

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

B.Tech.

Computer Science and Engineering

Curriculum and Syllabus

Regulation 2022

(Based on Choice Based Credit System (CBCS)

and

Outcome Based Education (OBE))

Effective from the Academic year

2022-2023

Department of

Computer Science and Engineering

School of Engineering

VISION AND MISSION OF THE DEPARTMENT

VISION

To develop a knowledge hub for Computer Science Engineers and Technocrats in application of their competence for the betterment of the Individual, Industry and Society.

MISSION

- To nurture the students to be industry ready by providing a strong conceptual foundation and by enhancing their employability and entrepreneurial skills.
- To provide holistic growth by conducting relevant enrichment programs, which includes curricular, co-curricular, extra-curricular and extension activities.
- To inculcate innovation and creativity through practically viable Internships and Project works.
- To create a research oriented mindset and focus in fulfilling growing demands of the society through mentoring and lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES(PEO)

PEO 1: To design, analyze, innovate and synthesize information in the field of Computer Science and Engineering relating to Industrial applications and Research.

PEO 2: To become Entrepreneurs or Employees of Reputed Organizations or Pursue Higher Education.

PEO 3: To exhibit leadership capability, endeavoring Social and Economical commitment and a mindset to inculcate community service and to conserve the Environment.

PEO 4: To accomplish any tasks with ethical values and commitment to meet the Social needs.

PEO 5: To work in a Multidisciplinary environment by providing solutions to real time problems.

PROGRAM OUTCOMES (PO)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: An expert who will be able to design, develop, analyze and apply acquired knowledge in computer software and hardware.

PSO 2: A Professional who can solve problem in varied fields and appraise environmental as well as social issues with ethics.

COMPETENCIES AND PERFORMANCE INDICATORS			
PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.			
1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems
		1.1.2	Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
1.2	Demonstrate competence in basic sciences	1.2.1	Apply laws of natural science to an engineering problem
1.3	Demonstrate competence in engineering fundamentals	1.3.1	Apply engineering fundamentals
1.4	Demonstrate competence in specialized engineering knowledge to the program	1.4.1	Apply theory and principles of computer science and engineering to solve an engineering problem
PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.			
2.1	Demonstrate an ability to identify and formulate complex engineering problem	2.1.1	Evaluate problem statements and identifies objectives
		2.1.2	Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem
		2.1.3	Identify mathematical algorithmic knowledge that applies to a given problem
2.2	Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1	Reframe the computer-based system into interconnected subsystems
		2.2.2	Identify functionalities and computing resources.
		2.2.3	Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions
		2.2.4	Compare and contrast alternative solution/methods to select the best methods
		2.2.5	Compare and contrast alternative solution processes to select the best process.
2.3	Demonstrate an ability to formulate and interpret a model	2.3.1	Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.

		2.3.2	Identify design constraints for required performance criteria.
2.4	Demonstrate an ability to execute a solution process and analyze results	2.4.1	Applies engineering mathematics to implement the solution.
		2.4.2	Analyze and interpret the results using contemporary tools.
		2.4.3	Identify the limitations of the solution and sources/causes.
		2.4.4	Arrive at conclusions with respect to the objectives.
PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.			
3.1	Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1	Able to define a precise problem statement with objectives and scope
		3.1.2	Able to identify and document system requirements from stake- holders
		3.1.3	Able to review state-of-the-art literature to synthesize system requirements.
		3.1.4	Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard
		3.1.5	Explore and synthesize system requirements from larger social and professional
		3.1.6	Able to develop software requirement specifications (SRS).
3.2	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Able to explore design alternatives.
		3.2.2	Able to produce a variety of potential design solutions suited to meet functional requirements.
		3.2.3	Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.3	Demonstrate an ability to select optimal design scheme for further development	3.3.1	Able to perform systematic evaluation of the degree to which several design concepts meet the criteria.
		3.3.2	Consult with domain experts and stakeholders to select candidate engineering
3.4	Demonstrate an ability to advance an engineering design to defined end state	3.4.1	Able to refine architecture design into a detailed design within the existing constraints.
		3.4.2	Able to implement and integrate the modules.

		3.4.3	Able to verify the functionalities and validate the design.
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.			
4.1	Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1	Define a problem for purposes of investigation, its scope and importance
		4.1.2	Able to choose appropriate procedure/algorithm, dataset and test cases.
		4.1.3	Able to choose appropriate hardware/software tools to conduct the experiment.
4.2	Demonstrate an ability to design experiments to solve open-ended problems	4.2.1	Design and develop appropriate procedures/methodologies based on the study objectives
4.3	Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1	Use appropriate procedures, tools and techniques to collect and analyze data
		4.3.2	Critically analyze data for trends and correlations, stating possible errors and limitations
		4.3.3	Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions
		4.3.4	Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.			
5.1	Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1	Identify modern engineering tools, techniques and resources for engineering activities
		5.1.2	Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2	Demonstrate an ability to select and apply discipline specific tools, techniques and resources	5.2.1	Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
		5.2.2	Demonstrate proficiency in using discipline-specific tools

5.3	Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1	Discuss limitations and validate tools, techniques and resources
		5.3.2	Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.			
6.1	Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1	Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.2	Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1	Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.			
7.1	Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1	Identify risks/impacts in the life-cycle of an engineering product or activity
		7.1.2	Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.2	Demonstrate an ability to apply principles of sustainable design and development	7.2.1	Describe management techniques for sustainable development
		7.2.2	Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.			
8.1	Demonstrate an ability to recognize ethical dilemmas	8.1.1	Identify situations of unethical professional conduct and propose ethical alternatives
8.2	Demonstrate an ability to apply the Code of Ethics	8.2.1	Identify tenets of the ASME professional code of ethics

		8.2.2	Examine and apply moral & ethical principles to known case studies
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.			
9.1	Demonstrate an ability to form a team and define a role for each member	9.1.1	Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
		9.1.2	Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2	Demonstrate effective individual and team operations--communication, problem solving, conflict resolution and leadership skills	9.2.1	Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
		9.2.2	Treat other team members respectfully
		9.2.3	Listen to other members
		9.2.4	Maintain composure in difficult situations
9.3	Demonstrate success in a team-based project	9.3.1	Present results as a team, with smooth integration of contributions from all individual efforts
PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions			
10.1	Demonstrate an ability to comprehend technical literature and document project work	10.1.1	Read, understand and interpret technical and non-technical information
		10.1.2	Produce clear, well-constructed, and well-supported written engineering documents
		10.1.3	Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2	Demonstrate competence in listening, speaking, and presentation	10.2.1	Listen to and comprehend information, instructions, and viewpoints of others
		10.2.2	Deliver effective oral presentations to technical and non-technical audiences
10.3	Demonstrate the ability to integrate different modes of	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations

	communication	10.3.2	Use a variety of media effectively to convey a message in a document or a presentation
PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.			
11.1	Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1	Describe various economic and financial costs/benefits of an engineering activity
		11.1.2	Analyze different forms of financial statements to evaluate the financial status of an engineering project
11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	11.2.1	Analyze and select the most appropriate proposal based on economic and financial considerations.
11.3	Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1	Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
		11.3.2	Use project management tools to schedule an engineering project, so it is completed on time and on budget.
PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.			
12.1	Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1	Describe the rationale for the requirement for continuing professional development
		12.1.2	Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2	Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1	Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current
		12.2.2	Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3	Demonstrate an ability to identify and access sources for new information	12.3.1	Source and comprehend technical literature and other credible sources of information

		12.3.2	Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.
PSO 1: An expert who will be able to design, develop, analyze and apply acquired knowledge in computer software and hardware.			
13.1	Ability to investigate complex problems	13.1.1	Identify problem statements and develop smart solutions for real time applications
		13.1.2	Investigate all the probable solutions towards the identified problem
13.2	Design and Develop solutions systematically	13.2.1	Specify the design tools that may help in finding the solution
		13.2.2	Systematically evaluate and identify the testing strategies to develop an optimal solution
		13.2.3	Implement an optimal solution for the desired problem
PSO 2: A Professional who can solve problem in varied fields and appraise environmental as well as social issues with ethics.			
14.1	Develop cost benefit solutions using engineering principles and practices	14.1.1	Describe the rationale for choosing solutions based on engineering principles
		14.1.2	Conduct feasibility and cost-benefit analysis for implementing the solution
14.2	Ability to understand and develop the social and environmental issues using the current technology	14.2.1	Identify the problem and develop an appropriate solution
		14.2.2	Design solution with ethics for social and environmental problems

VELS INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Panel members for Board of studies meeting are listed below

S. No	Name of the Board Member	Designation	Institute / Industry
Internal Members			
1	**Dr. R. Anandan**	Professor & Head Department of Computer Science and Engineering Vels Institute of Science, Technology & Advanced Studies (VISTAS)	Chairman
2	**Dr. S. Arun**	Director, IQAC Vels Institute of Science, Technology & Advanced Studies (VISTAS)	Internal Member
3	**Dr. R. A. Karthika**	Associate Professor Department of Computer Science and Engineering Vels Institute of Science, Technology & Advanced Studies (VISTAS)	Internal Member
4	**Dr. A. Rajesh**	Associate Professor Department of Computer Science and Engineering Vels Institute of Science, Technology & Advanced Studies (VISTAS)	Internal Member
5	**Dr. K. Kalaivani**	Assistant Professor Department of Computer Science and Engineering Vels Institute of Science, Technology & Advanced Studies (VISTAS)	Internal Member
External Expert Members			
1	**Dr. Asnath Victy Phamila Y**	Associate Professor School of Computer Science and Engineering Vellore Institute of Technology - VIT Chennai	Academic Expert
2	**Mr. Santhosh Gopynadhan**	Senior Director Optum Global Solutions (India) Private Limited, Chennai	Industrial Expert
Student Member			
1	**Mr. Pavan Srivatsav**	Project Associate Cognizant Technology Solutions, Chennai	Alumni

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES
SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CREDIT DISTRIBUTION

B.E (Computer Science and Engineering)										
Credits Per Semester										
S. No	**Course Category**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total Credits**
1	HSC		3	2	2	2	2			11
2	BSC	8	8	4	7					27
3	ESC	10	7	4						21
4	PCC			13	15	15	11	4		58
5	PEC					3	7	7	3	20
6	OEC					3	3	6	6	18
7	Project							5	10	15
8	MC									0
	TOTAL	**18**	**18**	**23**	**24**	**23**	**23**	**22**	**19**	**170**

HSC	Humanities and Social Science Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
EEC	Employability Enhancement Courses
MC	Mandatory Courses

B.E CSE (Regulation 2022-23)								
Category	**Course Title**	**Lecture**	**Tutorial**	**Practical**	**Credits**	**CA**	**SEE**	**Total**
SEMESTER 1								
BSC	Engineering Chemistry	3	-	-	3	40	60	100
BSC	Mathematics I(Calculus and Linear Algebra)	3	1	-	4	40	60	100
ESC	Programming for Problem Solving	3	-	-	3	40	60	100
ESC	Basics of Civil and Mechanical Engineering	3	-	-	3	40	60	100
ESC	Workshop and Manufacturing Practices	1	-	4	3	40	60	100
BSC	Chemistry Laboratory	-	-	2	1	40	60	100
ESC	Programming for Problem Solving Laboratory	-	-	2	1	40	60	100
MC	Student Induction Program	-	-	-	-	-	-	-
MC	Universal Human Values	2	-	-	-			100
		15	**1**	**8**	**18**			
SEMESTER II								
HSC	English	2	-	-	2	40	60	100
BSC	Physics	3	-	-	3	40	60	100
BSC	Mathematics II	3	1	-	4	40	60	100
ESC	Basic Electrical and Electronics Engineering	3	-	-	3	40	60	100
ESC	Engineering Graphics and Design	1	-	4	3	40	60	100
HSC	English Laboratory	-	-	2	1	40	60	100
BSC	Physics Laboratory	-	-	2	1	40	60	100
ESC	Basic Electrical and Electronics Engineering Laboratory	-	-	2	1	40	60	100
MC	Constitution of India	2	-	-	-			100
		14	**1**	**10**	**18**			
SEMESTER III								
BSC	Mathematics III	3	1	-	4	40	60	100
ESC	Python Programming	3	1	-	4	40	60	100
PCC	Operating Systems	3	-	-	3	40	60	100
PCC	Data Structures	3	1	-	4	40	60	100
PCC	Design and Analysis of Algorithms	3	-	2	4	40	60	100
PCC	Operating Systems Lab	-	-	2	1	40	60	100

