.Poteet (Eds), "Natural Language Processing and Text Mining",Springer Verlag London Limited 2007.
4. Artificial Intelligence:A Modern Approach,Stuart Russel,Peter Norvig,Third Edition.
5. Steven Bird,Ewan Klein and Edward Loper,Natural Language Processing with Python,First Edition,|OReilly Media,2009.

Lab Exercises

1. Word Level Analysis
2. Morphological Parsing
3. Spelling Error Detection and Correction
4. Part of Speech Tagging
5. N-gram word models
6. Hidden Markov Models (HMM)
7. Naïve Bayes Text Classification
8. Support Vector Machine (SVM)

Sample programs

PART A

1. Implement Word analysis.
2. Implement Morphology.
3. Implement Ngram Language Model.
4. Implement N-Grams Smoothing.

PART B

5. Implement text classification using Naïve Bayes.
6. Implement text classification using Support Vector Machine.
7. Implement Part of Speech Tagging on text using Hidden Markov model.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basic Concepts of NLP	U	PSO 1
CO-2	Extract information from text using concepts and methods from NLP including N-Grams, POS Tagging and Parsing	Ap	PSO-1,2
CO-3	Explain Syntax and Semantic analysis	U	PSO 1
CO-4	Implement different text classification and information retrieval methods	Ap	PSO 1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: NATURAL LANGUAGE PROCESSING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture(L)/ Tutorial(T)**	**Practical (P)**
CO1	Summarize the basic Concepts of NLP	PO- 1,6,7 PSO-1	U	F, C	L	-
CO2	Extract information from text using concepts and methods from NLP including N-Grams, POS Tagging and Parsing	PO-1,6,7 PSO-1,2	Ap	F, C, P	L	P
CO3	Explain Syntax and Semantic analysis	PO-1,6,7 PSO-1	U	F, C	L	-
CO4	Implement different text classification and information retrieval methods	PO-6,7 PSO-1,2	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**-**	**-**	**-**
CO 2	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**-**	**-**
CO 3	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**-**	**-**	**-**
CO 4	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**3**	**2**		**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓		✓	✓

4. BLOCKCHAIN TECHNOLOGY

Discipline	COMPUTER SCIENCE
Course Code	UK7DSCCSC404
Course Title	BLOCKCHAIN TECHNOLOGY
Type of Course	**DSC**
Semester	VII
Academic Level	4

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4			4 hours
Pre-requisites	Nil				
Course Summary	This course is meant to introduce the student to the realm of Block Chain Technology.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Introduction to Blockchain technology**	**12**
	1	Blockchain, Growth of Blockchain	
	2	Distributed system, History of Blockchain and Bitcoin, Generic elements of Blockchain . Benefits and limitations of Blockchain. Tiers of Blockchain technology. Features of Blockchain Technology	
	3	Consensus mechanism. Types of Consensus mechanism. Consensus in Blockchain.	

	4	Types of Blockchain. Decentralization. Routes of Decentralization, Smart Contracts, Decentralized Organization, Platforms for decentralization.	
II	**Blockchain Architecture**		**12**
	5	Architecture, Versions, Variants, Use cases	
	6	Blockchain and shared database	
	7	Introduction to Cryptocurrencies, Types, Applications	
	8	Bitcoins, Introduction to bitcoins, Bitcoin digital keys and addresses, Limitations of bitcoin, Transactions, Types of transactions	
	9	Structure of Blockchain, Structure of Blockchain header, Genesis block, Mining, Types of Miners, Mining rewards, POW, Mining algorithm	
III	**Title of the Module**: **Bitcoin network and payments**		**12**
	10	Wallets, Nondeterministic and Deterministic wallets, Hierarchical Deterministic Wallets, Brain Wallets, Paper Wallets, Online Wallets, Mobile Wallets	

	11	Bitcoin payments: Innovation in Bitcoin, Bitcoin improvement proposals, Bitcoin clients and APIs, Types of Bitcoin core clients	
	12	Text Mining – Categorization, Extraction based Categorization, Clustering, Hierarchical Clustering, Document Clustering, Routing	
	13	Alternative Coins	
IV		**Block Chain Platforms**	**12**
	14	Ethereum	
	15	Hyperledger	
	16	Blockchain Services, Consensus services Distributed Ledger, The peer to peer protocol, Ledger storage, Chaincode services	
	17	IOTA, EOS, Multichain, Bigchain	
	18	Advantages and Disadvantages of Blockchain Block chain Applications	
V		**Flexi Module: Not included in End Semester Exams**	**12**
	19	Application specific Blockchains, Enterprise grade Blockchains, Start-ups	

	20	Enhancements and Real-world implementations	

REFERENCES

Core

1. Mastering Blockchain – Imran Bashir

Additional References

2. Blockchain Technology,Concepts and Applications – Kumar Saurabh,Ashutosh Saxena
3. Fundamentals of Blockchain Technology-Dr. D.David Neels Ponkumar,Dr. S.Ramesh,Dr.K.Ramanan

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the basic concept and needs according to the application	U	PSO-1
CO-2	Explain the concept of Data storage.	U	PSO-1
CO-3	Relate with real life applications.	Ap	PSO-1,2,3
CO-4	Compare various Blockchain platforms.	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: BLOCKCHAIN TECHNOLOGY

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO-1	Summarize the basic concept and needs according to the application	PO-3,4, 6, 7 PSO-1,	U	F, C	L	-
CO-2	Explain the concept of Data storage.	PO-1,3,6,7 PSO-1	U	F, C	L	-
CO-3	Relate with real life applications.	PO-1,3,6,7 PSO-1,2. 3	Ap	F, C	L	-

CO-4	Compare various Blockchain platforms.	PO-3,6,7 PSO-1,2	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	1	-		3	3	-	2	1	-	-
CO 2	1	-	2	-	--	2	3	-	2	2	-	-
CO 3	1	-	2	-	-	2	3	-	2	3	-	-
CO 4	-	-	3	-	-	2	3-	-	2	3	-	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

5. PROMPT ENGINEERING

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSCCSC406</td></tr>
<tr><td>Course Title</td><td colspan="5">PROMPT ENGINEERING</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Prior knowledge in engineering principles and practices alonge with analytical skills will be desirable.</td></tr>
<tr><td>Course Summary</td><td colspan="5">Prompt Engineering is a course that delves into the creation, optimization and evaluation of prompts used for various categories of AI systems. The course covers techniques for designing prompts to elicit desired responses from language models. The course explores the various strategies for fine tuning prompts through experimentation and iteration to obtain specific outcomes.</td></tr>
</table>

	On an overall the prompt engineering course equips students with skills to harness the power of language models through strategic prompting.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Introduction to Prompt Engineering**	**15 hrs**
	1	Prompt Engineering- Definition, Importance of Prompt Engineering, Role of Prompt Engineers, Application domains- Education, Engineering, Entertainment	
	2	Principles of Prompt Engineering- Understanding User Prompts- Types of Prompts- Information Prompts, Confirmation Prompts, Suggestion Prompts, Social Influence Prompts. Factors influencing prompt effectiveness- clarity, timing, relevance, language and tone, personalization.	
	3	Foundation of Language Models- Definition, tasks- Text generation, Translation, Question Answering, Summarization, Natural Language Inference, other capabilities- chatbots, virtual assistants, Examples of Language Models- Gemini, BERT, GPT based Models, GPT-3, GPT4, LaMDA, PaLM, Parti.	
	4	Processing text in Language Models- Tokenization, Generation of text in Language Models- Beam Search	

II	**Crafting Prompts**		**15**
	5	Types of Prompts. Visual Prompts, Auditory Prompts, Tactile Prompts, Open ended Prompts, closed ended prompts, Instructional prompts, Contextual prompts.	
	6	Factors influencing Model responses- Context, Length, Structure, Complexity, Fine tuning. Conciseness and specificity in prompt design	
	7	Query Formulation Techniques, importance of context in prompt formulation, Techniques for crafting clear and effective instructions, tailoring prompts to specific tasks or domains	
	8	Structuring Prompts for Unambiguous understanding- Clear Communication, Contextual Cues- images, code. Best practices to be followed for designing user prompts –- designing effective prompt systems - understanding user perspective, clear and concise prompts, providing context, considering user input, feedback and validation, iterative design process. Strategies for iteratively improving prompts based on feedback and performance analysis, Feedback Mechanism-Quantitative analysis, qualitative analysis, iterative prompt design, A/B testing,	
	9	Approaches for adjusting prompt language, structure and complexity, Fine tuning, techniques used – Supervised learning, Reinforcement learning	

	10	Prompt generation Tools- Prompt Studio, Prompt Bard, PromptInsight, Prompt evaluation tools- PromptEvaluator, PromptRanker, PromptTuning	
III	**Prompt Engineering Strategies and Applications**		**15**
	11	Pillars of Prompting- Providing Examples, Giving Direction, Formatting Responses, Evaluating Quality, Chaining AIs	
	12	Debiasing techniques, Context Manipulation, Controlled Generation, Iterative Prompting	
	13	Prompt strategies for tasks – summarization, translation, Q & A, creative writing, other tasks	
	14	Role of Prompt Engineering in various applications- Search and Recommendation, Natural Language Processing, Creative AI, AT Safety	
	15	Examples of applications using prompt engineering- Google AI, Microsoft AI, Salesforce AI, Open AI	
IV	**Prompt Engineering Technologies & Ethical issues**		**15**
	16	Machine Learning Models for personalized prompts- Rule based Models, Collaborative filtering Models, Content based Models, Hybrid Models	

	17	Emerging Technologies in Prompting- Natural Language Processing, Machine Learning, Augmented Reality, Virtual Reality, Sustainable Prompting Strategies- Energy efficient hardware, optimizing prompt frequency and timing	
	18	Ethical considerations in Prompt Engineering- Privacy and Consent, Manipulative prompting practices, Ensuring Prompt conformity to Ethical standards	
	19	Handling Constraints, Addressing Biases in prompts and response, Interpreting Model Output, tools used for auditing bias and fairness example- Google Text to Text Transfer Model, Metrics for assessing quality and effectiveness of prompts	
V	**Flexi Module: Not included for End Semester Exams**		**15**
	20	Advanced Techniques-Meta Prompting, Multimodal prompt engineering, prompt embedding, conditional generation.	
	21	Prompt techniques- Zero-shot Prompting, Auto-prompting, Few shots prompting, Chain of Thought Prompting, Self-consistency prompting, General Knowledge Prompting, Tree of Thoughts prompting	

References

1. Utkarsh Pal, Mastering Prompt Engineering: A Guide to Effective Communication with language Models, December 2023
2. Alan Weston, Prompt Engineering for Beginners, February 2024
3. A Scholtens, Course book Prompt Engineering, January 2023, SAS155,

4. Naween Balani, Prompt Engineering: Unlocking Generative AI, April 2023, ISBN -13-979-8390487082
5. Yaswanth Sai Palghat, The Art of Asking prompt Engineering, Notion Press Media Pvt Ltd, August 2023, ISBN 13979-8890673169
6. Nathan Hunter, The Art of Prompt Engineering with ChatGPT: A Hands On Guide, Shroff/Hunter, First edition, June 2023