PCC	Data Structures using Python Lab	-	-	2	1	40	60	100
HSC	Personality Development I (Effective Technical Communication)	2	-	-	2	40	60	100
MC	Basic Life Skills	2	-	-	-			100
		19	**3**	**6**	**23**			
SEMESTER IV								
BSC	Mathematics IV (Random Process and Queuing Theory)	3	1	-	4	40	60	100
PCC	Computer Organization and Architecture	3	-	-	3	40	60	100
PCC	Database Management Systems	3	-	-	3	40	60	100
PCC	Computer Networks	3	-	-	3	40	60	100
PCC	Introduction to AI & ML	3	-	2	4	40	60	100
PCC	Database Management Systems Lab	-	-	2	1	40	60	100
PCC	Computer Networks Lab	-	-	2	1	40	60	100
HSC	Personality Development II	2	-	-	2	40	60	100
BSC	Environmental Science and Engineering	3	-	-	3	40	60	100
MC	Gender Sensitivity Related Course	2	-	-	-			100
		22	**1**	**6**	**24**			
SEMESTER V								
PCC	Java and Web Programming	3	-	-	3	40	60	100
PCC	Computer Graphics and Multimedia	3	1	-	4	40	60	100
PEC	Professional Elective Course - I	3	-	-	3	40	60	100
OEC	Open Elective Course - I	3	-	-	3	40	60	100
PCC	Fundamentals of Blockchain and Use cases	3	-	2	4	40	60	100
PCC	Java and Web Programming Lab	-	-	2	1	40	60	100
PCC	Computer Graphics and Multimedia Lab	-	-	2	1	40	60	100
HSC	Personality Development III	2	-	-	2	40	60	100

PCC	Industrial Training/ Mini Project/ MOOC Course (NPTEL/SWAYAM/CourseEra/ Mathworks) - Minimum 4 weeks	-	-	4	2			100
		17	**1**	**10**	**23**			
SEMESTER VI								
PCC	.Net Programming	3	-	-	3	40	60	100
PCC	Theory of Computation and Compiler Design	3	1	-	4	40	60	100
PEC	Professional Elective Course - II	3	-	-	3	40	60	100
PEC	Professional Elective Course - III	3	-	2	4	40	60	100
OEC	Open Elective Course - II	3	-	-	3	40	60	100
PCC	.Net Programming Lab	-	-	2	1	40	60	100
PCC	Compiler Design Lab	-	-	2	1	40	60	100
HSC	Personality Development - IV	2	-	-	2	40	60	100
PCC	Summer Internship (4 weeks)	-	-	4	2			100
		17	**1**	**10**	**23**			
SEMESTER VII								
PCC	Full Stack Web Development	3	-	-	3	40	60	100
OEC	Open Elective Course - III	3	-	-	3	40	60	100
OEC	Open Elective Course - IV	3	-	-	3	40	60	100
PEC	Professional Elective Course - IV	3	-	-	3	40	60	100
PEC	Professional Elective Course - V	3	-	2	4	40	60	100
PCC	Full Stack Web Development Lab	-	-	2	1	40	60	100
Project	Project Phase I	-	-	10	5	40	60	100
		15	**0**	**14**	**22**			
SEMESTER VIII								
PEC	Professional Elective Course - VI	3	-	-	3	40	60	100
OEC	Open Elective Course - V	3	-	-	3	40	60	100
OEC	Open Elective Course - VI	3	-	-	3	40	60	100
Project	Project Phase II	-	-	20	10	40	60	100
		9	**0**	**20**	**19**			

LIST OF ALL BASIC SCIENCE COURSES (BSC)

S.NO	COURSE TITLE
1	Physics
2	Mathematics II
3	Physics Laboratory
4	Chemistry
5	Mathematics I
6	Chemistry Laboratory
7	Mathematics III
8	Environmental Science and Engineering

LIST OF ALL HUMANITIES AND SOCIAL SCIENCES COURSES

S.NO	COURSE TITLE
1	English
2	English Laboratory
3	Personality Development I (Effective Technical Communication)
4	Personality Development II
5	Personality Development III
6	Personality Development IV

LIST OF ALL ENGINEERING SCIENCE COURSES

S.NO	COURSE TITLE
1	Basic Electrical and Electronics Engineering
2	Engineering Graphics and Design
3	Basic Electrical and Electronics Engineering Laboratory
4	Programming for Problem Solving
5	Basics of Civil and Mechanical Engineering
6	Workshop and Manufacturing Practices
7	Programming for Problem Solving Laboratory
8	Electronic Devices and Circuits

LIST OF ALL PROFESSIONAL ELECTIVE COURSES

S.NO	COURSE TITLE
	PROFESSIONAL ELECTIVE
1	APPLIED CRYPTOGRAPHY
2	BIG-DATA PROGRAMMING
3	BIOINFORMATICS
4	CLOUD COMPUTING
5	CRYPTOGRAPHY AND NETWORK SECURITY
6	CYBER FORENSICS
7	DATA WAREHOUSING AND DATA MINING
8	E- COMMERCE
9	ETHICAL HACKING
10	GAME THEORY
11	INFORMATION RETRIEVAL
12	INTERNET OF THINGS
13	OBJECT ORIENTED ANALYSIS AND DESIGN
14	SOFT COMPUTING
15	SOFTWARE ENGINEERING
16	SOFTWARE PROJECT MANAGEMENT
17	SOFTWARE QUALITY ASSURANCE
18	SOFTWARE TESTING
19	SYSTEM SOFTWARE
20	INTRODUCTION TO DATA ANALYTICS
21	USER INTERFACE DESIGN
22	VIRTUAL REALITY
23	AGILE METHODOLOGIES

24	INFORMATION SECURITY
25	SOFTWARE DEFINED NETWORKS
26	APPLICATIONS OF AI
27	QUANTUM COMPUTING
28	GREEN COMPUTING
29	CLOUD SECURITY
30	WEB ANALYTICS AND SOCIAL MEDIA MINING
31	VIRTUALIZATION TECHNIQUES
32	DISTRIBUTED COMPUTING
33	CYBER LAWS AND ETHICS
34	OPEN-SOURCE TECHNOLOGIES

LIST OF ALL PROFESSIONAL ELECTIVE COURSE (Blended - Theory + Practical)

S.NO	COURSE TITLE
	PROFESSIONAL ELECTIVE
1	DATA EXPLORATION AND VISUALIZATION
2	BIG DATA ANALYTICS
3	NOSQL DATABASE
4	GAME PROGRAMMING
5	ROBOTICS AND ITS APPLICATIONS
6	CONCEPTS OF VIRTUAL AND AUGMENTED REALITY
7	DIGITAL IMAGE PROCESSING
8	KNOWLEDGE ENGINEERING
9	STREAM PROCESSING
10	SECURITY AND PRIVACY IN CLOUD
11	ROBOTIC PROCESS AUTOMATION

LIST OF ALL MANDATORY COURSES

S.NO	COURSE TITLE
1	CONSTITUTION OF INDIA
2	STUDENT INDUCTION PROGRAM
3	UNIVERSAL HUMAN VALUES – 2
4	BASIC LIFE SKILLS
5	GENDER CULTURE TECHNOLOGY

LIST OF OPEN ELECTIVE COURSES OFFERED TO OTHER PROGRAMS

S.No	Course
OCSE01	DATA STRUCTURES AND ALGORITHMS
OCSE02	INTERNET OF THINGS
OCSE03	PYTHON PROGRAMMING
OCSE04	ARTIFICIAL INTELLIGENCE
OCSE05	CLOUD COMPUTING
OCSE06	E-COMMERCE
OCSE07	ETHICAL HACKING
OCSE08	BLOCK CHAIN TECHNOLOGIES
OCSE09	INTRODUCTION TO DATA ANALYTICS
OCSE10	FUNDAMENTALS OF AI AND ML

CSE	Engineering Chemistry	L	T	P	Credits
		3	0	0	3

Course Objectives

- To learn about the molecular orbitals, ionic interactions and periodic properties.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

UNIT I Atomic and molecular structure, Intermolecular forces and potential energy surfaces 9

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene, benzene and aromaticity. Valence Bond Theory and the energy level diagrams for transition metal ions and their magnetic properties. Ionic, dipolar and van Der Waals interactions, potential energy surfaces of H_3, H_2F and HCN.

UNIT II Spectroscopic techniques and applications 9

Principles of spectroscopy and selection rules. Electronic spectroscopy. Vibrational, rotational spectroscopy of diatomic molecules, Morse equations and Mossbauer spectroscopy . Applications. Diffraction and scattering

UNIT III Use of free energy in chemical equilibria 9

Thermodynamic functions: energy, entropy , free energy and fugacity. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

UNIT IV Periodic properties 9

Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, diagonal relationship, anomalous behaviour of Lithium, carbon and Nitrogen, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT V Organic reactions and synthesis of a drug molecule 9

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, Coupling reaction and ring openings. Synthesis of a commonly used drug molecule.

TOTAL: 45 hours

Text Books

T1: Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.

T2: Fundamentals of Molecular Spectroscopy, by C. N. Banwell.

T3: Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.

Reference Books

R1: Physical Chemistry, by P. W. Atkins.

R2: Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp.

R3: University chemistry, by B. H. Mahan.

Web Links:

1. https://opentextbc.ca/chemistry/chapter/10-1-intermolecular-forces/
2. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod2.pdf
3. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium
4. https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Properties_of_the_Elements
5. https://www.bcebhagalpur.ac.in/wp-content/uploads/2020/03/Organic-Reactions-Synthesis-of-Drug-Molecule.pdf

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO3: Analyze bulk properties and processes using thermodynamic considerations.

CO4: Classify the properties and reactivity of different types of elements based on the periodic table.

CO5: Apply the basic terms involved in an Organic reactions and synthesis of a drug molecule.

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔

Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✔	✔

CSE	Mathematics-I (Calculus and Linear Algebra)	3L:1T:0P:4 credits

Course Objectives

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines

Unit-I: Calculus **(12 hours)**

Rolle's theorem-Mean value theorems-Taylor's and Maclaurin theorems -Indeterminate forms and L'Hospital's rule-Curvature-radius of curvature – Evolutes and envelopes.

Unit-II: Multivariable Calculus **(12hours)**

Limits-continuity- partial derivative – total derivative – maxima and minima- saddle points-method of Lagrange multipliers

Unit-III: Sequence and series **(12hours)**

Convergence of sequence and series – test for convergence- power series – Comparison test- Root test, D'Alembert's test and Leibnitz's test

Unit-IV: Matrices **(12 hours)**

Introduction to Matrices- Rank of matrix- Linear systems of equations-symmetric- skew symmetric matrix and orthogonal matrices-Eigen values and Eigen vectors Diagonalization of matrices- Cayley-Hamilton theorem and orthogonal transformation.

Unit-V: Vector spaces **(12 hours)**

Vector Space- linear Independence and dependence of vectors, basis, dimension- Linear transformations (maps), range and kernel of a linear map, rank and nullity- Inner product spaces-Gram-Schmidt Orthogonalization.

Total Hours: 60

Textbooks:

1. G.B.Thomas and R.L.Finney, Calculus and Analytic geometry, 9thEdition,Pearson,Reprint, 2002.

2. Ramana B.V., Higher Engineering Mathematics,Tata McGraw Hill New Delhi, 11,Reprint,2010

3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference books:

1. P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, First Edition, Pearson India Education services Pvt. Ltd.
2. Erwinkreyszig, Advanced Engineering Mathematics, 9 Edition, John Wiley&Sons, 2006.
3. VeerarajanT.,Engineering Mathematics for firstyear,TataMcGraw-Hill,NewDelhi,2008.
4. D.Poole, LinearAlgebra: A ModernIntroduction,2nd Edition, Brooks/Cole,2005.
5. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition,2010.