Lab Exercises

- Familiarization of any one Language Model /application /GPT
- Select a prompt generation tool or framework (e.g., GPT-3, Prompt Studio).
- Create effective prompts for generation of text, creative writing, content generation, resume writing., poetry, fiction, non fiction or any other genre
- Design prompts for different scenarios (e.g., recommendation prompts for an e-commerce website, feedback prompts for a survey).
- Evaluate the generated prompts based on clarity, relevance, and user engagement.
- Discuss strategies for improving prompt effectiveness and iterate on the design process
- Compare various prompt generation tools (e.g., GPT-3, OpenAI Codex, DialoGPT).
- Case Studies in Prompt Engineering- Successful prompting campaigns, Failures in Prompt Engineering
- Case Studies demonstrating effective prompt engineering strategies

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize prompt engineering principles	U	PSO-1

CO-2	Develop effective prompts	Ap	PSO-1,2,3
CO -3	Illustrate prompt engineering strategies:	Ap	PSO-1,2,3
CO -4	Make use of prompt engineering technologies	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: PROMPT ENGINEERING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
1	Summarize prompt engineering principles	PO-6,7 PSO-1	U	F, C	L	-
2	Developing effective prompts	PO-6,7 PSO-1,2,3	Ap	F, C, P	L	P

3	Illustrate prompt engineering strategies:	PO-6,7 PSO-1,2,3	Ap	F, C,P	L	P
4	Make use of prompt engineering technologies	PO-6,7 PSO-1,3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	--	-	-	2	2	-	2	-	-	-
CO 2	-	-	-	-	-	2	2	-	2	2	2	-
CO 3	-	-		--	-	2	2	-	2	1	2	-
CO 4	-	-	-	-	-	2	2	1	2	-	2	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment/ Seminar	Lab Assessment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

7. **THEORY OF COMPUTATION**

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC407				
Course Title	THEORY OF COMPUTATION				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge of Mathematics is desirable.				
Course Summary	This course covers the mathematical foundations of computation, formal languages, automata theory, computability theory, and complexity theory.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L)
I		**Introduction to automata theory and Regular Languages**	12
	1	Introduction to Automata Theory; Mathematical notations and terminology (sets, sequences and tuples, Functions and relations, Graphs, String and languages, Boolean logic); **Finite Automata** : Formal definition of a finite automaton; Examples of finite automata; Formal definition of computation; Designing finite automata, The regular operations; Nondeterminism; Formal definition of a nondeterministic finite automaton; Equivalence of NFAs and DFA	
	2	**Regular Expressions**: Formal definition of a regular expression; Equivalence with finite automata; Formal definition of a regular expression; Closure properties; Equivalence with finite automata	
II		**Context Free Grammar and PDA**	12
	3	**Context-Free Grammars**: Formal definition of a context-free grammar; Examples of context-free grammars; Designing context-free grammars; Ambiguity; Chomsky normal form; Non-Context-Free Languages; The pumping lemma for context-free languages	

	4	**Pushdown Automata:** Formal definition of a pushdown automaton; Examples of pushdown automata; Equivalence with context-free grammars	
III		**Turing Machine**	**12**
	5	Context-sensitive Grammar; Linear Bounded Automata	
	6	Turing Machine (TM) – Basics and formal definition; Transition diagrams of TM; Language of a TM	
	7	Recursively Enumerable languages; Recursive languages; Properties of Recursively Enumerable and Recursive languages; Chomsky Hierarchy	
IV		**Undecidability**	**15**
	8	Decidable Languages; Decidable problems concerning regular languages; Decidable problems concerning context-free languages; Undecidability; The diagonalization method; An undecidable language; A Turing-unrecognizable language	
V		**Flexi Module: Not Included for End Semester Exams**	**15**
	9	Applications of FA, PDA, and TM	

References

Core Books

1. Michael Sipser, Introduction To Theory of Computation, Cengage Publishers, 2013 John E Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata
2. Theory, Languages, and Computation, 3/e, Pearson Education, 2007

Additional References

1. John C Martin, Introduction to Languages and the Theory of Computation, TMH, 2007
2. Dexter C. Kozen, Automata and Computability, Springer1999.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Build regular expressions, finite state automata, and regular grammar.	Ap	PSO-1,2
CO2	Design grammar representations free of context and push-down automata for context-free languages.	Ap	PSO-1, 2
CO3	Interpret formal languages into four categories: unrestricted, context-sensitive, context-free and regular	Ap	PSO-1, 2

CO4	Summarize decidability and Undecidability	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: THEORY OF COMPUTATION

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Build regular expressions, finite state automata, and regular grammar.	PO-1,6,7 PSO-1, 2	Ap	F, C, P	L	-
CO2	Design grammar representations free of context and push-down automata for context-free languages.	PO-1, 6,7 PSO-1, 2	Ap	F, C, P	L	-

CO3	Interpret Formal languages into four categories: unrestricted, context-sensitive, context-free and regular.	PO-1,6,7, PSO-1, 2	Ap	F, C	L	-
CO4	Summarize decidability and Undecidability	PO1,6,7 PSO-1, 2	U	F, C	L + T	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	1	-	-	-	-	3	3	-	3	3	-	-
CO 2	1	-	-	-	-	3	3	-	3	3	-	-
CO 3	1	-	-	-	-	3	3	-	3	3	-	-
CO 4	1	-	-	-	-	3	3	-	3	3	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz	Assignment	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

8. WIRELESS DATA COMMUNICATION

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSCCSC408</td></tr>
<tr><td>Course Title</td><td colspan="5">WIRELESS DATA COMMUNICATION</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td>-</td><td>4 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Nil</td></tr>
<tr><td>Course Summary</td><td colspan="5">At present, Data communication has moved from wired to wireless form.. This course introduces the benefits of wireless transmission, wireless connectivity and the technology behind wireless communication.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs

I		**Introduction**	**12**
	1	Need for wireless communication, Types of wireless communication, Advantages and Disadvantages of wireless communication	
	2	Application of wireless communication. Different types of wireless networks -WLAN, WMAN, WPAN, WWAN.	
	3	Basics of Satellite communication systems,.Types of Satellites,	
	4	Cordless systems, wireless local loop, RFID -Working, Features	
II		**Channel Access Methods**	**12**
	5	Multiple access techniques in wireless communication: contention-free multiple access schemes - FDMA, TDMA, CDMA, SDMA and Hybrid	
	6	Contention-based multiple access schemes - ALOHA and CSMA.	
	7	Features and Comparison of various methods	
III		**WPAN and WLAN**	**12**
	8	Wireless personal area networks - Bluetooth Architecture, Bluetooth Layers, Frame Format, ZigBee	

	9	Wireless Local Area Networks - IEEE802.11, Network Architecture, Medium Access Methods, WLAN standards - IEEE802.11a, b, g, n, p	
	10	Wireless Metropolitan Area Networks (WiMax) - Working, Features and Advantages, Comparison of Wifi and WiMax	
IV	**Security in Wireless Networks**		**12**
	11	Adhoc Wireless Networks, Security in wireless Networks	
	12	Wireless Security Protocols- WEP, WPA, WPA2, WPA3	
	13	Mobile Transport Layer Protocol, Mobile network layer protocol. Mobile IP - Registration, Discovery,Tunneling.	
	14	Session Initiation Protocol, WAP	
V	**Flexi Module: Not included for End Semester Exams**		**12**
	15	History of wireless communication. Technical Issues in Wireless communication. Wireless spectrum.	
	16	Radio wave propagation, Transmit and Receive signal models, Free space path models	
	17	Spread spectrum principles, DSSS and FHSS (Basic concepts only)	

	18	Various generations in cellular phones	

Text Books

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press 2005
2. William Stallings, “Wireless Communications and Networking” Second Edition, Pearson Education, India.
3. Vijay K Garg,”Wireless Communication and Networking”, Morgan Kauffman

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	List the requirements and types of wireless networks.	U	PSO-1
CO-2	Explain the different types of channel access methods in wireless networks	U	PSO-1
CO-3	Illustrate the various WLAN standards.	Ap	PSO-1, 3
CO-4	Infer about the various types of wireless network security protocols.	Ap	PSO-1,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: WIRELESS DATA COMMUNICATION

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	List the requirement and types of wireless networks.	PO- 1, 6,7 PSO- 1	U	F, C	L	-
2	Explain the different types of channel access methods in wireless networks	PO- 6,7 PSO- 1,2	U	F, C	L	-
3	Illustrate the various WLAN standards.	PO -6,7 PSO - 1,3	Ap	F,C	L	-
4	Infer about the various types of wireless network security protocols.	PO- 6,7 PSO- 1, 3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	-	-	-	-	2	1	-	3	-	-	
CO 2	1	-	-	-	-	2	3	-	-	3	-	
CO 3	1	-	-	-	-	2	-	-	2	-	-	
CO 4	1	-	-	-	-	2	2	-	-	-	2	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments

- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Seminar**	**End Semester Examinations**
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

9. ADVANCED DBMS

Discipline	COMPUTER SCIENCE
Course Code	UK7DSCCSC409
Course Title	ADVANCED DBMS
Type of Course	**DSC**
Semester	VII
Academic Level	4

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic Knowledge about DBMS is desirable				
Course Summary	The Advanced DBMS course explores advanced database design and management techniques. It covers transaction management, concurrency control, and recovery methods for data integrity. The course addresses advanced architectures like distributed, parallel databases and Object Database Systems.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L)**
I		**Database Application Development**	**12**
	1	Accessing Databases from Applications: Embedded SQL, Cursors, Dynamic SQL.	
	2	Stored Procedures: Creating a Simple Stored Procedure, Calling a Stored Procedure, SQL/PSM. SQLJ.	

	3	Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock Based Concurrency Control.	
	4	Transaction Support in SQL: Creating and Terminating Transactions, Transaction Properties. Crash Recovery: Stealing Frames and Forcing Pages, Recovery-Related Steps during Normal Execution, Implementing Rollback.	
II	**Schema Refinement and Normal Forms**		**12**
	5	Introduction to Schema Refinement: Problems Caused by Redundancy, Decomposition, Problems Related to Decomposition.	
	6	Functional Dependencies, Reasoning about FDs: Closure of a Set of FDs, Attribute Closure. Properties of Decomposition: Lossless-Join Decomposition, Dependency-Preserving Decomposition.	
	7	Dependencies: Multivalued Dependencies, Join Dependencies and Inclusion Dependencies. Normal Forms: BCNF, 3NF, 4NF and 5NF.	
III	**Parallel and Distributed Databases**		**12**
	8	Parallel Database Architecture, Parallel Query Evaluation, Parallelizing Individual Operations: Bulk Loading and Scanning, Sorting, Joins. Parallel Query Optimization.	

	9	Types of Distributed Databases, Distributed DBMS Architectures, Storing Data in Distributed DBMS: Fragmentation, Replication.	
	10	Distributed Query Processing, Distributed Transactions, Distributed Concurrency Control.	
	11	Distributed Recovery: Normal Execution and Commit Protocols, Two-Phase Commit, Three-Phase Commit.	
IV	**Object Database Systems**		**12**
	12	Structured Data Types, Operations on Structured Data: Operations on Rows, Operations on Arrays, Operations on Other Collection Types, Queries Over Nested Collections.	
	13	Database Design for ORDBMS: Collection Types and ADTs, Object Identity, Extending the ER Model, Using Nested Collections.	
	14	ORDBMS Implementation Challenges, Comparing RDBMS, OODBMS and ORDBMS.	
V	**Flexi Module (Not Included for End Semester Examination)**		**12**
	14	Multidimensional Data Model, Implementing Techniques for OLAP: Bitmap Indexes, Join Indexes and File Organization.	

	15	Creating Data Warehouse, Views and Decision Support.	
	16	Creating and Marinating Materialized Views, Counting Co-Occurrences: Frequent Itemset and Iceberg Queries.	