Course Outcome

CO1:	Apply the concept of differential calculus and to evaluate the curvature, radius of curvature and envelope	**K3**
CO2:	Understand the concept of limits, continuity and to evaluate derivatives	**K2**
CO3:	Analyze the convergence of the series using root test, D'Alembert's test, Leibnitz's test	**K3**
CO4:	Determine the rank of a matrix, linear system of Equation and Eigen values and Eigenvectors	**K3**
CO5:	Evaluate the linear independence and dependence of vectors, linear transformations and inner product space.	**K4**

Mapping of Program outcomes with course outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	3	2	1	3	-	-	-	-	-	-	-	3	-
CO 2	3	3	2	2	3	-	-	-	-	-	-	-	3	-
CO 3	3	3	2	2	2	-	-	-	-	-	-	-	3	-
CO 4	3	3	2	2	2	-	-	-	-	-	-	-	3	-
CO 5	3	3	2	2	3	-	-	-	-	-	-	-	3	-

Assessment Methods:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**

CSE	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	3

Course Objectives

- To understand the basic concepts of programming – Flow chart, Pseudocode.
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations.
- To understand the concepts of arrays, basic sorting and searching algorithms.
- To find the order of time complexity of basic algorithms

UNIT I INTRODUCTION TO PROGRAMMING 9 hours

Introduction to Programming (Flow chart/pseudo code, compilation etc.), Variables (including data types), Input / Output - Arithmetic expressions and precedence, Conditional Branching and Loops -Writing and evaluation of conditionals and consequent branching - Iteration and loops

UNIT II ARRAYS AND BASIC ALGORITHMS 9 hours

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs

UNIT III FUNCTIONS AND POINTERS 9 hours

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers- Defining pointers, Use of Pointers in self-referential structures

UNIT IV STRUCTURES AND UNIONS 9 hours

Structures - Defining structures and Array of Structures, Structures containing Pointers, Unions - Storage classes: auto, static, extern, register – Dynamic memory allocation

UNIT V STRING FUNCTIONS AND FILES 9 hours

Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of typedef, Command line arguments, Enumerated data types.

TOTAL : 45 hours

Text Books:

T1: E. Balaguruswamy, “Programming in ANSI C”, Tata McGraw-Hill
T2: Byron Gottfried, “Schaum's Outline of Programming with C”, McGraw-Hill

Reference Books:

R1: Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, PrenticeHall of India R2: YashavantKanetkar, “Let Us C”, BPB Publications
R3: Ashok.N.Kamthane, “Computer Programming”, Pearson Education (India)

Web Links:

W1. https://www.edx.org/course/c-programming-getting-started

COURSE OUTCOMES

CO1:	Determine a pictorial representation with a stepwise procedure for solving complex problems	**K2**
CO2:	Develop a high level programming code using c languages.	**K3**
CO3:	Evaluate the various functional operations for solving problem.	**K4**
CO4:	Make use of various c operations like array, pointer, strings and searching method	**K3**
CO5:	Develop a C module for a given set of instruction.	**K4**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**P O4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO2**
CO1	3	2	2	1	1	-	-	-	-	-	-	2	3	-
CO2	3	2	3	2	2	-	-	-	-	-	-	2	3	3
CO3	3	2	3	2	2	-	-	-	-	-	-	2	3	2
CO4	3	2	3	1	2	-	-	-	-	-	-	2	3	2
CO5	3	2	3	2	2	-	-	-	-	-	-	2	3	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	**BASIC CIVIL AND MECHANICAL ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
- To help students acquire knowledge in the basics of surveying and the materials used for Construction.
- To provide an insight to the essentials of components of a building and the infrastructure Facilities.
- To explain the component of power plant units and detailed explanation to IC engines their Working principles.
- To explain the Refrigeration & Air-conditioning system.

UNIT I PART A: OVERVIEW OF CIVIL ENGINEERING (5 hours)

Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.

UNIT I PART B: OVERVIEW OF MECHANICAL ENGINEERING (4 hours)

Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS (9 hours)

Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours. Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber – Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)

UNIT III BUILDING COMPONENTS AND INFRASTRUCTURE (9 hours)

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering. Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste

Management - Introduction to Highways and Railways - Introduction to Green Buildings.

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS (9 hours)

Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM (9 hours)

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.

TOTAL: 45 PERIODS

OUTCOMES:

CO1	Understanding profession of Civil and Mechanical engineering.	K2
CO2	Summarise the planning of building, infrastructure and working of Machineries.	K2
CO3	Apply the knowledge gained in respective discipline	K3
CO4	Illustrate the ideas of Civil and Mechanical Engineering applications.	K2
CO5	Appraise the material, Structures, machines and energy.	K3

TEXT BOOKS:

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013.
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
4. Shantha Kumar SRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

Web Links:

1. https://nptel.ac.in/courses/105106201
2. https://geekztrainerblog.wordpress.com/basic-civil-and-mechanical-engineering/

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	1	2	2	2	2	-	-	-	-	-	-	2	1
CO2	1	2	2	3	3	3	-	-	-	-	-	-	3	2
CO3	1	2	2	3	3	3	-	-	-	-	-	-	3	2
CO4	1	2	2	3	3	3	-	-	-	-	-	-	2	3
CO5	2	3	2	2	3	2	-	-	-	-	-	-	2	3
	1.2	2	2	2.6	2.8	2.6	-	-	-	-	-	-	2.4	2.2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester**	**Assignments**	**Case Studies**

			Exams		
✓	✓	✓	✓	✓	✓
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✓		✓		✓	

CSE	**WORKSHOP AND MANUFACTURING PRACTICES**	**1**	**0**	**4**	**3**

COURSE OBJECTIVES:

1. To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
2. To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

DETAILED CONTENTS:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical &Electronics (1 lecture)

5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

WORKSHOP PRACTICE:

1. Machine shop (9 hours)

Machining: Basics of Machining Processes Equipment'S, Simple turning of cylindrical surface on MS rod using lathe machine tool,To make Facing and plain turning, step turning, drilling in the lathe

2. Fitting shop (9hours)

To make square, V joint in bench fitting as per the given dimensionand tolerances,Tools and demonstration of producing model

3. Carpentry (9 hours)

Basics of Carpentry operations, Equipment's ,To make half lap joint, dovetail, TEE Lap joint ,Cross halving joint of two wooden pieces at perpendicular direction,

4. Welding shop (9 hours)

To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.To make simple Dust pan, Rectangular trays in sheet metal with the jigs as perthe given Dimensions.

5. Plumbing Works (9 hours)

Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

TOTAL : 45 hours

COURSE OUTCOMES

CO1:	Experiment with facing, Turning and various types of fitting joint	**K 1**
CO2:	Develop the half lap joint, TEE Lap joint carpentry and welding.	**K 5**
CO3:	Practice casting, moulding, & smithy trades	**K 2**
CO4:	Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering	**K 5**
CO5:	Make a Basic pipe connections for Mixed pipe material connection and Pipe	**K 1**

	connections with different joining components	

TEXT/REFERENCE BOOKS:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007

2. Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, 2006.

3. Bawa H.S., Workshop Practice, Tata McGraw, 2007. 4. Rajendra Prasad A. & Sarma P.M.M.S., Workshop Practice, Sree Sai Publication, 2002

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**1**	**3**	**1**	**2**	**-**	**2**	**-**	**2**	**-**	**1**	**2**	**1**	**2**
CO2	**3**	**1**	**3**	**1**	**3**	**-**	**2**	**-**	**2**	**-**	**1**	**2**	**2**	**2**
CO3	**3**	**1**	**3**	**1**	**2**	**-**	**2**	**-**	**3**	**-**	**1**	**2**	**1**	**1**
CO4	**3**	**1**	**2**	**1**	**2**	**-**	**2**	**-**	**2**	**-**	**1**	**2**	**1**	**1**
CO5	**3**	**1**	**3**	**1**	**2**	**-**	**2**	**-**	**1**	**-**	**1**	**2**	**2**	**2**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
			✓	✓	✓
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

CSE	**CHEMISTRY LABORATORY**	**0**	**0**	**2**	**1**

Course Objectives

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time.
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule.

Experiments

1. Determination of the rate constant of a reaction.
2. Determination of the partition coefficient of a substance between two immiscible liquids.
3. Determination of surface tension and viscosity.
4. Thin layer chromatography.
5. Determination of chloride content in water.
6. Determination of cell constant and conductance of solutions.
7. Synthesis of a polymer/drug.
8. Determination of saponification / acid value of an oil.
9. Determination of redox potentials and emf by Potentiometric method.
10. Estimate the adsorption of acetic acid by charcoal.

Text Books

T1: S. Sundaram and K. Raghavan "Practical Chemistry", S. Viswanathan. Co. 3rd edition 2011.
T2: Gnanaprakasam, Ramamurthy, "Organic Chemistry Lab Manual" S. Viswanathan Pvt. Ltd. 3rd edition 2011.

Reference Books

R1: Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011
R2: J. N. Gurtu and R. Kapoor "Advanced experimental Chemistry", S. Chand and Co. 6th edition, 2010.

Web Links

1. https://www.khanacademy.org/science/ap-chemistry-beta/x2eef969c74e0d802:kinetics/x2eef969c74e0d802:introduction-to-rate-law/v/experimental-determination-of-rate-laws
2. https://www.youtube.com/watch?v=qdmKGskCyh8
3. https://www.youtube.com/watch?v=7_6_dKlo67k

COURSE OUTCOMES

At the end of this course the students will be able to,
CO1: Estimate the rate constants of reactions and partition coefficient of immiscible liquids.
CO2: Find the viscosity and to test the purity of the compound.
CO3: Estimate the amount of chlorine content present in drinking water and to know the conductance of a solution.
CO4: Develop a small drug molecule and to know the saponification of an oil.
CO5: Find out the unknown element by Potentiometric method and to remove some of the toxic chemical by charcoal method.

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	0	0	2	1

Course Objectives

- To design and develop C Programs for various applications

Any Eight Experiments

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

COURSE OUTCOMES

At the end of this course the students will be able to

CO1**:** Determine the advanced features of the C language.
CO2: Develop the model data using primitive and structured types.
CO3: Construct programs that demonstrate effective use of C features including arrays, structures, pointers and files.
CO4: Develops the ability to analyze a problem, develop an algorithm to solve it.
CO5: Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3	3	0	1	-	0	1	2	3	2
CO2	2	2	2	2	2	2	0	3	-	0	2	2	3	3
CO3	2	2	2	2	2	3	0	0	-	1	2	3	2	2
CO4	1	2	3	3	3	2	0	3	-	1	3	2	3	2
CO5	2	3	2	3	3	3	3	3	-	1	2	3	1	3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	**UNIVERSAL HUMAN VALUES 2 : UNDERSTANDING HARMONY**	**2**	**0**	**0**	**0**

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT II Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity indetail, Programsto ensure Sanyam andHealth

UNIT III Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to worldfamily!.

UNIT IV Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics:

a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Course Outcome:

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics Excel Books, New Delhi, 2010

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins,USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs,Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

CSE	ENGLISH	L	T	P	Credits
		2	0	0	2

Course Objective:

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

UNIT I VOCABULARY BUILDING 08

General Vocabulary –Nouns--Compound nouns, Synonyms , Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.- Instructions.

UNIT II BASIC WRITING 08

Sentences structures –Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations,Blending and Clipping,Framing questions- Yes/No types and "Wh" questions, Summarizing, Precise writing, Paragraph Writing.

UNIT III IDENTIFYING COMMON ERRORS IN ENGLISH 08

Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund, Checklist.

UNIT IV NATURE AND STYLE OF SENSIBLE WRITING 08

Situational Dialogues, Process description, Definitions, Numerical Expressions, Recommendation, Information Transfer- Flow chart Bar chart and Pie chart, ,Writing introduction and conclusion.