References:

1. R Ramakrishnan, J Gehrke, "Database Management Systems", Third Edition, McGraw Hill.
2. A Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw Hill.
3. C J Date, "An Introduction to Database Systems", Eighth Edition, Pearson Education.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Demonstrate the advanced concepts in Database Management Systems.	Ap	PSO-1, 2
CO-2	Explore the concepts of Schema Refinement and Normal Forms	An	PSO-1, 2
CO-3	Compare parallel and distributed databases in DBMS	An	PSO-1
CO-4	Illustrate the features of Object Database Systems	An	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ADVANCED DBMS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Demonstrate the advanced concepts in Database Management Systems.	PO-1, 2, 6,7 PSO-1, 2	Ap	F, C, P	L	P
CO-2	Explore the concepts of Schema Refinement and Normal Forms	PO-1, 2, 6, 7 PSO-1,2	An	F, C, P	L	P
CO-3	Compare parallel and distributed databases in DBMS	PO-5, 6, 7 PSO-1	U	F, C	L	-

CO-4	Illustrate the features of Object Database Systems	PO-1, 6, 7 PSO-1, 2	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	1	1	-	-	-	2	2	-	3	1	-	-
CO 2	2	2	-	-	-	3	2	-	3	2	-	-
CO 3	-	-	-	-	2	3	1	-	3	-	-	-
CO 4	2	-	-	-	-	3	2	-	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

10. BIOINFORMATICS

Discipline	COMPUTER SCIENCE
Course Code	UK7DSCCSC410
Course Title	BIOINFORMATICS
Type of Course	DSC

Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Knowledge in Python Programming and Machine learning is desirable.				
Course Summary	This course offers a comprehensive overview on the various concepts involved in bioinformatics.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Introduction**		**15**
	1	Introduction to Bioinformatics and Computational biology, Nature & Scope of Bioinformatics.	

	2	Biological databases -Primary database, Secondary database, Nucleic Acid databases, Protein database	
	3	The central dogma of molecular biology.	
	4	Applications of Bioinformatics.	
II		**DNA and RNA Structure**	**15**
	7	DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Gene expression.	
	8	Transcription, Translation	
	9	General introduction to Gene expression in prokaryotes and eukaryotes	
	10	RNA classification –coding and non-coding RNAs- mRNA, tRNA, microRNA and circular RNA.	
III		**Sequence Alignment**	**15**

	12	Sequence alignment – local/global, pairwise sequence alignment, Needleman algorithm, global and local alignments, Multiple sequence alignment, BLAST.	
	13	Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and protein sequences.	
	14	Differences between distance & similarity matrix.	
IV		**Amino Acids and Protein Structure**	**15**
	19	Amino acids- Building blocks of proteins	
	20	Protein Structure- Primary, Secondary - alpha helix, beta sheets & turns, Tertiary and Quaternary structures. Protein Folding	
	21	Introduction to Molecular Docking	
V		**Flexi Module: Not included for end semester exams**	**15**
	22	Literature review on Biomedical data classification	

References

1. Lesk, Arthur, Introduction to genomics, Oxford University Press, 2017

2. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.
3. David W. Mount, Bioinformatics: Sequence & Genome Analysis, Cold spring Harbor press, 2004.
4. Gautam B. Singh, Fundamentals of bioinformatics and computational biology, Springer, 2015
5. Jean-Michel Claverie, Cerdric Notredame, Bioinformatics- A Beginner's Guide, WILEY Dreamtech India Pvt. Ltd, 2006
6. Ruchi Singh, Richa Sharma, Bioinformatics- Basics, Algorithms and Applications, University Press, 2010
7. Orpita Bosu, S K Thukral, Bioinformatics- Databases, Tools, and Algorithms, Oxford University Press, 2007
8. Gautam B. Singh, Fundamentals of Bioinformatics and Computational Biology - Methods and Exercises in MATLAB, Gautam B. Singh,Springer International Publishing Switzerland 2015

Lab Exercises

1. Basic programs in Python.
2. Implementation of Bioinformatics problems

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Summarize the foundational concepts and applications of bioinformatics	U	PSO – 1, 3

CO2	Sketch DNA and RNA structures, Genetic Code, Gene Expression, and RNA classification.	Ap	PSO – 1, 2, 3
CO3	Illustrate sequence alignment techniques and usage of scoring matrices	Ap	PSO – 1, 2, 3
CO4	Outline the structure of protein and amino acids, and basic concepts of molecular docking.	U	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: BIOINFORMATICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Summarize the foundational concepts and applications of bioinformatics	PO- 6, 7 PSO – 1, 3	U	F, C	L	P

2	Sketch DNA and RNA structures, Genetic Code, Gene Expression, and RNA classification.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
3	Illustrate sequence alignment techniques and usage of scoring matrices.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
4	Outline the structure of protein and amino acids, and basic concepts of molecular docking.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**-**	**1**	**-**
CO2	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**1**	**-**

CO3	**2**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**2**	**2**	**-**
CO4	**2**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**2**	**2**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓		✓	✓

CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

11. IMAGE PROCESSING AND ITS APPLICATIONS

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC411				
Course Title	IMAGE PROCESSING AND ITS APPLICATIONS				
Type of Course	DSC				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours

Pre-requisites	Basic knowledge on images and python is desirable
Course Summary	This course provides an introduction to the fundamental concepts, techniques, and applications of image processing. Students will learn about various image processing operations, including image preprocessing, segmentation, and feature extraction, and how these techniques are applied in diverse fields such as healthcare, satellite imaging, and computer vision.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I	**Introduction**		**12**
	1	Fundamentals of Image Processing; Applications of Image Processing; Human Visual Perception: Human Eyes; Components of an Image Processing System: Digital Camera	
	2	Image Preprocessing: Image scaling, Normalization, Noise Removal, Image Rotation, Image Translation	
	3	Image Segmentation: Preliminaries; Edge Detector: Edge, Line, and Point Detection (Basic Concepts only); Image Thresholding Techniques (Basic concepts only)	

	4	Introduction to OpenCV in Python: Functions for image preprocessing and segmentation	
II	**Morphological and Colour Image Processing**		**12**
	5	Morphological Image Processing: Preliminaries; Erosion and Dilation; Opening and Closing	
	6	OpenCV functions for Morphological Image processing	
	7	Colour Image Processing: Colour Fundamentals, Colour Models, Pseudocolour Image Processing, Basics of Full-Colour Image Processing	
III	**Image Mining and Content-Based Image Retrieval**		**12**
	8	Introduction; Image Mining; Image Features for Retrieval and Mining: Colour Features, Texture Features, Shape features, Topology, Multidimensional Indexing, Results of a Simple CBIR System	
	9	Recognition of Image Patterns: Introduction, Decision Theoretic Pattern Classification, K-Nearest-Neighbour Classification; Unsupervised Classification Strategies – clustering-K-Means Clustering Algorithm	
	10	Feature Extraction, classification, clustering functions in OpenCV	

IV	**Biometric And Biomedical Image Processing**		**12**
	11	Biometric Pattern Recognition: Feature Selection, Extraction of Front Facial Features, Extraction of side facial features, Face Identification; Signature Verification, Preprocessing of Signature Patterns	
	12	Biomedical Image Analysis: Microscopic Image Analysis, Macroscopic Image Analysis	
	13	Biomedical Imaging Modalities: Magnetic Resonance Imaging (MRI), Computed Axial Tomography, Nuclear and Ultrasound Imaging	
V	**Flexi Module (Not included for end semester exam)**		**12**
	14	Applications: Satellite image processing, Biomedical image processing, Object classification, Object Detection, Scene Understanding	

References

1. Tinku. K. Acharya and Ajay. K. Ray, " Image Processing: Principles and Applications", WILEY Inderscience publishers
2. Gonzalez, R. C., & Woods, R. E. (2018). Digital Image Processing (4th ed.). Pearson.
3. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision (4th ed.). Cengage Learning.
4. Szeliski, R. (2010). Computer Vision: Algorithms and Applications. Springer.

5. OpenCV Documentation and Tutorials: https://opencv.org

Lab Exercises (Using OpenCV)

1. Implement image loading and displaying functions
2. Implement image preprocessing operations such as Image scaling, Normalization, Noise Removal, Image Rotation, Image Translation.
3. Implement image thresholding.
4. Implement image segmentation.
5. Implement morphological image processing.
6. Implement image feature extraction methods.
7. Implement image classification problems.
8. Implement clustering.
9. Implement face recognition.
10. Implement a simple project on medical image processing.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Apply Image and Preprocessing Techniques	Ap	PSO 1, 3

CO2	Demonstrate morphological and colour image processing techniques	Ap	PSO 1, 3
CO3	Implement Image Mining and Content-Based Image Retrieval methods.	Ap	PSO 1, 3
CO4	Use Image Processing Techniques in Biometric and Biomedical Contexts	An	PSO 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: IMAGE PROCESSING AND ITS APPLICATIONS

Credits: 2:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
CO1	Apply Image and Preprocessing Techniques	PO-5,6,7 PSO- 1, 3	Ap	F, C, P	L	P

CO2	Demonstrate morphological and color image processing techniques	PO-5,6,7 PSO- 1, 3	Ap	F, C, P	L	P
CO3	Implement Image Mining and Content-Based Image Retrieval methods.	PO-5,6,7 PSO- 1, 3	Ap	F, C, P	L	P
CO4	Use Image Processing Techniques in Biometric and Biomedical Contexts	PO-5,6,7 PSO- 1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	-	-	-	1	2	2	-	3	-	3	-

CO 2	-	-	-	-	1	2	2	-	3	-	3	-
CO 3	-	-	-	-	1	2	2	-	3	-	3	-
CO 4	-	-	-	-	1	2	2	-	3	3	3	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓

CO 4	✓	✓	✓	✓

11. SOFT COMPUTING

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC413				
Course Title	SOFT COMPUTING				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic Computing knowledge is necessary.				
Course Summary	This course aims to provide a foundation in the area of soft computing.				

Detailed Syllabus:

Module	Unit	Content	Hrs(L)
I		**Introduction**	**12 hrs**
	1	What is Soft Computing?	
	2	Difference between Hard and Soft Computing	
	3	Requirement of Soft Computing	
	4	Major Areas of Soft Computing	
	5	Applications of Soft Computing	
		Neural Networks	
	6	Basics of Neural Network	**12**
	7	Learning rules and various activation functions	
	8	Single layer Perceptrons	
	9	Back Propagation networks	
	10	Architecture of Back Propagation (BP) Networks	

	11	Backpropagation Learning	
	12	Recent Applications	
II		**Fuzzy Systems**	**12**
	13	Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method Fuzzy Logic	
	14	Fuzzy Rule based systems	
	15	Predicate logic	
	16	Fuzzy Decision Making	
	17	Fuzzy Classification	
III		**Genetic Algorithms**	**12**
	18	History of Genetic Algorithms (GA)	
	19	Working Principle	
	20	Various Encoding Methods	

	21	Fitness Function	
	22	GA Operators- Reproduction, Crossover, Mutation,	
	23	Convergence of GA	
	24	Bit wise operation in GA	
IV		**Hybrid Systems**	**12**
	25	Sequential Hybrid Systems	
	26	Auxiliary Hybrid Systems	
	27	Embedded Hybrid Systems	
	28	Neuro-Fuzzy Hybrid Systems	
	29	Neuro-Genetic Hybrid Systems	
V		**Flexi Module: Not included in End Semester Exams**	**12**
	30	Pros and Cons of Neural Networks and Genetic Algorithms	
	31	Case studies on recent applications of Genetic Algorithms / Fuzzy Logic	

	32	Any one or two relevant and recent Genetic algorithms	

References

1. S.Rajasekaran, G. A. Vijayalakshmi, PHI, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications”
2. E. Goldberg, “Genetic Algorithms: Search and Optimization”
3. Chin Teng Lin, C. S. George Lee, PHI, “Neuro-Fuzzy Systems”

<u>Course Outcomes</u>

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarise about the basic concepts of soft computing	U	PSO - 1
CO2	Discuss about neural networks and its various applications	U	PSO - 1, 2
CO3	Demonstrate the use of fuzzy logic in various contexts	Ap	PSO - 1, 2
CO4	Illustrate the principles and working of different operators in Genetic Algorithms	Ap	PSO - 1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Summarise about the basic concepts of soft computing	PO - 6, 7 PSO - 1	U	F, C	L	-
2	Discuss about neural networks and its various applications	PO - 1, 6, 7 PSO - 1, 2	U	F, C, P	L	-
3	Demonstrate the use of fuzzy logic in various contexts	PO - 1, 2, 6, 7 PSO - 1, 2	Ap	F, C, P	L	-
4	Illustrate the principles and working of different operators in Genetic Algorithms	PO - 1, 2, 4, 5, 6, 7 PSO - 1, 2	Ap	F, C, P	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and Pos:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	2	2	-	3	-	-	-
CO2	1	-	-	-	-	2	2	-	3	1	-	-
CO3	1	2	-	-	-	2	2	-	3	2	-	-
CO4	1	2	-	1	1	2	2	-	3	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Case Study / Seminar	End Semester Examinations
CO1	✓			✓
CO2	✓	✓		✓
CO3	✓	✓	✓	✓
CO4	✓		✓	✓

13. BIG DATA TECHNOLOGIES USING HADOOP

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSCCSC414</td></tr>
<tr><td>Course Title</td><td colspan="5">BIG DATA TECHNOLOGIES USING HADOOP</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">3</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>3 hours</td><td>-</td><td>2 hours</td><td>5 hours</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Data Science Fundamentals</td></tr>
<tr><td>Course Summary</td><td colspan="5">The Big Data Technologies Using Hadoop course is designed to introduce students to the concepts, tools, and technologies for processing and analyzing large-scale datasets commonly referred to as Big Data. The course focuses on Hadoop, an open-source framework that provides distributed storage and processing capabilities for handling massive volumes of data across clusters of commodity hardware. Students will learn the fundamentals of Hadoop ecosystem components and how to leverage them to solve real-world big data challenges.</td></tr>
</table>

Detailed Syllabus:

Module	Unit	Content	Hrs (L + P)
I		**Introduction**	**15**
	1	Big Data: Definition, Properties, Applications; Hadoop: Introduction, Understanding the Hadoop Distributed File System (HDFS) Getting Data into Hadoop, Understanding Data Processing in Hadoop	
II		**Advanced Map Reduce Concepts**	**15**
	2	Advanced Map Reduce API Concepts, Introduction to Apache Pig, Advanced Pig Usage, Introduction to Apache Hive, Advanced Hive Usage YARN Administration.	
III		**SQL and Cluster management**	**15**
	3	SQL on Hadoop Overview, The Hadoop Ecosystem, Cluster Management using Apache Ambari, Scaling Hadoop, Advanced Cluster Configuration, the Hadoop User Environment (HUE).	
IV		**Advanced concepts in Hadoop**	**15**
	4	Advanced HDFS, Securing Hadoop, Troubleshooting Hadoop, Integrating Hadoop into the Enterprise, Hadoop in the Cloud, Introduction to NoSQL, Introduction to Apache Spark.	

References

Core

1. Jeffrey Aven , Hadoop In 24 Hours Sams Teach Yourself, 2018.

Lab Exercises

1. Installation of Hadoop.
2. Implementation of Map Reduce in Hadoop.
3. Demonstrate SQL queries in Hadoop.
4. Implement a word count program using map reduce concepts.
5. Implement cluster management in hadoop.
6. Implement NoSQL programs in MongoDB.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarise map reduce concepts	U	PSO- 1
CO2	Implement data processing in Hadoop and apply Hive to YARN administration	Ap	PSO- 1,2

CO3	Develop cluster management system using Apache Ambari	Ap	PSO-1,2
CO4	Restate HDFS, NoSQL and Apache Spark	Ap	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Remember map reduce concepts	PO -6, 7 PSO- 1	U	F, C	T	P
CO2	Understand data processing in Hadoop and apply Hive to YARN administration	PO- 6, 7 PSO- 1, 3	Ap	F, C, P	T	P
CO3	Develop cluster management system using Apache Ambari	PSO- 6, 7 PO- 1, 3	Ap	F, C, P	T	P
CO4	Restate HDFS, NoSQl and Apache Spark	PSO- 6,7 PO -1,3	Ap	F, C, P	T	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	3	3	-	2	-	2	-
CO 2	-	-	-	-	-	3	3	-	2	-	2	-
CO 3	-	-	-	-	-	3	3	-	2	-	2	-

CO 4	-	-	-	-	-	3	3	-	2	-	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

14. SOCIAL MEDIA ANALYTICS

Discipline	Computer Science				
Course Code	UK7DSCCSC415				
Course Title	**SOCIAL MEDIA ANALYTICS**				
Type of Course	DSC				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge about Data Science				
Course Summary	This course provides an in-depth exploration of social media analytics focusing on understanding, analysing, and leveraging data generated through various social media platforms.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Social Media Data**	**12**
	1	Introduction to Analytics, Understanding the fundamentals of social media data.	
	2	Evaluation of Data: Learning to evaluate the quality and relevance of data	
	3	Data Sources: Recognizing different sources of social media data, both online and offline, Data Sources in Social Media Channels	
	4	Data Gathering Techniques: Exploring methods such as APIs and web crawling for collecting data efficiently	
II		**From Data to Insights**	**12**
	5	From Data to Insights: Key - Actionable, metric	
	6	Creating a plan to shape data	
	7	Choosing a good Analytical Tool, Data Aggregation, Calculation and Display	
	8	Social media and Big Data (Concepts)	
III		**Types of Analytics Tools**	**12**
	9	Types of Analytics: Various types of analytics in social media, including listening, advertising, CMS and CRM analytics	
	10	Social Media Listening: Exploring methods for analysing keywords, Mention based Analysis, Interest and sentiment.	
	11	Advertising Analytics: Focusing on measuring the effectiveness of paid social media campaigns.	
	12	CMS and CRM Analytics: Understanding how to measure content performance and customer interactions.	
IV		**Dedicated vs Hybrid Tools**	**12**

	13	Advantages and Disadvantages of Dedicated vs Hybrid Tools	
	14	Data Integration Tools – Advantages and Disadvantages.	
	15	Differences of Social Media Networks, Interactivity	
	16	The Analytics Process - Investigation Beyond Social Analytics Metrics, Dashboards, and Reports	
V	**Flexi Module - Not included for End Semester Examination**		**12**
	17	Case study on any social media network	
	18	Comparison of some recent media analytic tools	
	19	Metrics used in CMS and CRM Analytics	

TEXT BOOK

1. Alex Goncalves, "Social Media Analytics strategy using data to optimize Business performance", Apress
2. Matthew Ganis, "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media", Pearson, 2018

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Acquire knowledge on the fundamentals of social media data	U	PSO-1
CO-2	Articulate data aggregation, key metrics, and usage of proper analytical tools for discerning insights.	U	PSO-1, 2
CO-3	Illustrate the methods to analyze keywords, sentiments and campaigns in social media.	Ap	PSO-1, 2
CO-4	Compare the use of dedicated and hybrid tools in social media analytics	Ap	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Social Media Analytics

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial (T)	Practical (P)
CO-1	Acquire knowledge on the fundamentals of social media data	PO-6, 7 PSO-1	U	F, C	L	-
CO-2	Articulate data aggregation, key metrics, and usage of proper analytical tools for discerning insights.	PO-6, 7 PSO-1	U	F, C	L	-
CO-3	Illustrate the methods to analyze keywords, sentiments and campaigns in social media.	PO-1, 6, 7 PSO-1, 2	Ap	F, C	L	-
CO-4	Compare the use of dedicated and hybrid tools in social media analytics	PO-1, 6, 7 PSO-1, 2	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	1	1	-	2	-	-	-
CO 2	-	-	-	-	-	2	3	-	2	-	-	-
CO 3	2	-	-	-	-	2	3	-	2	2	-	-
CO 4	2	-	-	-	-	2	3	-	2	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	**Assignment**	**End Semester Examinations**
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓	✓	✓
CO 4	✓	✓	✓

15. TEXT MINING

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC416				
Course Title	Text Mining				
Type of Course	DSE				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	2 hours	-	2 hours	4
Pre-requisites	Awareness in data mining techniques is necessary.				
Course Summary	Text Mining explores techniques for extracting useful information and insights from large collections of text data. This course covers the fundamentals of text preprocessing, representation, classification, clustering, and sentiment analysis. Students will learn how to apply text mining algorithms to real-world datasets and interpret the results.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction and Text**	**15**
	1	Definition; Applications; Challenges	
	2	Architecture	
	3	Text Mining tools: NLTK; Spacy; scikit-learn; Gensim	

II	**Text preprocessing and representation**		**15**
	4	Text preprocessing : Tokenization, Stemming, stopwords removal, parts of speech tagging, Named Entity Recognition, Word Sense Disambiguation, Parsing	
	5	Text Representation: Bag of Words model, TF-IDF model, Word Embedding model-word2vec,GLoVe; Document Embedding model: Doc2Vec	
III	**Text classification and clustering**		**15**
	6	Text classification:Supervised learning algorithms - Naive Bayes, kNN, Support Vector Machine ; Evaluation metrics: Accuracy, Precision, Recall, F1-score	
	7	Text clustering : Unsupervised learning algorithms - k means, Hierarchical clustering, DBSCAN; Evaluation metrics	
IV	**Text Summarization**		**15**
	8	Text Summarization and Information Extraction; Important Concepts: Documents, Text Normalization, Feature Extraction, Feature Matrix, Singular Value Decomposition; Text Normalization; Feature Extraction; Keyphrase Extraction: Collocations, Weighted Tag–Based Phrase Extraction	
	9	Topic Modeling : Latent Semantic Indexing, Latent Dirichlet Allocation’ Non-negative Matrix Factorization Extracting Topics from Product Reviews	
	10	Automated Document Summarization : Latent Semantic Analysis , TextRank, Summarizing a Product Description	
V	**Flexi module- not needed for external examination**		**15**
	11	Sentiment Analysis; Text Mining in social media	
	12	Text Mining in Healthcare ; Text mining in finance and business intelligence	

References

Core

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data" Apress publishers.

Additional

1. Michael W. Berry and Jacob Kogan, "Text Mining: Applications and Theory"
2. Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze, 2009
3. Charu C. Aggarwal and ChengXiang Zhai, "Mining Text Data", Springer, 2012

Lab Exercise

1. Demonstrate the removal of stopwords from a given text.
2. Apply part-of-speech tagging to identify nouns and verbs in a sample sentence.
3. Use Named Entity Recognition to extract entities from a news article.