UNIT VWRITING PRACTICES 08

Active voice and Passive voice, ,Making negative sentences ,Tenses,Letter Writing- Formal & Informal Letters, Report Writing- Letter Report, Accident Report, Investigation Report and Survey, Essay writing, Reading Comprehension Passages.

TOTAL - 40 HOURS

Text Books:

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.

2. Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.

3. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.

4. Department of Humanities and Social Sciences, Anna University, ‘‘English for Engineers and Technologists’’ Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.

5. M.AshrafRizvi, “Effective Technical Communication”, Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

Reference Books:

(i) Practical English Usage. Michael Swan. OUP. 1995.
(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Weblinks:

- https://ehlion.com/magazine/technical-english/
- https://www.kkcl.org.uk/pdf/KKCL_Technical_English_for_Engineers_Brochure.pdf

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

CO 1 Improve the language proficiency of a technical under-graduate in English with emphasis on Learn, Speak, Read and Write skills.

CO 2 Develop listening skills for academic and professional purposes.

CO 3 Acquire the ability to speak effectively in English in real life situations

CO 4 Provide learning environment to practice listening, speaking, reading and writing skills.

CO 5 Variety of self-instructional modes of language learning and develop learner autonomy.

Mapping of Program outcomes with course outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	-	-	-	-	2	2	-	2	3	3	3	3	2	-
CO 2	-	-	-	-	2	2	-	2	3	3	3	3	2	-
CO 3	-	-	-	-	-	-	2	-	1	1	1	1	2	-
CO 4	-	-	-	-	2	1	3	1	-	-	-	-	2	-
CO 5	-	1	2	2	2	2	-	2	3	3	3	3	2	-
Average		1	2	2	2	1.75	2.5	1.75	2.5	2.5	2.5	2.5	2	-

Assessment Methods:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**
			✔	✔

CSE	PHYSICS	3	0	0	3

Course Objectives

- To learn the basics of electronic materials, semiconducting materials and their interaction with light, new engineered semiconductor devices.
- To apply these fundamental principles to solve practical problems related to materials used for engineering applications.

UNIT I Electronic materials **9**

Energy bands in solids -Types of electronic materials: metals - semiconductors and insulators - Direct and indirect band gaps - Free electron theory - electrical conductivity and thermal conductivity - Fermi distribution- Effect of temperature on Fermi function – Density of energy states - Kronig-Penny model - E-k diagram.

UNIT II Semiconductors **9**

Intrinsic semiconductor - carrier concentration derivation – Variation of Fermi energy level with temperature -extrinsic semiconductors – derivation- carrier concentration in n type and p type semiconductor – Variation of Fermi energy level with temperature and impurity concentration.

UNIT III Light-semiconductor interaction **9**

Optical transitions in bulk semiconductors: absorption - spontaneous emission and stimulated emission - Einstein's coefficient- derivation - Photovoltaic effect - Solar cells – principle and working - excitons

UNIT IV Semiconductor devices and Measurements **9**

Semiconductor diodes: construction and working – PN diode – Zener diode – Light Emitting Diode (LED) – Measurements: UV-Vis spectroscopy - Hall effect – Determination of Hall coefficient – Applications.

UNIT V Engineered semiconductor materials **9**

Shape Memory Alloys (SMA) – Characteristics, Properties of Ni-Ti alloy - Applications - Semiconductor Nanomaterials: Synthesis, properties and applications of nanophase materials – Quantum confinement - Quantum nanostructures: quantum dots - quantum wires - quantum wells.

TOTAL: 45 hours

Text books:

T1: Rajendran V, and Marikani A, 'Materials Science' Tata McGraw Hill publications, New Delhi 2011.
T2: Vijaya, M. and Rangarajan G, 'Materials Science' Tata McGraw Hill publications, New Delhi 2006.
T3: Dr. Mani P , 'A text book of Engineering Physics – II' Shri Dhanam Publilsher, Chennai 2016
T4: Murugeshan R, Kiruthiga Sivaprasath, 'Modern Physics' S Chand Publisher 2016

Reference Books:

R1: S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
R2: Charles Kittel 'Introduction to Solid State Physics', John Wiley and sons, 7th edition, Singapore 2008.
R3: Kasap S.O, "Principles of Electronic Materials", 3rd edition, McGrawHill Higher Education, 2005.
R4: Pradeep T, "A text book of Nanoscience and Nano technology, McGrawHill Higher Education, 2012.

R5: Palanisamy P.K, 'Materials Science', Scitech publications, Chennai, 2007.
R6: J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
R7: P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

Web Links:

1. https://nptel.ac.in/courses/115102026/2
2. https://nptel.ac.in/courses/115102026/15
3. http://textofvideo.nptel.ac.in/115102026/lec18.pdf
4. https://nptel.ac.in/courses/122103010/34
5. http://orbit.dtu.dk/files/4817236/petersen.pdf

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1: Analyze the behavior of free electrons in conducting materials.
CO2: Analyze the type of semiconducting materials and their applications.
CO3: Identify the direct and indirect band gap semiconductors.
CO4: Demonstrate the construction and working of various semiconductor devices.
CO5: Develop the design and fabrication of quantum nanostructures.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	3	3	-	-	-	-	-	-	3	-	3	3
CO5	-	3	3	3	-	-	-	-	-	-	3	-	-	2
AVG	**3.00**	**2.60**	**2.25**	**3.00**	-	-	-	-	-	-	3	-	**2.25**	**2.50**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	Mathematics-II (Probability and Statistics)	3	1	0	4

Course Objective:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

UNIT I: Basic Probability:
12

Introduction to Probability-Conditional probability – Baye's Theorem- Random Variables-Discrete random variables-Continuous Random Variables –Probability mass function-Probability density function.

UNIT II: Standard Distributions:
12

Introduction to theoretical distribution-Discrete Distributions- Binomial, Poisson, Geometric Distributions-Continuous Distribution-Uniform, Normal, Exponential and Gamma distribution-Properties.

UNIT III: Correlation and Regression Analysis: 12

Correlation: Types of Correlation-Methods of studying correlation- Scatter diagram method, Karl Pearson's Coefficient of correlation, Spearman's Rank Correlation Coefficient. Regression: Regression Lines and Regression equations - simple problems

UNIT IV: Basic Statistics: 12

Introduction-Measures of Central tendency: Mean, Median and Mode- Measure of Dispersion- Range, Mean deviation- Standard Deviation and coefficient of variation

UNIT V: Sampling : 12

Introduction to small sample – t-test-Single mean, difference of means, and Paired t-test- F-test- Chi-square test for goodness of fit and independence of attributes.

Total Hours: 60

Course Outcome:

CO1: Apply the fundamental concepts of probability.
CO2: Understand of standard distributions which can describe real life phenomenon.
CO3: Understand and critically discuss the issues surrounding of correlation and Regression
CO4: Evaluate the underlying assumptions of analysis tools of measures of central tendency and dispersion
CO5: Analyze the uses and limitations of Testing of hypothesis used in engineering

Text Books

1. N.P. Bali and Manish Goyal, A text book of engineering mathematics, laxmi publications, reprint, 2014 (Ninth Edition)
2. S.P.Gupta, Statistical Methods. Sultan Chand & Sons, New Delhi
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition, 2001.
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

CSE	**BASIC ELECTRICAL ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

- To obtain basic knowledge on electrical quantities such as current, voltage, power and energy.
- To provide employability skill of adequate working knowledge on basic DC and AC circuits used in

electrical and electronic devices. To understand the working principle, construction, applications of DC machines, AC machines & measuring instruments.

UNIT I DC Circuits **12**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Mesh and Nodal analysis, Analysis of simple circuits with dc excitation, Wye↔Delta Transformation, Superposition, Thevenin and Norton Theorems.

UNIT II AC Circuits **12**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III Transformers **12**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT IV Electrical Machines & Power Converters **12**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Construction of Single phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. DC-DC buck and boost converters, duty ratio control. Single phase Bridge Rectifier, Single Phase voltage source inverters.

UNIT V Basics of Electronics **12**

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics. Binary Number System — Boolean Algebra theorems– Logic gates- Introduction to sequential Circuits– Flip-Flops.

TOTAL : -60 hours

Text Books:

T1: D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
T2: D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
T3: John Bird, “Electrical Circuit theory and technology”, Routledge; 5th edition,2013

Reference Books:

R1: 3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
R2: 4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
R3: 5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989 Text book 1

Web Links:

1. https://www.electricaltechnology.org/category/basic-electrical-fundamentals
2. https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/

COURSE OUTCOMES

CO1:	Understand and analyse DC circuits	K2
CO2:	Understand and analyse AC circuits	K2
CO3:	Explain the construction, operation and characteristics of transformer and classify the types of three –phase transformer connections.	K3
CO4:	Understand and Examine the various electrical machines and converter circuits	K2
CO5:	Identify the basics of electronics	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	1	1	1	-	-	1	-	1	3	-
CO2	3	2	1	1	1	-	-	-	-	1	-	1	3	-
CO3	1	1	1	1	1	3	3	2	-	1	1	1	-	-
CO4	1	-	1	1	1	3	1	1	-	1	1	1	-	1
CO5	2	1	1	1	1	1	-	-	-	1	-	1	1	-

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
√	**√**			**√**	**√**

CSE	ENGINEERING GRAPHICS AND DESIGN	1	0	4	3

COURSE OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I INTRODUCTION TO ENGINEERING DRAWING AND PLANE CURVES 12

Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves. Scales – Plain, Diagonal and Vernier Scales.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes - Auxiliary Planes.

UNIT III PROJECTION OF SOLIDS 12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method - Auxiliary Views.

UNIT IV 12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section - Auxiliary Views. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V 12

Free hand sketching: Representation of Three-Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement - layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.

TOTAL: 60 Hours

TEXT BOOKS:

1. N.D. Bhatt, “Engineering Drawing” Charotar Publishing House, 46 th Edition, (2003).
2. K. V. Natrajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai (2006).

REFERENCES

1. M.S. Kumar, “Engineering Graphics”, D.D. Publications, (2007).
2. K. Venugopal & V. Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited (2008).
3. M.B. Shah and B.C. Rana, “Engineering Drawing”, Pearson Education (2005).
4. K. R. Gopalakrishnana, “Engineering Drawing” (Vol.I&II), Subhas Publications (1998).
5. Dhananjay A.Jolhe, “Engineering Drawing with an introduction to AutoCAD” Tata McGraw Hill Publishing Company Limited (2008).
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).

Course Outcomes

CO1:	Understand the theory of projection able to know and understand the conventions and the methods of engineering drawing	K2
CO2:	Improve their visualization skills so that they can apply these skills in projections of surfaces	K3
CO3:	Improve their visualization skills so that they can apply these skills in projections of solids	K3
CO4:	Impart and inculcate a proper understanding of the theory of projection. Improve the visualization skills	K3
CO5:	Understand the various concepts like dimensioning, conventioning and standards related to working drawings in order to become professionally efficient. Impart the knowledge for understanding and drawing of simple residential/office buildings	K4

Mapping of Program outcomes with course outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	-	-	-	-	-	-	-	3	-
CO 2	3	3	3	2	3	-	-	-	-	-	-	-	3	-
CO 3	3	3	3	2	2	-	-	-	-	-	-	-	3	-
CO 4	3	3	2	2	2	-	-	-	-	-	-	-	3	-
CO 5	3	3	2	2	3	-	-	-	-	-	-	-	3	-

Assessment Methods:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**
				✔

CSE	ENGINEERING PRACTICAL – ENGLISH	0	0	2	1

Course Objectives

- To enable the student to explore the knowledge in communication skills.
- To gain knowledge in the process of Placement Interviews, Group Discussions and other recruitment procedures.

List of Experiments **40**

1. Introduction to English sounds
2. Consonants and vowels
3. Syllable and Stress
4. Intonation
5. Communication Skills
6. Summarizing
7. Report Writing
8. Information Transfer
9. Presentation Skills
10. Group Discussion
11. Letter Writing
12. Cover letter and Resume

Text Books:

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. M.AshrafRizvi, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, New Delhi.2009.