4. Implement the Bag-of-Words model for a given set of documents.
5. Calculate the TF-IDF scores for a set of terms in a document collection.
6. Train a Word2Vec model using a sample corpus and explore word embeddings.
7. Apply Doc2Vec to represent documents in a vector space.
8. Implement a Naive Bayes classifier for sentiment analysis on a movie review dataset.
9. Use kNN algorithm to classify text documents into predefined categories.
10. Train a Support Vector Machine (SVM) model to classify spam emails.
11. Evaluate the classification performance using accuracy, precision, recall, and F1-score metrics.
12. Apply k-means clustering to group similar documents based on their content.
13. Implement hierarchical clustering on a text dataset and visualize the resulting dendrogram.
14. Use DBSCAN algorithm to cluster news articles into topics.
15. Evaluate clustering results using appropriate metrics such as silhouette score and clustering purity.
16. Implement Latent Semantic Analysis (LSA) for automated document summarization.
17. Use TextRank algorithm to generate keyphrases from a given text.
18. Summarize a product description using extractive text summarization techniques.

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Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Summarize text mining, explore its applications, challenges, and tools effectively.	U	PSO 1, 3
CO2	Apply text preprocessing techniques and various text representation models for effective text mining.	Ap	PSO 1, 3
CO3	Analyse supervised and unsupervised algorithms for text classification and clustering, using evaluation metrics	An	PSO 1, 3
CO4	Develop skills in Text summarization.	An	PSO 1,2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: TEXT MINING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO1	Summarize text mining, explore its applications, challenges, and tools effectively.	PO1, 6, 7 PSO 1,3	U	F, C	L	-
CO2	Apply text preprocessing techniques and various text representation models for effective text mining.	PO1, 6, 7 PSO 1, 3	Ap	F, C, M	L	P
CO3	Analyse supervised and unsupervised algorithms for text classification and clustering, using evaluation metrics	PO 1, 6, 7 PSO 1, 3	An	F, C, M	L	P
CO4	Develop skills in Text summarization.	PO1, 6, 7 PSO 1, 3	An	F, C, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	3	-	-	-	-	3	-	-	-	3	-	3
CO 2	3	-	-	-	-	3	-	-	-	3	-	3
CO 3	3	-	-	-	-	3	-	-	-	3	-	3
CO 4	3	-	-	-	-	3	-	-	-	3	-	3

CO 5	3	-	-	-	-	3	-	-	-	3	-	3
CO 6	3	-	-	-	-	3	-	-	-	3	-	3

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

16. APPLIED PREDICTIVE ANALYSIS

Discipline	Computer Science
Course Code	UK7DSCCSC417
Course Title	Applied Predictive Analytics
Type of Course	DSC
Semester	VII
Academic Level	4

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	Basic knowledge on Mathematics and Statistics				
Course Summary	Predictive analytics is what translates big data into meaningful, usable business information. Written by a leading expert in the field, this guide examines the science of the underlying algorithms as well as the principles and best practices that govern the art of predictive analytics. It clearly explains the theory behind predictive analytics, teaches the methods, principles, and techniques for conducting predictive analytics projects, and offers tips and tricks that are essential for successful predictive modelling.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Overview of Predictive Analytics**	**15**
	1	What Is Analytics? What Is Predictive Analytics?	
	2	Supervised vs. Unsupervised Learning, , Parametric vs. Non-Parametric Models.	
	3	Business Intelligence, Predictive Analyticsvs. Business Intelligence.	
	4	Similarities between Business Intelligence and Predictive Analytics.	
II		**Defining Data for Predictive Modeling**	**15**
	5	Columns as Measures, Defining the Unit of Analysis.	
	6	Which Unit of Analysis? Defining theTarget Variable, Temporal Considerations for Target Variable.	
	7	Defining Measures of Success for Predictive Models.	
	8	Doing Predictive Modeling Out of Order.	
III		**Data Understanding**	**15**
	9	What the Data Looks Like, Single Variable Summaries.	
	10	Mean, Standard Deviation, The Normal Distribution, Uniform Distribution.	
	11	Skewness, Kurtosis, Rank.	
	12	Ordered Statistics, Categorical Variable Assessment.	
IV		**Data Visualization in One Dimension**	**15**
	13	Histograms, Multiple Variable Summaries - Hidden Value in Variable.	
	14	Interactions: Simpson' s Paradox, The Combinatorial Explosion of Interactions.	
	15	Correlations, Spurious Correlations, Crosstabs.	
	16	Data Visualization, Two or Higher Dimensions	
V		**Flexi Module- Not included for External Examination**	**15**
	17	Decision Trees, Building Decision Trees	
	18	Decision Tree Splitting Metrics, Decision Tree Knobs and Options	
	19	Logistic Regression	

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Overview of Predictive Analytics	Ap	PSO- 1,2,3
CO-2	Defining Data for Predictive Modeling	Ap	PSO- 1,2,3
CO-3	Data Understanding	Ap	PSO- 1,2,3
CO-4	Data Visualization in One Dimension	Ap	PSO- 1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	**Overview of Predictive Analytics**	PO-3,6,7 PS0-1,2,3	Ap	F,C,M	L	P
2	**Defining Data for Predictive Modeling**	PO-3,6,7 PS0-1,2,3	Ap	F,C,M	L	P
3	**Data Understanding**	PO-3,5,6,7 PS0-1,2,3	Ap	F,C,M	L	P
4	**Data Visualization in One Dimension**	PO-3,5,6,7 PS0-1,2,3	Ap	F,C,M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	3	-	-	3	3	-	2	1	2	-
CO 2	-	-	3	-	-	3	3	-	2	1	2	-
CO 3	-	-	3	-	1	3	3	-	2	1	2	-
CO 4	-	-	3	-	1	3	3	-	2	1	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓

17. DEEP LEARNING

Discipline	Computer Science				
Course Code	UK7DSCCSC418				
Course Title	Deep Learning				
Type of Course	**DSC**				
Semester	VI				
Academic Level	3				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Machine Learning				
Course Summary	This course provides an in-depth exploration of deep learning, a subfield of machine learning focused on algorithms inspired by the structure and function of the brain's neural networks. Students will delve into neural network architectures, training algorithms, optimization techniques, and applications across various domains				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15**
	1	Introduction; Applications; Deep Learning Process; Artificial Neural Network: neurons, activation functions, layers, and architectures; Types of Deep Learning Network; Limitations	
II		**Deep Neural Networks**	**15**
	2	Deep Neural Networks: Deep Feedforward Networks, Example: XOR problem; Gradient Based learning: Cost functions, Output Units: Linear, Sigmoid, Softmax; Hidden Units: Rectified Linear Units; Bagging; Boosting; Optimization strategies: Batch Normalization	
	3	Python packages for Deep Learning: TensorFlow, Keras	
III		**Convolutional Neural Networks**	**15**
	4	Convolutional Neural Networks: Introduction, Convolution operation, Pooling, Batch Normalisation, CNN architecture; Convolutional Networks and the History of Deep Learning	
IV		**Sequence Modeling**	**15**

	5	Recurrent Neural Networks; Bidirectional RNNs; Encoder-Decoder Sequence to sequence architecture; Deep Recurrent Neural Network; Recursive Neural Networks; Long Short-Term Memory; Deep Generative models: Boltzmann Machines	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	6	Computer Vision; Natural Language Processing; Speech Recognition; Medical Data Processing	

Reference Books

Core Books

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press 2016

Additional References

1 Aurelien Geron, .Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition, October 2022

2. Adam Gibson and Josh Patterson, “Deep Learning: A Practitioner’s Apprach”, O'Reilly Media, First Edition, 2017

3. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow”, O'Reilly Media, Second Edition, 2019

4. Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision", First Edition, 2018.

<u>Practical Components (30 Hours)</u>

1. Implement basic functions in Keras and Tensorflow.
2. Implement a deep neural network using Keras
3. Implement a CNN using Keras.
4. Implement a RNN.
5. Implement LSTM.
6. Implement MNIST handwritten digits classification.
7. Implement object classification.
8. Implement classification in different scenarios.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Understand the concepts of deep learning	U	PSO-1, 2,
CO2	Apply deep neural networks in various real world problems	Ap	PSO-1, 2, 3
CO3	Apply various methods in convolutional neural networks	Ap	PSO- 1, 2, 3
CO4	Illustrate the working various learning methods	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: DEEP LEARNING

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO1	Understand the concepts of deep learning	PO 2, 5, 6, 7 PSO 1, 2, 3,	U	F, C, P	L	P
CO2	Apply deep neural networks in various real world problems	PO 2,5, 6, 7 PSO 1, 2, 3,	Ap	F, C, P	L	P

CO3	Apply various methods in convolutional neural networks	PO 2, 5, 6, 7 PSO 1, 2, 3,	Ap	F, C, P	L	P
CO4	Illustrate the working various learning methods	PO2, 5, 6, 7 PSO 1, 2, 3, 4	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	2	-	-	1	3	3	-	3	2	3	-
CO 2	-	2	-	-	1	3	3	-	3	2	3	-
CO 3	-	2	-	-	1	3	3	-	3	2	3	-
CO 4	-	2	-	-	1	3	3	-	3	2	3	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Lab Assignments

- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Quiz/Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓

18. COMPUTER VISION

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC419				
Course Title	COMPUTER VISION				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	1. Basic Knowledge about computer images and computer Graphics 2. Basic Knowledge about machine learning				
Course Summary	This course aims to introduce the main concepts of computer vision, understand some essential principles and to implement computer vision techniques in projects or other related works.				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction**	**12**
	1	Computer Vision	
	2	Image formation, 2D transformation, 3D transformations, 3D to 2D projections	
	3	Photometric image formations: Lighting, Reflectance and shading, optics	
	4	Digital camera: Sampling and aliasing, colour, compression	
II		**Filtering and Fitting**	**12**
	5	Point operators: Pixel transforms, Colour transforms	
	6	Linear filtering: Non-linear filtering, Bilateral filtering,	

	7	Model fitting and optimization: Scattered data interpolation. Variational methods and regularization, Markov random fields.	
III		**Recognition and Feature Detection**	**12**
	8	Recognition: Instance recognition.	
	9	Image classification, Feature-based methods, Deep networks.	
	10	Object detection, video understanding.	
	11	Feature detection and matching: feature detectors, feature descriptors, feature matching, edge detection	
IV		**Image Alignment and Stitching**	**12**
	12	Image alignment and stitching: pairwise alignment.	
	13	Image stitching, Motion estimation: translational alignment, parametric motion.	
V		**Computational Photography**	**12**
	14	Photometric calibration, High dynamic range imaging	
	15	Image matting and compositing: blue screen matting, natural image matting, optimization-based matting	
	16	smoke, shadow, and flash matting	

References:

1. Richard Szeliski, 2020. Computer Vision: Algorithms and Applications. Springer, 2nd Edn,
2. Linda F. Shapiro, George C. Stockman, 2001. Computer Vision. Prentice Hall, 1st Edn.
3. David. A. Forsyth, Jean Ponce, 2011. Computer Vision: A Modern Approach, 2nd Edn.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize the fundamental concepts and principles of computer vision, including image formation, transformations, and photometric image formations.	U	PSO-1
CO-2	Illustrate the concepts of linear and non-linear filtering techniques, their role in image enhancement and noise reduction, model fitting and optimization methods	Ap	PSO-1, 2, 3
CO-3	Experiment with feature detection and matching algorithms, including feature detectors, descriptors, matching techniques, and edge detection.	Ap	PSO-1,2,3

CO-4	Demonstrate the principles and techniques of image alignment and stitching in computer vision and image processing.	Ap	PSO-1, 2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/Tutorial (T)**	**Practical (P)**
CO-1	Summarize the fundamental concepts and principles of computer vision, including image formation, transformations, and photometric image formations.	PO-6,7 PSO-1	U	F, C	L	-
CO-2	Illustrate the concepts of linear and non-linear filtering techniques, their role in image enhancement and noise reduction, model fitting and optimization methods	PO6, 7 PSO-1,2,3	Ap	F, C	L	-
CO-3	Experiment with feature detection and matching algorithms, including feature detectors, descriptors, matching techniques, and edge detection.	PO6, 7 PSO-1, 2,3	Ap	F, C	L	-
CO-4	Demonstrate the principles and techniques of image alignment and	PO6, 7 PSO-1, 2,3	Ap	F, C	L	-

	stitching in computer vision and image processing.					