Reference Books:

3. Practical English Usage. Michael Swan. OUP. 1995.
4. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
5. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Weblinks:

- https://onlinemasters.ohio.edu/blog/engineering-communication/
- https://online.rice.edu/courses/communication-skills-for-engineers-specialization

Course Outcome

CO1 Distinguish various listening & written contexts for understanding the implied meanings and responding to them accordingly.

CO2 Use appropriate pronunciation and rhythm of spoken language in oral communication.

CO3 Draft and interpret the written communication in officialcontexts like narrative, descriptive, creative, critical and analytical reports.

CO4 Infer implied meanings of different genres of texts and critically analyze and evaluate them for ideas, as well as for method of oral presentation.

CO5 Make use of suitable communicative strategies to express their point of views convincingly in any type of discussions, negotiation and conversations.

Mapping of Program outcomes with course outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	2	-	-	-	-	-	1	-
CO2	3	2	1	1	3	1	3	3	-	-	-	-	2	-
CO3	3	2	1	1	3	1	3	3	-	-	-	-	2	-
CO4	3	2	1	1	3	1	3	3	-	-	-	-	2	-
CO5	3	2	1	1	3	1	3	3	-	-	-	-	2	-

Assessment Methods:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Observations**
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration/ Presentation**
✔		✔	✔	✔

CSE	**PHYSICS LABORATORY**	**0**	**0**	**2**	**1**

Course Objectives

- To enable the student to explore the field of Mechanics of Solids and Properties of Matter.
- To gain knowledge in the scientific methods and learn the process of measuring different Physical variables.

Experiments

1. Determination of Rigidity Modulus – Torsional pendulum
2. Determination of wavelength and particle size using laser
3. Ultrasonic Interferometer
4. Determination of band gap of a semiconductor material
5. Hooke's law – Determination of spring constant
6. Determination of Young's Modulus – Uniform Bending
7. Determination of Young's Modulus – Non Uniform Bending
8. Determination of Viscosity of a liquid - Poiseuille's method
9. Spectrometer – Grating
10. Deflection Magnetometer - Tan A position
11. Deflection Magnetometer - Tan B position
12. Potentiometer - Calibration of low range Voltmeter

Text Books:

T1: C. C. Ouseph, U. J. Rao, V. Vjiayendran, Practical Physics,1st Edition, 2015.

T2: Biswajit Saha, Practical Physics Book, LAP LAMBERT Academic Publishing, 1st Edition, 2020.

Reference Books:

R1: G.L. Squires, Practical Physics, 4th Edition, Cambridge University Press, 2001.

R2: D. Chattopadhyay, P.C. Rakshit, B. Saha, “An Advanced Course in Practical Physics”, 2nd ed., Books & Allied Ltd., Calcutta, 1990.

Web Links:

1. http://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=2
2. https://vlab.amrita.edu/index.php?sub=1&brch=280&sim=1509&cnt=4

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1**:** Measure the wavelength and particle size of semiconductor diode laser.

CO2: Analyze the coefficient of viscosity of a liquid.

CO3: Estimate the band gap energy of given semiconductor material.

CO4: Determine the compressibility of the liquid using ultrasonic interferometer.

CO5: Measure the Young's modulus of the given solid materials.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**P O4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	-	-	2	3	3	-	-	-	3	-	3	-	3	2
CO2	-	-	-	2	2	-	-	-	3	-	3	-	3	3
CO3	-	-	3	3	3	-	-	-	3	-	3	-	3	2
CO4	-	-	-	3	3	-	-	-	3	-	3	-	3	3
CO5	-	-	3	3	3	-	-	-	3	-	3	-	3	2
Average	-	-	2.66	2.80	2.80	-	-	-	3.00	-	3.00	-	3.00	2.40

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Observation**
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1

Course Objectives

- To provide comprehensive idea about AC and D C circuit analysis, working principles and applications of basic machines in electrical engineering.
- To expose the students to learn experimental skills about Transformers, DC Motor, Converters.

LIST OF EXPERIMENTS

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line- line voltage, phase-to-neutral voltage, line and phase currents).
5. Load Characteristics of a DC Motor
6. Torque - Slip Characteristic of an Induction motor
7. Three phase induction motors – Direction reversal by change of phase-sequence of connections.
8. Demonstration of DC-DC Converter.
9. Demonstration of DC-AC converter.
10. Demonstration of AC-DC converter.

TOTAL: 30 hours

COURSE OUTCOMES

CO1:	Understand the basic safety precautions and learn to make use of measuring instruments	K2
CO2:	Analyse the steady state response of R-L, R-C circuits	K3
CO3:	Experiment with loading of transformer to measure the primary and secondary voltages, currents and power and classify the different types of transformer connections	K3
CO4:	Understand and Experiment with single phase induction motor and three phase induction motor	K2
CO5:	Demonstrate DC-DC, DC-AC and AC-DC converters	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	2
CO2	3	2	2	3	2	-	-	-	-	-	-	-	3	3
CO3	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Observation**
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	CONSTITUTION OF INDIA	2 0 0 0

COURSE OBJECTIVES:

- The purpose of the course is to acquaint the students with basic principles of the Constitution of India and its working.
- To help students be familiar with the historical and significant aspects of the constitution of India.
- To make students aware of their fundamental duties and rights.
- To know about central and state government functionalities in India.

UNIT I NATURE, OBJECT AND SCOPE OF THE CONSTITUTION 6

Nature, object and scope of Constitutional Law and Constitutionalism – Historical Perspective of the Constitution of India – Salient Features and Characteristics of Constitution of India.

UNIT II FUNDAMENTAL RIGHTS 6

Nature and scope of Fundamental Rights – Scheme of Fundamental Rights – Right to Equality – Right to Freedom of Speech and Expression – Right to Life – Right against Exploitation – Right to Religious Freedom – Minority Rights.

UNIT III DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES 6

Directive Principles of State Policy – Importance and Implementation – Scheme of Fundamental Duties and its Legal Status.

UNIT IV FEDERAL STRUCTURE 6

Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNIT V AMENDMENT AND EMERGENCY PROVISIONS 6

Amendment of the Constitution – Procedure – Historical Perspective of the Constitutional Amendments in India – Emergency Provisions – National Emergency – President Rule – Financial Emergency – Local Self Government – Constitutional Scheme in India.

TOTAL: 30 h

COURSE OUTCOME:

At the end of this course the students will be able to,

CO1: Elaborate the constitution of India and its salient features.
CO2: Know the fundamental rights and duties.
CO3: Discuss the Parliamentary Form of Government in India.
CO4: Recognize the Directive Principles of State Policy.
CO5: Understand and abide the rules of the Indian constitution and to appreciate different culture among the people.

TEXT BOOKS:

1. V.N. Shukla, Constitutional Law of India
2. D.D. Basu, Commentary on the Constitution of India

3. J.N. Pandey, Constitution of India
4. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
5. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.
6. Maciver and Page, “Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
7. K.L.Sharma, (1997) “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi.

REFERENCES BOOKS:

1. V.D. Mahajan, Constitutional Law of India
2. H.M. Seervai, Constitution of India
3. Sharma, Brij Kishore, “Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
4. U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar.
5. R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.

CSE	MATHEMATICS III (Fourier Series and Transforms)	3	1	0	4

Course Objective:

This course aims to provide the students to study Fourier Transforms and some concepts of infinite Fourier Sine and Cosine transforms, finite Fourier Sine and Cosine transforms and applications to solve some infinite and boundary value problems using finite and infinite transforms.

UNIT I FOURIER SERIES 12

Dirichlet's conditions – Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series- Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 12

Fourier integral theorem (without proof) – Fourier transform pair – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification PDE-Method of separation of variables – One dimensional wave equation and One dimensional heat equation of heat conduction – Steady state solution of two-dimensional heat equation of heat conduction (square plate only) .

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform –Introduction- properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

Total Hours: 60

TEXTBOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications, Delhi,43rd Edition, 2013.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6th reprint,2008.
3. Sivaramakrishna Das. P & Vijayakumari. C , A Text book of Engineering Mathematics-III

REFERENCE BOOKS:

1. Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9th edition,2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
3. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education,3rd Edition, 2012.

Course Outcome:

At the end of the course the students will be able to

CO1: Develop Fourier series for different types of functions.
CO2: Acquaint the student with Fourier Transform techniques used in wide variety of situations.
CO3: Introduce the basic concepts of Partial differential equations for solving standard Partial differential equations
CO4: Analyze the student with Fourier series techniques in solving heat flow problems used in various situations.
CO5: Understand the z-transforms and its properties

Mapping of Program outcomes with course outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	1	1	2	2	-	-	-	-	-	3	3	3
CO 2	3	2	2	1	2	2	1	-	-	-	-	1	2	2
CO 3	3	2	1	1	1	3	-	-	-	-	-	1	2	1
CO 4	3	1	1	2	1	-	-	-	-	-	-	2	1	1
CO 5	2	1	1	1	1	3	-	-	-	-	-	2	2	3

Assessment Methods:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation

CSE	Python Programming	3	1	0	4

Course Objectives

- To learn the basic concepts of Python
- To create a web application using Django
- To explore GUI Programming in tkinter and PyQT5

UNIT I PYTHON BASICS **9 Hours**

Introduction to Python, Python Interpreter and its working, Syntax and Semantics- Data Types: Booleans - Numbers - Lists - Tuples – Set - Dictionaries - Comprehensions - Assignments and Expressions, Control Flow Statements - Functions and lambda expressions

UNIT II PYTHON : ADVANCED FEATURES **9 Hours**

Iterations and Comprehensions - Handling text files - Modules, Classes and OOP - Exception Handling -- Strings and Regular Expressions

UNIT III PYTHON WEB FRAMEWORK **9 Hours**

Introduction to Frameworks, Full Stack Frameworks vs Micro Frameworks, Installing Django creating an application using Django and project folder structure- URLs and views -Models –Migrating the models- Experimenting with models API - Django Template Engine-Creating an Administration Interface- Users, groups, and permissions - Object relational mapper

UNIT IV GUI PROGRAMMING - tkinter **9 Hours**

Introduction to tkinter, Top Level Windows, Dialogs, Message and Entry - Event Handling, Menus, List boxes and Scrollbars, Text - SQL Database interfaces with sqlite3 : Basic operations and table load scripts

UNIT V GUI PROGRAMMING - PyQT5 **9 Hours**

Creating a User Interface with Qt Components – Radio button, Checkbox, List. Combo box, Scrollbars, Progress bar- Undestanding dialog-Layout, Displaying tabular data using Table Widget, Database Handling

TOTAL : 45 Hours

Text Books:

T1: Sanjeev Jaiswal Ratan Kumar, “Learning Django Web Development”, Packt Publishing

T2: B.M. Harwani, ” Qt5 Python GUI Programming Cookbook, Packt Publishing

Reference Books:

Allen Downey Think Python, Green Tea Press

Web Links:

- https://simpleisbetterthancomplex.com/series/beginners-guide/1.11/
- https://www.fullstackpython.com/

COURSE OUTCOMES

CO1:	Understand the basic concepts of Python	**K1**
CO2:	Apply the knowledge to use advanced features of python	**K3**
CO3:	Demonstrate the skills to create web application using Django	**K4**
CO4:	Ability to apply the programming concepts using tkinter	**K3**
CO5:	Build GUI application using PyQT5	**K5**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3
CO2	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3
CO3	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3
CO4	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3
CO5	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3
	2	2	2.6	2.2	2.4	-	-	-	-	-	-	-	2.6	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

CSE	OPERATING SYSTEM	3	0	0	3

Course Objectives

- To understand the features of operating system and its role in managing various system resources.
- To learn the Structure and functions of OS, Process scheduling, Deadlocks, Device management, Memory management and File systems

UNIT I PROCESSES AND THREADS 9 hours

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication – Communication in client-server systems. Threads: Multi-threading models – Threading issues.

UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION 9 hours

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Algorithm Evaluation. Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance –Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9 hours

Memory Management: Background – Swapping – Contiguous memory allocation –Paging – Segmentation – Segmentation with paging. Virtual Memory: Background –Demand paging – Process creation – Page replacement – Allocation of frames –Thrashing.

UNIT IV FILE SYSTEMS 9 hours

File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File System Implementation: Directory implementation –Allocation methods – Free-space management – efficiency and performance – recovery– log-structured file systems.

UNIT V I/O SYSTEMS 9 hours

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem –streams – performance. Mass storage Structure: Disk scheduling – Disk management –Swap-space management – RAID – disk attachment – stable storage – tertiary storage.

TOTAL : 45 hours

Text Books:

T1: Silbers chatz, Galvin, and Gagne, “Operating System Concepts”, Sixth Edition, Wiley India Pvt Ltd, 2003

T2: Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004

Reference Books:

R1: Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004

R2: Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004

Web Links:

1. https://www.tutorialspoint.com/operating_system/index.html
2. https://onlinecourses.nptel.ac.in/noc21_cs44/preview

COURSE OUTCOMES

CO1:	Understand the concept of operating system structures, system calls, system programs and build user programs based on it	K2, K6
CO2:	Compare the performance of various CPU scheduling algorithms	K4
CO3:	Compare and contrast various memory management schemes	K4
CO4:	Use allocation methods to allocate disk space to the files	K3
CO5:	Evaluate the various file and disk management strategies	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	2	-	-	-	-	-	-	-	-	2	3
CO2	3	2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	1	3	2	3	-	-	-	-	-	-	-	3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	1
CO5	1	3	1	3	3	-	-	-	-	-	-	-	3	3
AVG	2.4	2.2	2.2	2.6	2.4	-	-	-	-	-	-	-	2.2	2.2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

CSE	DATA STRUCUTRES	3	1	0	4

Course Objectives:

- To understand the basic concepts of data structures.
- To study the various abstract data types and their applications.
- Todesignandimplementdifferenttypesofsearchingandsortingalgorithms.
- To analyze graphical representation and apply algorithms of path finding.

Unit I Linear Structures 12 hours

Abstract Data Types (ADT) – List ADT – Array based implementation – Linked list implementation – Cursor-based linked lists–Singly Linked List-Doubly linked lists: Operations–Circular linked list: Singly and Doubly–Applications of lists – Stack ADT : Operations – Queue ADT : Operations–Circular queue implementation – Applications of stacks and queues.

Unit II Tree Structures 12 hours

Tree ADT: Introduction -– Tree Representation - Binary Tree Traversals and their implementations – Conversion of Left child right sibling data structures for general trees – Binary Tree ADT: Basics – Expression trees and their implementations–Applications of trees Binary search Tree ADT: Operations: Insert and Delete**–**Threaded Binary Trees.

Unit III Balanced Trees and Sorting 12 hours

AVL Trees: Balance factor, Single and Double rotations – Splay Trees: Rotation – B Tree: Operations: Insert and Delete-Binary heaps: Min and Max heaps–Applications of binary heaps–Sorting: Internal and External–Insertion sort : STL Implementation of Insertion sort– Quick sorting – Merge sorting : Analysis of Merge sort – Heap sort: Analysis of heap sort–Radix sorting.

Unit IV Hashing and Set 12 hours

Hashing: Hashing Functions, Collision Resolution Techniques - Open addressing: Linear Probing and Quadratic Probing – Separate chaining - Rehashing – extendible hashing –Set :Definitions and Concepts - Disjoint Set ADT –Dynamic equivalence problem – Smart union algorithms : union by size and union by height – Path compression –Applications of Set.

Unit V Graphs 12 hours

Definitions – Topological sort and their implementation – Graph Traversal: Depth-first traversal and Breadth-first traversal – Shortest-path algorithms: Single source and All Pairs Shortest path algorithms – Dijkstras algorithms –Minimumspanningtree–Prim'sandKruskal'salgorithms—Biconnectivity– Eulercircuits–applicationsofgraphs.

Total :45 Hrs

TEXTBOOKS

1. M.A.Weiss,“DataStructuresandAlgorithmAnalysisinC”,thirdEdition,PearsonEducation,2007

2. A.V.Aho,J.E.Hopcroft,andJ.D.Ullman,"DataStructuresandAlgorithms",PearsonEducation,FirstEditionReprint 2003

REFERENCEBOOK:

1. R.F.Gilberg,B.A.Forouzan,"DataStructures",SecondEdition,ThomsonIndiaEdition,2009

Course Outcome	Description	Knowledge Level
CO1	Interpret the knowledge of basic data structures for creation, insertion, deletion and Searching of ordered or unordered data. Data structures include: arrays, Linked lists (Singly and Doubly), Stack and Queue.	K2,K5
CO2	Experiment with Binary search tree and their various tree traversals.	K3
CO3	AnalyzeandcomparethevariousrotationswiththeirefficiencyusingAVLTrees.	K4
CO4	Evaluate the operations like searching, insertion, deletion, traversing mechanism of various Hash function.	K6
CO5	Build the knowledge of various graph traversals including ADT operation for Prim's And Kruskal's algorithms.	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	3	1	2	2	2	-	1	2	1
CO2	2	2	2	2	2	3	2	2	2	2	1	2	2	2
CO3	2	2	2	2	1	3	2	2	2	2	1	2	2	3
CO4	2	3	2	2	3	3	3	2	1	2	3	2	3	3
CO5	2	3	3	3	3	0	3	3	2	3	3	2	3	3
Average	2	2.2	2	2	2.2	2.4	2.2	2.2	1.8	2.2	1.6	1.8	2.4	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	Design and Analysis of Algorithms	3	0	2	4

Course Objectives:

- To provide a mathematical foundation for analyzing and proving the efficiency of an algorithm.
- To understand and apply the algorithm analysis techniques.
- To critically analyze the efficiency of alternative algorithmic solutions for the same problem
- To understand different algorithm design techniques

UNIT I INTRODUCTION 12 hours

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Algorithm Design Techniques- Fundamentals of the Analysis of Algorithmic Efficiency – Time Space Tradeoff –Asymptotic Notations and their properties. AnalysisFramework–Empiricalanalysis–RecurrenceEquations–SolvingRecurrenceEquations–Analysisoflinearsearch.

UNIT II DIVIDE-AND-CONQUER AND GREEDY TECHNIQUE 12 hours

Divide and Conquer Methodology – Binary Search – Finding Maximum and Minimum – Closest-Pair and Convex Hull Problems – Matrix multiplication: Strassen's algorithm, Greedy Algorithms: General Method – Container Loading – Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem – Minimum Spanning Tree (Kruskals Algorithm) – Huffman Trees.

UNIT III DYNAMIC PROGRAMMING AND BACKTRACKING 12 hours

Dynamic programming: General Method - Multi stage graphs - All Pair Shortest Paths-Optimal Binary Search- 0/1 Knapsack Problem, Travelling Salesman Problem – Floyd's algorithm. Backtracking- State Space Tree – General and Recursive Backtracking Algorithm – Estimating the Efficiency – 8- Queens problem– Sum of Subsets – Graph Colouring – Hamiltonian Circuit Problem – Knapsack Problem.

UNIT IV GRAPH AND COMPLEXITY CLASS 12 hours

Graph Traversals – Breadth and Depth first search Traversal – Connected Components – Biconnected Components -Floyd-Warshall Algorithm. Network Flows - Flow Networks, Maximum Flows – Ford-Fulkerson Algorithm - Minimum Cost Flows – Cycle Cancelling Algorithm-The Class P, The Class NP, Reducibility and NP-completeness

UNIT V STRING MATCHNG, APPROXIMATION AND RANDOMIZED ALGORITHMS 12 hours

Naïve String-matching Algorithms, KMP algorithm, Rabin-Karp Algorithm, Approximation Algorithms - The set-covering problem – Vertex cover, K-center clustering, Randomized Algorithms - The hiring problem, Finding the global Minimum Cut

TOTAL: 60 hours

Text Books:

T1: Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
T2: Ellis Horowitz, Sartajsahni, Sanguthevar, Rajesekaran, “Fundamentals of Computer Algorithms”, Galgotia Publication Pvt. Ltd., Reprint, 2010.
T3: Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, “Introduction to Algorithms” 3 rd Edition, The MIT Press Cambridge, Massachusetts London, England, 2014
T4: S.Sridhar, “Design and Analysis of Algorithms”, Oxford University Press, 2015

Reference Books:

R1: Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, Reprint 2006.
R2: Harsh Bhasin, —Algorithms Design and Analysis, Oxford university press, 2016.
R3: Jon Kleinberg, ÉvaTardos ,Algorithm Design, Pearson education, 2014
R4: Ravindra K. Ahuja, Thomas L. Magnanti, and James B. Orlin, “Network Flows: Theory, Algorithms, and Applications”, Pearson Education, 2014.

Web Links:

1. https://archive.nptel.ac.in/courses/106/101/106101060/
2. https://archive.nptel.ac.in/courses/106/106/106106127/

COURSE OUTCOMES

CO1:	Determine asymptotic notation, its properties and measure algorithm’s behavior	**K5**
CO2:	Apply mathematical principles to solve various problems using Divide and Conquer and Greedy approach	**K3**
CO3:	Design an algorithm using Dynamic Programming and Backtracking for various complex problems	**K6**
CO4:	Perform graph traversals and analyze the complexity of class problems	**K5**
CO5:	Develop an approximation and randomized algorithms	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

CSE	OPERATING SYSTEMS LAB	L	T	P	Credits
		0	0	2	1

Course Objective:

To practice various system calls and concepts of process management, memory management techniques.

List of Experiments:

1. Study of Linux commands.
2. Writing programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Writing programs using the I/O system calls of UNIX operating system (open, read, write, etc)
4. Writing C programs to simulate UNIX commands like ls, grep, etc.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions).
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time. (2 sessions)
7. Developing Application using Inter Process communication (using shared memory, pipes or message queues)
8. Implementation of Producer – Consumer problem using semaphores (using UNIX system calls).
9. Implementation of Deadlock avoidance using Banker's algorithm.
10. Implementation of some memory management schemes – I
11. Implementation of some memory management schemes – II
12. Implementation of any file allocation technique (Linked, Indexed or Contiguous)

Text Books:

T1: Silberschatz, Galvin, and Gagne, "Operating System Concepts", Sixth Edition, Wiley India Pvt Ltd, 2003

T2: Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004

Reference Books:

R1: Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004

R2: Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004

Web Links:

3. https://www.tutorialspoint.com/operating_system/index.html
4. https://onlinecourses.nptel.ac.in/noc21_cs44/preview

Course Outcome	Description	Knowledge Level
CO1	Implement the concept of Linux commands in Linux terminal.	K3
CO2	Develop a program using the system calls of UNIX operating system	K6
CO3	Analyze the performance of different CPU Scheduling Algorithms for the given process	K4
CO4	Develop Application using Inter Process communication.	K6
CO5	Solve Deadlock using Banker's algorithm.	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	3	3	-	-	-	-	-	-	-	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	-	3	1	3
Average	2.4	2.2	2.2	2.4	-	-	-	-	-	-	-	2.2	2.4	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	DATA STRUCTURES AND PYTHON LAB	0	0	2	1

Course Objectives

- Understand various data representation techniques in the real world.
- Implement linear and non-linear data structures.
- Analyze various algorithms based on their time and space complexity.
- Develop real-time applications using suitable data structure.
- Identify suitable data structure to solve various computing problems

Experiments

1. Implementation of Single Linked List operations: (i) Creation (ii) insertion (iii) deletion (iv) traversal
2. Implementation of polynomial expression in memory using single linked list.
3. Implementation of Circular Linked List operations: (i) Creation (ii) insertion (iii) deletion (iv) traversal
4. Implementation of Double Linked List operations: (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.
5. Design and implement Stack and its operations using List.
6. Implementation of stack operations:

a. To convert infix expression into postfix expression.

b. To evaluate the postfix expression.

7. Design and implement Queue and its operations using List.
8. Implementation of binary search tree operations: a. Creation of node. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order. c. Count the number of nodes in the binary search tree.
9. Implementation of searching techniques:

- Linear search b. Binary search c. Fibonacci search

10. Implementation of sorting techniques to arrange a list of integers in ascending order. a. Bubble sort b. Insertion sort c. Selection sort
11. Implementation of sorting techniques to arrange a list of integers in ascending order. a. Quick sort b. Merge sort
12. Implementation of graph traversal algorithms: a. Depth first search. b. Breadth first search.

Text Books:

T1: M. A. Weiss, “Data Structures and Algorithm Analysis in C”, third Edition, Pearson Education, 2007
T2: A. V. Aho, J. E. Hop croft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint 2003.

Reference Books:

R1**:** R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Edition, 2009

Web Links:

1. https://nptel.ac.in/courses/106102064
2. https://onlinecourses.nptel.ac.in/noc22_cs26/preview

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1**:** Gain skills to design and analyze simple linear and non linear data structures.
CO2: Examine insertion, deletion and modification in singly and doubly linked list.
CO3: Construct Stack, Queue in array for which all insertions and deletions are made at both end using various operations
CO4: Apply Insertion, find and deletion operations in Binary Search Tree and Hashing functions.
CO5: Evaluate shortest path in an undirected graph using depth and breadth first algorithms

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	3	3	-	-	-	-	-	-	-	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	-	3	1	3
Average	**2.4**	**2.2**	**2.2**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2.4**	**2.4**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	PERSONALITY DEVELOPMENT I	2	0	0	2

COURSE OBJECTIVES:

- To nurture and develop winning personalities and eventually leading them to become dynamic and socially responsible leaders

UNIT I SOFT SKILLS I 6

Introduction to Personality Development – Meaning–Features of personality – Dimensions of Personality Determinants of Personality–Features and Traits– Components of self concept–Barriers–Self analysis

UNIT II SOFT SKILLS II 6

Importance of Soft Skills – First impression–Work Place requirements–Discipline –Cleanliness Hygiene – general Appearance—Building Confidence—Concept of Thinking and Usage –Value of Time–Focus & Commitment.

UNIT III SOFT SKILLS IN ACTION 6

Grooming – Attire – Understanding others– Stability & Maturity Development – Strength s – Weakness – Opportunities–threats – Merits of SWOT Analysis – Components – how to convert weakness into strengths – Goal settings

UNIT IV SELF AWARENESS AND SELF ESTEEM 6

Definitions – Components of Self awareness – Developing Self awareness – Self esteem – meaning – Steps to improve self esteem.

UNIT V SELF MOTIVATION 6

Motivation – Meaning –Techniques of self motivation–Motivation & goal setting – Motivation and emotion – Motivation at work.

TOTAL: 30 h

COURSE OUTCOME:

At the end of this course the students will be able to,

TEXT BOOKS:

1. Personality Development And Soft Skills Barun K Mitra, Oxford Publication
2. Seven habits of Highly Effective people – Stephen R. covey

REFERENCE BOOKS:

1. Emotion, motivation and Self regulation – Nathan C. Hall, McGill University, Canada Thomas Goetz, University of Konstanz, Germany http://www.emeraldgrouppublishing.com.
2. Psychology of Self esteem – Nathaniel Branden, Nash (1st edition), Jossey – Bass (32 nd anniversary edition)

COURSE OUTCOMES

CO1:	Discuss the features, dimensions and determinants of personality	**K2**
CO2:	Make a good first impression in professional and other situations	**K3**
CO3:	Demonstrate confidence, punctuality and commitment as an engineer	**K3**
CO4:	Set goals for development using SWOT analysis	**K5**
CO5:	Develop self-awareness and improve self esteem	**K3**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
			✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔	✔	

CSE	BASIC LIFE SKILLS	2 0 0 0

COURSE OBJECTIVE:

1. To provide value education to improve the students' character, understanding of principled life, physical health, maintaining youthfulness, measures and methods in five aspects of life.

UNIT I PHYSICALHEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.Yogasanas: Pranamasana – HasthaUttanasana - PadaHasthasana – AswaSanjalana Asana – ThuvipathaasvaSanjalana asana – AstangaNamaskara - Bhujangasana–AthaMukthaSavasana – AswaSanjalana Asana - PadaHasthasana–HasthaUttanasana - Pranamasana.Pranayama: Naddisuddi - Clearance Practice - Benefits.

UNIT II LIFE FORCE 6

Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds).Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force -Bio-Magnetism - Mind. Maintaining youthfulness. Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid Measure and method in five aspects of life - Controlling undue Passion.Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies - Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits.
Shanthi Meditation explanation – Benefits - Thuriya Meditation explanation – Benefit.Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

UNIT IV VALUES 6

Human Values Self-control - Self-confidence - Honesty Contentment - Humility – ModestyTolerance - Adjustment - Sacrifice – ForgivenessPurity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual puritySocial Values:Non-violence– ServicePatriotism – EqualityRespect for parents and elders - care and protection - Respect for teacher Punctuality - Time Management.

UNIT V MORALITY (VIRTUES) 6

Importance of Introspection - I - Mine (Ego, Possessiveness).Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance.Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness).Five

essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity. Improved Memory Power - Success in the Examination.

TOTAL: 30 h

COURSE OUTCOME:

At the end of this course the students will be able to,

CO1:Utilize skills developed through participation in Manavalakalai (SKY) Yoga to help maintain lifelong health and fitness.

CO2:Demonstrate foundational standing, sitting, balance postures with proper alignment andMaintain youthfulness through kaya kalpa practice.

CO3:Explore relaxation techniques to observe thoughts and to manage emotions and stress, and reflect on those techniques which are most effective to them.

CO4:Demonstrate an understanding of anatomy and physiology as it applies to the intentional integration of breath, postures, and movement within the practice of yoga to understand the human values.

CO5:Achieve a greater sense of awareness, wisdom, introspection, and a deeper sense of relaxation through meditation to keep up morality in life.

TEXT BOOKS/ REFERENCE BOOKS:

1. Vethathiri Maharishi, 16th Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
2. Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
3. Vethathiri Maharishi, 3rd Edi.2014, Kayakalpam, Vethathiri Publications, Erode.
4. Rev.Dr.G.U. Pope, 2016, Thirukkural, Giri Trading Agency,
5. Vethathiri Maharishi, 1994, Mind, Vethathiri Publications, Erode.
6. Chandrasekaran.K, 1999, Sound Health through yoga, Sedapati, Tamilnadu, Premkalyan Publications.
7. Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.,
8. K. R. Dhanalakshmi and N. S. Raghunathan, " Personality Enrichment, Margham Publications
9. D.r V. M. Selvaraj, "Personality Development" Bhavani Publications
10. R. S. Agarwal, "Quantitative Aptitude".
11. A.K Gupta, "Logical and Analytical Reasoning (English)", 30th Edition.

CSE	Mathematics-IV (Random Process &Queuing Theory)	3L:1T:0P	4Credits

Course Objective:

- To understand and conduct computer systems modeling and performance analysis.
- To introduce the basic probability tools and concepts this is useful in modeling, such as Markov models and queuing theory.
- To provide necessary mathematical support and confidence to tackle real life problems.
- To provide the required mathematical support to develop probabilistic models which can be used in several areas of science and engineering.

UNIT I:CLASSIFICATION OF RANDOM PROCESSES **12**

Definition and examples – First order – Second order – Strictly stationary – Wide-sense stationary and ergodic process – Markov process – Poisson and Normal process.

UNIT II: QUEUEING THEORY-I **12**

Markovian queues – Birth and Death Queuing models- Steady state results- Single server queuing models- (M/M/1): ($\infty\infty$/FIFO) Model–(M/M/1): (kk/FIFO) Model -Characteristics of parameters of models.

UNIT III: QUEUEING THEORY-II **12**

Multiple server queuing models- Little's Formula - queues with finite waiting rooms- Finite source models.- (M/M/C): ($\infty\infty$/FIFO) Model –Characteristics of parameters of models,
(M/M/C): (k/FIFO) Model –Characteristics of parameters of models.

UNIT IV: NON-MARKOVIAN QUEUES **12**

Finite source models - M/G/$\infty\infty$ queues – Pollaczek -Khinchine formula - M/G/1:($\infty\infty$/GD) model as special cases.

UNIT V: QUEUEING NETWORKS **12**

Queueing Networks - Classification and Basic Concepts.Open and Closed Networks of M/M/m Type Queues, Jackson's Theorem.

Total hours:60

TEXT BOOKS:

T1: Gross. D. and Harris C.M, "Fundamentals of Queueing Theory", Wiley Student edition, 2004.

T2: Sivaramakrishna Das. P and Vijayakumari. C, "Probability &Queueing Theory", Pearson Eduaction Asia, 6th Edition ,2013.

T3. S.Palaniammal, “Probability &Queueing Theory”, Eastern Economy Edition, 2012.

REFERENCE BOOKS:

R1. A.O. Allen, “Probability, “Statistics and Queueing Theory with Computer Applications”, Elsevier, 2nd edition, 2005.

R2. G.Balaji, “Probability &Queueing Theory”, Balaji Publishers, 2018.

R3. T.Veerarajan , Probability Statistics and Random Process, M c Graw Hill,2018.

Web Links :

1. https://www.youtube.com/watch?v=dSej7AHlim4
2. https://www.youtube.com/watch?v=a3eq_8R8uFY
3. https://www.youtube.com/watch?v=DblXnXxUQc0
4. https://www.youtube.com/watch?v=2aPlzhsEsIw
5. https://www.youtube.com/watch?v=mbYVI-5cPUU

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1:	Demonstrate the problems on Ergodic process, Poisson process and Markov chain.	**K2**
CO2:	Analyzethe basic characteristic features of a queuing system and acquire skills in analyzing queuing models.	**K4**
CO3:	Apply M/M/C model with finite and infinite capacity.	**K3**
CO4:	Analyze a network of queues with Poisson external arrivals, exponential service requirements and independent routing. (Jackson networks)	**K4**
CO5:	Identifyvarious elements of a queuing networks and each of its description	**K3**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	-	-	1	1	2	1
CO2	2	1	1	1	1	-	-	-	-	-	1	-	-	-
CO3	2	2	1	1	1	-	-	-	-	-	1	1	2	1
CO4	2	1	1	1	1	-	-	-	-	-	-	-	1	1
CO5	2	2	1	1	1	-	-	-	-	-	1	1	1	1
	2.2	1.6	1	1	1.2	-	-	-	-	-	0.8	0.6	1.2	0.8

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**

			✔	✔

CSE	Computer Organization and Architecture	3	0	0	3

Course Objectives

- To understand the architecture of computers and to analyze the performance using various addressing modes.
- To familiarize with hierarchical memory system including cache memories and virtual memory.
- To impart knowledge about different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units – Basic operational concepts – Bus structures – Performance and metrics – Instructions and instruction sequencing – Hardware – Software Interface – Instruction set architecture – Addressing modes – RISC – CISC – ALU design – Fixed point and floating point operations : Floating Point Numbers and Operations.

UNIT II BASIC PROCESSING UNIT 9

Some Fundamental concepts – Execution of a complete instruction: Branch instructions – Multiple bus organization – Hardwired control: A Complete Processor – Micro programmed control: Microinstructions – Micro program Sequencing – Wide-Branch Addressing – Microinstructions with next address field – Prefetching and emulation – Nano programming.

UNIT III PIPELINING 9

Basic concepts: Role of Cache Memory – Pipeline Performance – Data Hazards – Instruction Hazards – Influence on Instruction Sets: Addressing modes – Condition Codes – Datapath and Control Considerations – Superscalar Operation: Out-of-Order Execution – Execution Completion – Dispatch Operation – Performance Considerations – Exception Handling.