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	3	3	-	3	3	3	3
CO 2	-	-	-	-	-	3	3	-	3	3	3	3
CO 3	-	-	-	-	-	3	3	-	3	3	3	3
CO 4	-	-	-	-	-	3	3	-	3	3	3	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓

19. ARTIFICIAL NEURAL NETWORKS

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC420				
Course Title	ARTIFICIAL NEURAL NETWORK				
Type of Course	DSC				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Awareness in Artificial Intelligence is desirable				
Course Summary	This course provides a comprehensive introduction to artificial neural networks (ANNs), a fundamental concept in machine learning inspired by the structure and function of the human brain. Students will learn about the basic principles, architectures, learning algorithms, and applications of ANNs through lectures, hands-on exercises.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Introduction**	**15**
	1	Introduction, Why neural network?, Research History, Biological Neuron model, Artificial Neuron model, Notations, Neuron equation.	
	2	Model of Artificial Neuron: Artificial neuron - basic elements, Activation functions – Threshold function, Piecewise linear function, Sigmoidal function, Example	
II		**Neural Network Architectures**	**15**
	3	Neural Network Architectures: Single layer Feed-forward network, Multi layer Feed-forward network, Recurrent networks.	
	4	Learning Methods in Neural Networks- Learning algorithms: Unsupervised Learning - Hebbian Learning, Competitive learning; Supervised Learning : Stochastic learning, Grant descent learning; Reinforced Learning.	
III		**Taxonomy Of Neural Network Systems**	**15**
	5	Popular neural network systems; Classification of neural network systems with respect to learning methods and architecture types.	
	6	Single-Layer NN System Single layer perceptron : Learning algorithm for training Perceptron, Linearly separable task, XOR Problem; ADAptive LINear Element (ADALINE) : Architecture, Training.	
	7	Multilayer Perceptrons: Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem.	
IV		**Self Organizing Maps**	**15**
	8	Introduction; Two basic feature-mapping models; SOM: Competitive process, Cooperative process, Adaptive process; Summary of SOM Algorithm; Properties of feature map.	
	9	Kohonen Self Organizing Maps: Architecture, Algorithm, Application.	
V		**Flexi Module: Not included for end semester exams**	**15**

	10	Applications of Artificial Neural Networks: Pattern Recognition, Medicine, Speech Production, Speech Recognition, Business.	
	11	Deep Neural Networks (Basic Concepts only)	

References

Core:

1. Simon Haykin, “Neural Networks and Learning Machines” , Pearson Prentice Hall, Third Edition.
2. Laurene Fausett, “Fundamentals of Neural Networks Architectures, Algorithms and Applications”, Pearson Education India, 2004.

Lab Exercises

1. Implement AND problem.
2. Implement XOR problem.
3. Single-Layer Perceptron Implementation
   . Implement a single-layer perceptron in a programming language of choice (Python recommended).
   . Train the perceptron on a binary classification task using a simple dataset.
   . Visualize the decision boundary and analyze the perceptron's performance.
2. Multi-Layer Perceptron (MLP) Demonstration:
   . Develop a multi-layer perceptron (MLP)
   . Train the MLP on a dataset such as MNIST for handwritten digit classification.
   . Experiment with different architectures, activation functions, and optimization algorithms to optimize performance.
2. Implement Self organizing maps.
3. Implement applications using Neural Network.

<u>Course Outcomes</u>

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO1	Outline neural network fundamentals.	U	PSO – 1, 3
CO2	Demonstrate neural network architectures.	Ap	PSO – 1, 2, 3
CO3	Experiment various learning methods	Ap	PSO – 1, 2, 3
CO4	Sketch the features and applications of SOM	Ap	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: ARTIFICIAL NEURAL NETWORKS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Outline neural network fundamentals.	PO- 6, 7 PSO – 1, 3	U	F, C	L	P
2	Demonstrate neural network architectures.	PO- 1, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
3	Experiment various learning methods	PO- 1, 6,7 PSO – 1, 2, 3	Ap	F, C, P	L	P
4	Sketch the features and applications of SOM	PO- 1, 2, 3, 4, 6 PSO – 1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	3	3-	-	2	-	2	
CO2	1	-	-	-	-	3	3-	-	3	3	3	

CO3	1	-	-	-	-	3	3	3	3	3	3	
CO4	1	-	-	-	-	2	3	-	3	3	3	

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

20. MEDICAL TRANSCRIPTION AND TELE-MEDICINE

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC422				
Course Title	MEDICAL TRANSCRIPTION AND TELEMEDICINE				
Type of Course	DSC				
Semester	VII				
Academic Level	4.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Nil				
Course Summary	This course deals with concepts of Telemedicine and Medical Transcription. It introduces the student to the technologies and concepts used behind both areas.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I		**Fundamentals of Telemedicine**	15
	1	Telemedicine - Definition	
	2	Telehealth, mHealth, uHealth, eHealth	
	3	Biomedical telemetry, History of Telemedicine	
		Major Areas of telemedicine, benefits, challenges, Types of telemedicine services, Delivery mechanisms in Telemedicine	
	4	Medical constraints and challenges, general issues in telemedicine	
II		**Telemedicine Systems**	15
	5	Types of information in Telemedicine	
	6	Telemedicine Process	
	7	Essential parameters for Telemedicine	
	8	Components of Telemedicine	
III		**Telemedicine Platform**	15
	9	Telemedicine Platform information Technology Structure	
	10	Clinical medical devices	
	11	Videoconferencing equipment	
	12	Software requirements	
	13	Connectivity and communication systems	
	15	Information sources in a telemedicine system, data transmission	

	16	Electronic medical records (EMR), Electronic health records (EHR), Personal Health record (PHR)	
	17	Standards for medical Data Exchange, Health level 7	
IV		**Medical Transcription**	**15**
	18	What medical transcription does	
	19	How is Medical Transcription done	
	20	Transcriptionists- the traits needed-knowledge in medical terminology, English grammar and punctuation skills, top notch reference skills, keen listening skills, ability to work under pressure, to work without no supervision	
	21	Types of reports to transcribe- the Big Four	
	22	Job prospects and Options	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	23	Clinical Document Architecture, Transmission of still images	
	24	Need for image and data compression, data compression for transmission, data compression for storage systems, standards for still images	
	25	DICOM, Document Imaging system, Video compression technology, Voice Compression	

References

1. R S Khandpur, Telemedicine Technology and Applications, (mHealth, TeleHealth, eHealth) PHI, 2017
2. Anne Martinez, Medical Transcription for Dummies, John Wiley & Sons, 1st Edition, 2013

Lab Exercises

1.Setting Up Telemedicine Equipments
2.Using various image formats
3. Visit to a centre with Telemedicine and report writing

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**
CO-1	Summarize about Telemedicine	U	PSO-1,2
CO-2	Explain about Telemedicine Systems	U	PSO-1,2
CO-3	Describe about platforms necessary for Telemedicine	U	PSO-1,2,3

CO-4	Explain about Medical Transcription	U	PSO-1,2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Summarize about Telemedicine	PO-6,7 PSO-1,2	U	F, C	T	
CO-2	Explain about Telemedicine Systems	PO-6,7 PSO-1,2	U	F, C	T	
CO-3	Describe about platforms necessary for Telemedicine	PO-6,7 PSO-1,2	U	F, C	T	P
CO-4	Explain about Medical Transcription	PO-6,7 PSO-1,2	U	F, C	T	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	--	-	2	2	-	2	2	-	-
CO 2	-	-	-		-	2	2	--	2	2	-	-
CO 3	-	-		-	--	2	2	-	2	2	3	-
CO 4	-	-	-	--	-	2	2	-	2	2	-	3

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Quiz/ Seminar	End Semester Examinations
CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓			✓
CO 4		✓		✓

21. **MEDICAL IMAGE PROCESSING**

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC423				
Course Title	MEDICAL IMAGE PROCESSING				
Type of Course	**DSC**				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4

Pre-requisites	A basic knowledge on image processing is desirable
Course Summary	This Course enables the student to get a comprehensive knowledge on Medical Image processing Techniques

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Medical Image Processing**	**15**
	1	Introduction to Medical imaging, Elements of Image Processing, Image Processing Techniques	
	2	Digital Image Classification Types, Brief history, Importance, Applications, Trends, Challenges	
	3	Spatial Domain Filtering, Filtering in Frequency domain	
	4	Image restoration, Image Compression, Wavelet based image compression, Morphological Image Processing, Image Segmentation.	
II		**Medical Image Formation Principles**	**15**
	5	X-Ray and Computed Tomography (CT) imaging, Basic principles of CT	
	6	2D Image reconstruction- Fourier space and Filtered back projection methods, Iterative reconstruction	
	7	3D reconstruction basics; Discrete Radon Transform (DRT).	
	8		
III		**Imaging Modalities:**	**15**
	9	Magnetic Resonance Imaging (MRI), Introduction, Nuclear Spin, Nuclei in a Magnetic Field	
	10	RF Excitation for the Resonance Phenomenon Generation	
	11	MR Signal Generation and Acquisition,	
	12	MR Signal Characteristics: Relaxation, Proton Density	
	13	The Bloch Equations, Multiple RF Pulses	
	14	Magnetic Field Gradients, Spatial Localization of MR Signals	
	15	Timing Diagram of an Imaging Sequence, Acquiring MR Signals in the K-Space	
	16	Different MRI sequences-Spin Echo Sequence, Gradient Echo Sequence	
	17	Inversion Recovery Sequence - STIR (Short T1 inversion Recovery), FLAIR (Fluid Attenuated Inversion Recovery), T1, T2, and PD weighted sequences.	
IV		**Nuclear Imaging**	**15**
	18	Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT), Ultrasound Imaging, Mathematical principles, Applications;	
	19	Medical Image Storage: Archiving and Communication Systems and Formats Picture Archiving and Communication System(PACS),	
	20	Formats - DICOM, Radiology Information Systems (RIS) and Hospital Information Systems (HIS);	

	21	Medical Image Visualization: Fundamentals of visualization, Different generations of visualization techniques, surface and volume rendering/visualization.	
	22	Introduction to Microscopes: Types of Microscopes, Microscopy Imaging Techniques – Bright field microscopy Dark field microscopy, Phase contrast microscopy, Differential Interference Contrast (DIC) microscopy, Fluorescence microscopy, Polarizing microscopy.	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	23	Medical Image Segmentation: Histogram-based methods, Region Growing, Watersheds, Edge based segmentation techniques, Multispectral Techniques, Segmentation by Fuzzy clustering methods and issues, Segmentation with Neural Networks, Segmentation with Deformable Models	
	24	Mathematical foundation of Deformable Models: Energy Minimizing Deformable Models, Dynamic Deformable Models, Probabilistic Deformable models, Active Contour Model (ACM). Two-Dimensional Shape and Texture quantification - Shape quantification: Compactness, Spatial Moments, Radial distance measure, Chain codes, Fourier descriptors, Thinning,	
	25	Texture quantification: Statistical moments, Co-Occurrence matrix measures, Spectral Measures, Fractal Dimension, Run-length statistics, Different Distance Measures.	

References:

1. Bankman I.N. “Hand book of Medical Image Processing and Analysis”, Second Edition, Academic Press, 2008.
2. Bovik A.I. “Handbook of Image and Video processing”, Second Edition, Academic Press 2005
3. Jiri Jan, “Medical Image Processing, Reconstruction and Restoration- Concepts and Methods”, CRC Tayler & Francis, 2006.
4. L. Landini, V. Positano, M.L. Santarelli, “Advanced Image Processing in Magnetic Resonance Imaging”, CRC Tayler & Francis, 2005
5. Rafel C Gonzalez, Richard E Woods, Digital Image Processing, PHI, 3rd edition,2007
6. Anil K Jain, Fundamentals of Digital Image Processing, Prentice Hall, US Edn, 1989

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize about medical image processing techniques	U	PSO-1,3
CO-2	Discuss about medical image formation principles	U	PSO-1,3
CO-3	Describe about Imaging modalities	U	PSO-1,2,3
CO-4	Explain about Nuclear imaging techniques	U	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: MEDICAL IMAGE PROCESSING

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize about medical image processing techniques	PO-6,7 PSO-1,3	U	F, C	L	--
CO-2	Discuss about medical image formation principles	PO-4,6,7 PSO-1,3	U	F, C	L	-
CO-3	Describe about Imaging modalities	PO-4,6,7 PSO-1,2,3	U	F, C	L	-

CO-4	Explain about Nuclear imaging techniques	PO-6,7 PSO-1,2,3	U	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	--	-	2	2	--	2	3	-	-
CO 2	-	-	-	2	-	22	2	-	2	3	-	-
CO 3	-	-	-	2		2	22	-	2	3-	2	-
CO 4	-	-	--	-	-	2	2	-	2	3-	2	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4		✓		✓

21. BIOINFORMATICS

Discipline	COMPUTER SCIENCE				
Course Code	UK7DSCCSC424				
Course Title	BIOINFORMATICS				
Type of Course	DSC				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial	Practical	Total Hours/Week

			per week	per week	
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Knowledge in Python Programming and Machine learning is desirable.				
Course Summary	This course offers a comprehensive overview on the various concepts involved in bioinformatics.				

Detailed Syllabus:

Module	Unit	Content	Hrs (L+P)
I	**Introduction**		**15**
	1	Introduction to Bioinformatics and Computational biology, Nature & Scope of Bioinformatics.	
	2	Biological databases -Primary database, Secondary database, Nucleic Acid databases, Protein database	
	3	The central dogma of molecular biology.	

	4	Applications of Bioinformatics.	
II		**DNA and RNA Structure**	**15**
	7	DNA and RNA structure – Nucleic Acid structure and function, Genetic Code, Genes and Gene expression.	
	8	Transcription, Translation	
	9	General introduction to Gene expression in prokaryotes and eukaryotes	
	10	RNA classification –coding and non-coding RNAs- mRNA, tRNA, microRNA and circular RNA.	
III		**Sequence Alignment**	**15**
	12	Sequence alignment – local/global, pairwise sequence alignment, Needleman algorithm, global and local alignments, Multiple sequence alignment, BLAST.	
	13	Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and protein sequences.	

	14	Differences between distance & similarity matrix.	
IV	**Amino Acids and Protein Structure**		**15**
	19	Amino acids- Building blocks of proteins	
	20	Protein Structure- Primary, Secondary - alpha helix, beta sheets & turns, Tertiary and Quaternary structures. Protein Folding	
	21	Introduction to Molecular Docking	
V		**Flexi Module: Not included for end semester exams**	**15**
	22	Literature review on Biomedical data classification	

References

9. Lesk, Arthur, Introduction to genomics, Oxford University Press, 2017
10. Neil C Jones and Pavel A Pevzner, An Introduction to Bioinformatics Algorithms, MIT press, 2004.
11. David W. Mount, Bioinformatics: Sequence & Genome Analysis, Cold spring Harbor press, 2004.
12. Gautam B. Singh, Fundamentals of bioinformatics and computational biology, Springer, 2015
13. Jean-Michel Claverie, Cerdric Notredame, Bioinformatics- A Beginner’s Guide, WILEY Dreamtech India Pvt. Ltd, 2006

14. Ruchi Singh, Richa Sharma, Bioinformatics- Basics, Algorithms and Applications, University Press, 2010
15. Orpita Bosu, S K Thukral, Bioinformatics- Databases, Tools, and Algorithms, Oxford University Press, 2007
16. Gautam B. Singh, Fundamentals of Bioinformatics and Computational Biology - Methods and Exercises in MATLAB, Gautam B. Singh,Springer International Publishing Switzerland 2015

Lab Exercises

3. Basic programs in Python.
4. Implementation of Bioinformatics problems

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO1	Summarize the foundational concepts and applications of bioinformatics	U	PSO – 1, 3
CO2	Sketch DNA and RNA structures, Genetic Code, Gene Expression, and RNA classification.	Ap	PSO – 1, 2, 3
CO3	Illustrate sequence alignment techniques and usage of scoring matrices	Ap	PSO – 1, 2, 3

CO4	Outline the structure of protein and amino acids, and basic concepts of molecular docking.	U	PSO – 1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: BIOINFORMATICS

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture(L)/ Tutorial(T)	Practical (P)
1	Summarize the foundational concepts and applications of bioinformatics	PO- 6, 7 PSO – 1, 3	U	F, C	L	P
2	Sketch DNA and RNA structures, Genetic Code, Gene Expression, and RNA classification.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P
3	Illustrate sequence alignment techniques and usage of scoring matrices.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	Ap	F, C, P	L	P

4	Outline the structure of protein and amino acids, and basic concepts of molecular docking.	PO- 1, 2, 6, 7 PSO – 1, 2, 3	U	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**	**2**	**-**	**1**	**-**
CO2	**2**	**1**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**2**	**1**	**-**
CO3	**2**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**2**	**2**	**-**
CO4	**2**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**2**	**2**	**-**

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	**Assignment**	**Lab Assessment**	**End Semester Examinations**
CO1	✓		✓	✓
CO2	✓	✓	✓	✓
CO3	✓		✓	✓
CO4	✓	✓	✓	✓

22. **CLOUD SECURITY**

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSECSC400</td></tr>
<tr><td>Course Title</td><td colspan="5">CLOUD SECURITY</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">4</td></tr>
<tr><td rowspan="2">Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial per week</td><td>Practical per week</td><td>Total Hours/Week</td></tr>
<tr><td>4</td><td>4 hours</td><td>-</td><td></td><td>4</td></tr>
<tr><td>Pre-requisites</td><td colspan="5">Awareness of basic concepts regarding Cloud Computing is essential.</td></tr>
</table>

Course Summary	This course provides an in-depth awareness on the principles, technologies, and best practices involved, for securing Cloud Computing environments. The topics covered include risk management, data protection, identity and access management, network security, and compliance.

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Risks in Cloud Computing**	**12**
	1	Cloud Computing Risks, Risk Management in Cloud Computing	
	2	Cloud's Impact on IT Operations	
	3	Risk Management Process in Enterprise-wide Risk Management	
	4	Types of Risks in Cloud Computing- Internal Security Risk, External Security Risk, Data Protection Risk, Data Loss	
II		**Data Security in Cloud**	**12**
	5	Current State, Security issues and challenges	
	6	Security advantages and disadvantages in Cloud environment	

	7	Cloud, Digital Persona and Data Security,	
	8	Content Level Security	
III		**Cloud Security Services**	**12**
	9	CIA triad- Data Confidentiality, Data Integrity and Data Availability	
	10	Security Authorization Challenges in the Cloud- Auditing, Risk Administration	
	11	Secure Cloud Software Requirements- Monitoring a constantly changing environment	
	12	Secure Cloud Software Testing- Reducing Testing Costs. Software Testing Tools to test Cloud Computing	
IV		**Cloud Security Architecture**	**12**
	13	Introduction, (CSA) Cloud Security Architecture	
	14	Authentication- Single Sign on	
	15	Authorization	
	16	Identity and Access Management	

	17	Securing Data in Rest, Securing Data in Motion	
		Key Management	
V		**Flexi Module: Not included for End Semester Exams**	**12**
	18	Virtual private clouds (VPCs) and network segmentation, Secure connectivity options (VPN, Direct Connect), Distributed denial of service (DDoS) protection	
	19	Compliance and Legal Considerations, Regulatory compliance requirements (GDPR, HIPAA, etc.)	
	20	Cloud Security standards and frameworks (ISO27001, NIST, etc)	
	21	Legal aspects of cloud security (contracts, data jurisdiction)	

References

1. A Srinivasan, J Suresh, Cloud Computing- A Practical Approach for Learning and implementation, Pearson Education, 2022

2. Arshdeep Bahga, Vijay Madisetti, Cloud Computing- A Hands on Approach, Universities Press (India) Private Limited, 2023

3. Tim Mather, Subra Kumaraswamy, Shaheed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, O’Reilly, 2009

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Outline risks in Cloud Computing	U	PSO-1,2
CO-2	Analyze issues in Cloud Security	Ap	PSO-1,2
CO-3	Plan appropriate Cloud security services	Ap	PSO-1,2,3
CO-4	Identify an effective Secure Cloud architecture	Ap	PSO-1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
CO-1	Outline risks in Cloud Computing	PSO-1,2	U	F, C	L	-

CO-2	Analyze issues in Cloud Security	PSO-1,2	Ap	F, C	L	-
CO-3	Plan appropriate Cloud security services	PSO-1,2,3	Ap	F, C	L	-
CO-4	Identify and effective Secure Cloud architecture	PSO-1,2,3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	-	-	-	-	-	2	2		2	2	-	-
CO 2	2	-	-	-	-	2	2		2	2	-	-

CO 3	2	-	1	1	-	2	2		2-	2	1	-
CO 4	2	-	1	1	-	2	2		2	2	1	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Dsicussion	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓		✓	✓

CO 4	✓	✓		✓

24. **SOCIAL MEDIA ANALYTICS**

Discipline	Computer Science				
Course Code	UK7DSECSC401				
Course Title	**SOCIAL MEDIA ANALYTICS**				
Type of Course	DSE				
Semester	VII				
Academic Level	4				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4 hours
Pre-requisites	Basic knowledge about Data Science				

Course Summary	This course provides an in-depth exploration of social media analytics focusing on understanding, analysing, and leveraging data generated through various social media platforms.

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Social Media Data**	**12 hrs**
	1	Introduction to Analytics, Understanding the fundamentals of social media data.	
	2	Evaluation of Data: Learning to evaluate the quality and relevance of data	
	3	Data Sources: Recognizing1 different sources of social media data, both online and offline, Data Sources in Social Media Channels	
	4	Data Gathering Techniques: Exploring methods such as APIs and web crawling for collecting data efficiently	
II		**From Data to Insights**	**12**

	5	From Data to Insights: Key - Actionable, metric	
	6	Creating a plan to shape data	
	7	Choosing a good Analytical Tool, Data Aggregation, Calculation and Display	
	8	Social media and Big Data (Concepts)	
III	**Types of Analytics Tools**		**12**
	9	Types of Analytics: Various types of analytics in social media, including listening, advertising, CMS and CRM analytics	
	10	Social Media Listening: Exploring methods for analysing keywords, Mention based Analysis, Interest and sentiment.	
	11	Advertising Analytics: Focusing on measuring the effectiveness of paid social media campaigns.	
	12	CMS and CRM Analytics: Understanding how to measure content performance and customer interactions.	
IV	**Dedicated vs Hybrid Tools**		**12**
	13	Advantages and Disadvantages of Dedicated vs Hybrid Tools	
	14	Data Integration Tools – Advantages and Disadvantages.	

	15	Differences of Social Media Networks, Interactivity	
	16	The Analytics Process - Investigation Beyond Social Analytics Metrics, Dashboards, and Reports	
V	**Flexi Module - Not included for End Semester Examination**		**12**
	17	Case study on any social media network	
	18	Comparison of some recent media analytic tools	
	19	Metrics used in CMS and CRM Analytics	

TEXT BOOK

1. Alex Goncalves, "Social Media Analytics strategy using data to optimize Business performance", Apress
2. Matthew Ganis, "Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media", Pearson, 2018

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize knowledge on the fundamentals of social media data	U	PSO-1

CO-2	Articulate data aggregation, key metrics, and usage of proper analytical tools for discerning insights.	U	PSO-1, 2
CO-3	Illustrate the methods to analyze keywords, sentiments and campaigns in social media.	Ap	PSO-1, 2
CO-4	Compare the use of dedicated and hybrid tools in social media analytics	Ap	PSO-1, 2

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: SOCIAL MEDIA ANALYTICS

Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Summarize knowledge on the fundamentals of social media data	PO-6, 7 PSO-1	U	F, C	L	-

CO-2	Articulate data aggregation, key metrics, and usage of proper analytical tools for discerning insights.	PO-6, 7 PSO-1	U	F, C	L	-
CO-3	Illustrate the methods to analyze keywords, sentiments and campaigns in social media.	PO-1, 6, 7 PSO-1, 2	Ap	F, C	L	-
CO-4	Compare the use of dedicated and hybrid tools in social media analytics	PO-1, 6, 7 PSO-1, 2	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO 1	-	-	-	-	-	1	1	-	2	-	-	-

CO 2	-	-	-	-	-	2	3	-	2	-	-	-
CO 3	2	-	-	-	-	2	3	-	2	2	-	-
CO 4	2	-	-	-	-	2	3	-	2	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Quiz	End Semester Examinations

CO 1	✓		✓	✓
CO 2	✓		✓	✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

25. **COMPUTER VISION**

<table>
<tr><td>Discipline</td><td colspan="5">COMPUTER SCIENCE</td></tr>
<tr><td>Course Code</td><td colspan="5">UK7DSECSC402</td></tr>
<tr><td>Course Title</td><td colspan="5">COMPUTER VISION</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Semester</td><td colspan="5">VII</td></tr>
<tr><td>Academic Level</td><td colspan="5">4</td></tr>
<tr><td>Course Details</td><td>Credit</td><td>Lecture per week</td><td>Tutorial</td><td>Practical</td><td>Total Hours/Week</td></tr>
</table>

			per week	per week	
	4	4 hours	-	-	4 hours
Pre-requisites	Basic Knowledge about computer images, computer Graphics and Machine Learning is desirable.				
Course Summary	This course aims to introduce the main concepts of computer vision, understand some essential principles and to implement computer vision techniques in projects or other related works.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I		**Introduction**	**12**
	1	Computer Vision	
	2	Image formation, 2D transformation, 3D transformations 3D to 2D projections	
	3	Photometric image formations: Lighting, Reflectance and shading, optics	

	4	Digital camera: Sampling and aliasing, colour, compression	
II	**Filtering and Fitting**		**12**
	5	Point operators: Pixel transforms, Colour transforms	
	6	Linear filtering: Non-linear filtering, Bilateral filtering,	
	7	Model fitting and optimization: Scattered data interpolation. Variational methods and regularization, Markov random fields.	
III	**Recognition and Feature Detection**		**12**
	8	Recognition: Instance recognition.	
	9	Image classification, Feature-based methods, Deep networks.	
	10	Object detection, video understanding.	
	11	Feature detection and matching: feature detectors, feature descriptors, feature matching, edge detection	
IV	**Image Alignment and Stitching**		**12**
	12	Image alignment and stitching: pair wise alignment.	

	13	Image stitching, Motion estimation: translational alignment, parametric motion.	
V	**Computational Photography**		**12**
	14	Photometric calibration, High dynamic range imaging	
	15	Image matting and compositing: blue screen matting, natural image matting, optimization-based matting	
	16	smoke, shadow, and flash matting	

References:

1. Richard Szeliski, 2020. Computer Vision: Algorithms and Applications. Springer, 2ndEdn,
2. Linda F. Shapiro, George C. Stockman, 2001. Computer Vision. Prentice Hall, 1stEdn.
3. David. A. Forsyth, Jean Ponce, 2011. Computer Vision: A Modern Approach, 2ndEdn.

Course Outcomes

No.	**Upon completion of the course the graduate will be able to**	**Cognitive Level**	**PSO addressed**

CO-1	Summarize the fundamental concepts and principles of computer vision, including image formation, transformations, and photometric image formations.	U	PSO-1
CO-2	Illustrate the concepts of linear and non-linear filtering techniques, their role in image enhancement and noise reduction, model fitting and optimization methods	Ap	PSO-1, 2, 3
CO-3	Experiment with feature detection and matching algorithms, including feature detectors, descriptors, matching techniques, and edge detection.	Ap	PSO-1,2,3
CO-4	Demonstrate the principles and techniques of image alignment and stitching in computer vision and image processing.	Ap	PSO-1, 2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: COMPUTER VISION

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**

CO-1	Summarize the fundamental concepts and principles of computer vision, including image formation, transformations, and photometric image formations.	PO-6,7 PSO-1	U	F, C	L	-
CO-2	Illustrate the concepts of linear and non-linear filtering techniques, their role in image enhancement and noise reduction, model fitting and optimization methods	PO6, 7 PSO-1,2,3	Ap	F, C	L	-

CO-3	Experiment with feature detection and matching algorithms, including feature detectors, descriptors, matching techniques, and edge detection.	PO6, 7 PSO-1, 2,3	Ap	F, C	L	-
CO-4	Demonstrate the principles and techniques of image alignment and stitching in computer vision and image processing.	PO6, 7 PSO-1, 2,3	Ap	F, C	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO 1	-	-	-	-	-	3	3	-	3	3	3	3

CO 2	-	-	-	-	-	3	3	-	3	3	3	3
CO 3	-	-	-	-	-	3	3	-	3	3	3	3
CO 4	-	-	-	-	-	3	3	-	3	3	3	3

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- · Quiz / Assignment/ Quiz/ Discussion / Seminar
- · Midterm Exam
- · Programming Assignments
- · Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓	✓		✓

23. **FULL STACK DEVELOPMENT**

Discipline	COMPUTER SCIENCE
Course Code	UK7DSECSC403
Course Title	FULL STACK DEVELOPMENT
Type of Course	DSE
Semester	VII
Academic Level	4

Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5 hours
Pre-requisites	Should have knowledge in HTML 5, CSS 3, JavaScript and node.js				
Course Summary	This course provides an in-depth exploration of full-stack web development, covering both front-end and back-end technologies. Students will learn to build dynamic web applications from scratch using industry-standard tools and practices.				

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs (L+P)**
I		**Basics of Full Stack Development**	**15**
	1	Understanding the Basic Web Development Structure, Structure of Web Applications, Components- User, Browser, Web Server, Backend Services	
	2	What are Software Stacks, Types of Stacks	
	3	Who is a Full Stack Developer	

	4	Tools for Full Stack Developers- Editors, Development Editors, Browsers	
	5	Familiarizing Nodej.s,	
II	**Familiarizing MongoDB**		**15**
	6	Understanding NoSQL and MongoDB- NoSQL, MOngoDB	
	7	Building MongoDB Environment	
	8	User Accounts- Listing Users,Create User Accounts, Remove Users	
	9	Access Control- Creating User Administrator Account Creating Database Administrator Account	
	10	Data types in MongoDB	
	11	Administering Databases	
	12	Managing Collections	
	13	Connecting to MongoDB from node.js	
	14	Understanding the Objects used in MongoDB Node.js driver	

	15	Simple applications	
	16	Advanced MongoDB- Indexing, Aggregation, Map Reduce	
III		**Express and Angular**	**15**
	17	Implementing Express in node.js- installing Express, configuring routes	
	18	Using Request and Response objects, Introduction to Typescript	
	19	Type Annotations, Variables and Constants, understanding Interfaces	
	20	Implementing Classes, Modules, Functions	
	21	Basics of Angular, Angular CLI, Creating First Application in Angular, Angular Lifecycle	
	22	Understanding and using rigModule	
	23	Angular Architecture, Angular Components	
	24	Expressions-Pipes,Data Binding, Built in Directives- Structural Directives-ngif, ngfor,ngSwitch, Attribute Directives	
IV		**React**	**15**

	25	Concept of MEAN Stack, MERN Stack	
	26	Basic React Applications, React Components	
	27	Inter Component Communication, The Props, React State	
	28	Express REST APIs	
	29	Modularization and Webpack, Routing with React Router, Server-side Rendering	
V		**Flexi Module: Not included for End Semester Exams**	**15**
	30	Data Formats- CSV, XWL, JSON, Image Formats- Photpgraphs in IPC Format, Graphs and animations in GIF format, Graphics in png formatVector Graphics in Svc format, Video Formats, Audio formats	
	31	Implementing Mobile Applications, Types of Mobile applications, Native applications, Mobile web applications, Hybrid applications, Comparison of approaches	
	32	Using Web Protocols, Using Web APIs	
	33	Responsive Design- Introduction, Viewports, Media queries, Flexible layouts	

References

1. A A Puntambekar, Full Stack Web Development, Technical Publications, First Edition, June 2023
2. Philip Ackermann, Full Stack Web Development The Comprehensive Guide, Rheinwerk Publishing Inc, First Edition, 2023

Lab Exercises

1. Creating web pages using HTML.
2. Designing web pages using CSS.
3. Making Web pages interactive with Javascript,
4. Making Webpages dynamic using server-side logic

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Summarize basic concepts of full stack development	Ap	PSO-1, 2, 3
CO-2	Develop Applications using Express and Angular	Ap	PSO-1, 2, 3
CO-3	Build Applications with REACT	Ap	PSO-1,2, 3

CO-4	Construct a MERN Stack	Ap	PSO-1, 2, 3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture: Tutorial: Practical)

CO No.	**CO**	**PO/PSO**	**Cognitive Level**	**Knowledge Category**	**Lecture (L)/ Tutorial (T)**	**Practical (P)**
CO-1	Summarize basic concepts of full stack development	PO- 2,3, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO-2	Develop Applications using Express and Angular	PO- 2,3, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P
CO-3	Build Applications with REACT	PO- 2,3, 6,7 PSO-1,2, 3	Ap	F, C, P	L	P

CO-4	Construct a MERN Stack	PO- 2,3, 6,7 PSO-1, 2, 3	Ap	F, C, P	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	-	2	2	-	-	3	3	-	2	2	2	-
CO 2	-	2	2	-	-	3	3	--	2	2	2	-
CO 3	-	2	2	-	-	3	3	-	2	2	2	--
CO 4	-	2	2	-	-	3	3	-	2	2	2	-

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Lab Assessment	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		✓

Semester 8

DSC (Online) (*Not Required Now*)

DSC (Offline) (*Not Required Now*)

Internship Project (*Not Required Now*)

Research Project (*Not Required Now*)