UNIT IV MEMORY SYSTEM 9

Basic concepts – Semiconductor RAM – ROM – Speed – Size and cost – Cache Memories: Mapping Functions – Replacement Algorithms – Example – Performance Considerations: Interleaving – Hit Rate and Miss Penalty– Caches on the Processor Chip – Virtual Memories – Memory Management Requirements – Associative Memories – Secondary Storage devices.

UNIT V I/O ORGANIZATION 9

Accessing I/O devices – Interrupts : Interrupt Hardware – Enabling and Disabling Interrupts – Handling Multiple Devices – Controlling Device Requests – Exceptions – Direct Memory Access: Bus Arbitration –

Buses: Synchronous Bus – Asynchronous Bus – Interface circuits: Parallel Port – Serial Port – Standard I/O Interfaces (PCI, SCSI, and USB), I/O devices and processors.

Total: 45h

TEXT BOOK:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, sixth Edition, Tata McGraw Hill, 2011

REFERENCE BOOKS:

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, eleventh Edition, Pearson Education, 2019.
2. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”,fifth Edition, Elsevier, 2014
3. John P. Hayes, “and Organization”, Third Edition, Tata McGraw Hill, Computer Architecture 2012
4. M. Morris Mano, “Computer system Architecture”, Third edition, Prentice Hall of India, 2017

Web Links:

1. https://nptel.ac.in/courses/106105163
2. https://nptel.ac.in/courses/106103180
3. https://nptel.ac.in/courses/106106166

Course Outcomes:

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Apply the basic features of operational concepts with its functional operations.	K3
CO2	Determine hardware blocks and control lines are used for specific instructions that execute at different operational level.	K5
CO3	Demonstrate the operation like add and multiply integers and floating-point numbers using two’s complement and IEEE floating point representation for	K5

	various models.	
CO4	Analyze clock periods, performance, and instruction throughput of single-cycle, multi-cycle, and pipelined implementations of a simple instruction set	K4
CO5	Deduct and describe the pipeline hazards and identify possible solutions to those hazards	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	-	-	-	-	2	2	3	2
CO2	3	3	3	3	2	2	-	-	-	-	2	2	3	2
CO3	3	3	3	3	2	2	-	-	-	-	2	2	3	2
CO4	3	3	3	3	2	2	-	-	-	-	2	2	3	2
CO5	2	3	3	3	2	2	-	-	-	-	2	2	3	2
AVG	2.8	3	3	3	2	2	-	-	-	-	2	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

Course Objectives

 To help the learner to understand the concepts, techniques, security features, how data is stored in the system, Query Languages used and different types of Statements used in the Query Processing in Database Management Systems.

UNIT I INTRODUCTION **9**

Database system application-Purpose of database system-View of data-Database language-Relational database-Data storage and queuing-Transaction management-Database architecture-Database users and administrators-History of database system

UNIT II INTRODUTION TO SQL **9**

SQL Data Definition and its types – Specifying Constraints in SQL – Basic Retrieval Queries in SQL – INSERT,UPDATE ,DELETE Statements in SQL – Aggregate Functions in SQL – GROUPING : The GROUP BY and HAVING Clause – JOIN Expressions - VIEWS - TRANSACTIONS – SUBQUERIES

UNIT III DATABASE DESIGN& PROGRAMMING TECHNIQUES **9**

Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form–Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form– Entity relationship Model –Entity relationship Diagram and Examples

UNIT IV TRANSACTION MANAGEMENT AND DATABASE SECURITY **9**

Transaction - Simple Transaction Model – Serialz ability- Lock based protocols-Time stamp based protocol-Deadlock handling- Two Phase Commit – Introduction to Database Security Issues – Access Control Based on Granting and Revoking Privileges – Challenges of Database Security

UNIT V DATA STORAGE AND QUERYING **9**

Overview of Physical storage Media - Magnetic disks - RAID-Tertiary storage – File organization-

Organization of
records in files- B+ - tree index files - B-tree Index files- Static Hashing- Dynamic Hashing -Overview of query
processing-CASE STUDY-ORACLE

TOTAL : 45 hours

Text Books:

T3: Abraham Silberschatz, Henry F.korthS.Sudharshan, ”Database system concepts” sixth edition,tata mcgraw hill 2010.

T4: Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, FourthEdition , Pearson / Addision wesley, fifth edition, 2009.

Reference Books:

R3: Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.

R4: S.K.Singh, “Database Systems Concepts, Design and Applications”, Second Edition, Pearson Education, 2011.

Web Links:

5. https://onlinecourses.nptel.ac.in/noc22_cs51/preview.
6. https://www.w3schools.com/mysql/mysql_rdbms.asp.

COURSE OUTCOMES

CO1:	Identify the purpose and need of database management system and compare it with conventional systems	**K3**
CO2:	Construct various SQL queries such as DDL & DML statements, Joins, Aggregate functions, Views and sub queries	**K5**
CO3:	Compare and distinguish all the five normal forms in Database management system	**K4**
CO4:	Apply and assess the transaction management and database security	**K5**
CO5:	Examine various data storage and querying techniques such as RAID, B tree and B+ tree index files, static and dynamic hashing and query processing	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	3	-	-	-	-	-	-	-	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	-	3

CO4	2	2	2	3	3	-	-	-	-	-	-	-	3
CO5	0	2	3	3	3	-	-	-	-	-	-	-	3
	2.2	2	2.6	3	3	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔		✔

CSE	COMPUTER NETWORKS	3	0	0	3

Course Objectives:

- To understand the concepts of data communications and to study the functions of different layers.
- To introduce IEEE standards employed in computer networking and to familiarize with different protocols and network components.
- To help the leaner to design, calculate, and apply subnet masks and addresses to fulfill networking requirements.
- To analyze the features and operations of various application layer protocols such as Http, DNS, and SMTP.

UNIT I PHYSICAL LAYER AND MEDIA 9

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Guided Media -Coaxial Cable – Fiber Optics – Unguided Media – Wireless- Switching- Digital Transmission –Analog Transmission- Line Coding – Dial up Modems

UNIT II DATA LINK LAYER 9

Error Detection and Correction – Introduction-Parity Checking– LRC – CRC – Check Sum-Hamming code – Framing - Flow Control and Error control - Stop and Wait – go back-N ARQ – selective repeat ARQ-Sliding window – HDLC - Multiple Access – Random Access –Channelization-Wired LAN - Ethernet IEEE 802.3 - IEEE 802.4 –Token Ring- FDDI – IEEE802.11.

UNIT III NETWORK LAYER 9

Logical Addressing-IPV4 Addresses - IPV6 Addresses-Inter Networking – Address Mapping – ARP, RARP,DHCP, ICMP- Delivery-Forwarding-Unicast Routing protocols- Intra Domain Routing-Inter domain Routing- Distance Vector Routing – Link State Routing – Path Routing – Multicast Routing Protocol-Subnetting – Congestion avoidance in network layer.

UNIT IV TRANSPORT LAYER 9

Duties of transport layer –Process to Process Delivery-Client Vs Server Paradigm - Multiplexing – DeMultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Flow Control – Error Control – Congestion Control – Open loop congestion control - closed loop congestion control - Quality of services (QOS)- Techniques to improve up QoS.

UNIT V APPLICATION LAYER 9

Domain Name Space (DNS) – Name Space- Domain Name Space –Distribution of Name Space –DNS in the Internet- DDNS – Electronic Mail- SMTP – POP – IMAP - FTP – HTTP - WWW – Cryptography-Symmetric Key Cryptography - Asymmetric Key Cryptography- Network Security –Security Services-Digital Signatures- IPsec-PGP.

Total :45 Hrs

Text Book:

1. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition,Tata McGraw-Hill, 2006. (Unit I to Unit V)

REFERENCE BOOKS:

1. Nader F. Mir, “Computer and Communication Networks”, Pearson Education, 2007
2. Comer, “Computer Networks and Internets with Internet Applications”, Fourth Edition, Pearson Education, 2003.
3. Andrew S. Tanenbaum, “Computer Networks”, Fourth Edition, 2003.William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000

Web links:

1. https://www.javatpoint.com/computer-network-tutorial

COURSE OUTCOMES

Course Outcome	Description	Knowledge Level
CO1	Discuss the functions of each layer in OSI and TCP/IP model	K6
CO2	Examine the Flow Control and Error control of Data link layer	K4
CO3	Evaluate the various functions and components of network layer	K5
CO4	Classify the protocols and techniques of transport layer	K4
CO5	Asses the important of application layer	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	0	1	2	0	2	0	1	0	1
CO2	2	2	2	2	3	3	3	3	3	3	2	3	2	3
CO3	2	3	2	2	3	3	3	3	3	3	2	3	3	3
CO4	2	3	3	3	3	3	3	3	3	2	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3
	2	2.4	2.2	2.2	2.6	2.4	2.6	2.8	2.4	2.6	2	2.6	2.2	2.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	MCQ	Projects	Seminars	Demonstration / Presentation
			✔	✔

CSE	Introduction to AI and ML	3	0	2	4

Course Objectives

- To understand the basics of Machine Learning (ML)
- Able to program in Python ML Packages
- To understand the methods of Machine Learning
- To visualize a dataset

UNIT I INTRODUCTION TO ARTIFICAIL INTELLIGENCE **12 hours**

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents- Structure of agents -– Problem solving agents –Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search –Bidirectional search – Searching with partial Information.

UNIT II INTRODUCTION TO MACHINE LEARNING **12 hours**

Machine learning: Types of Machine Learning - Understanding data – Continuous variable, categorical variable, Independent variable, dependent variable -Regression and classification- linear regression introduction- Over fitting and Underfitting - Bias and Variance -Machine Learning Life cycle -- Data Preprocessing techniques – Feature selection

UNIT III MACHINE LEARNING ALGORITHMS **12 hours**

Classification and Regression- Naïve bayes- Decision trees- support vector machine (SVM) – Random forest- Linear Regression- Multiple Linear Regression-Logistic Regression. -K-nearest neighbor - Unsupervised learning - k-means clustering- Principal component analysis

UNIT IV MODEL EVALUATION **12 hours**

Model Evaluation and Selection methods, Precision-Recall and ROC Curves Confusion Matrices, Regression Evaluation, Optimizing Classifiers for Different Evaluation Metrics

UNIT V MACHINE LEARNING USING PYTHON **12 hours**

Scikit- learn Dataset - Understanding Dataframe-slicing a dataframe-managing data -Data Loading with NumPy and pandas- creating training and test sets - Implementation of Machine learning algorithms - predictions - implementation of metrics for validating machine learning algorithms - Scaling and normalization- Data visualization

TOTAL : --60 hours

Text Books:

T1: Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

T2: Sebastain Raschka, “Python Machine Learning”, Packt publishing (open source).

Reference Books:

R1: Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009
R2: Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008

Web Links:

1. https://machinelearningmastery.com/types-of-learning-in-machine-learning/Online
2. https://www.coursera.org/learn/machine-learning
3. https://nptel.ac.in/courses/106/106/106106139/
4. https://www.timberlake.co.uk/machinelearning

COURSE OUTCOMES

CO1:	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	**K3**
CO2:	To apply the Basic Concepts of Machine Learning	**K4**
CO3:	To build various machine learning algorithms using Linear models	**K5**
CO4:	To apply ML techniques to application and evaluate the models	**K4**
CO5:	Apply basic principles of AI and ML in solutions that require problem solving, inference, perception, knowledge representation, and learning.	**K4**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	2	3
CO4	3	3	2	2	3	-	-	-	-	-	-	-	2	3
CO5	2	2	3	2	3	-	-	-	-	-	-	-	2	3
	2.8	2.6	2.6	2.2	2.4	-	-	-	-	-	-	-	2	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	**√**
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

√	√	√	√	√	√

CSE	**DATABASE MANAGEMENT LAB**	**0**	**0**	**3**	**1**

Course Objective:

To understand the various database management system concepts by working on databases.

Experiments:

1. DDL and DML Commands.
2. Join Queries.
3. Views and Set operations.
4. Built in functions.
5. Nested Queries
6. Triggers.
7. Aggregate Functions.
8. Roles and Privileges.
9. Cursors.
10. PL/SQL programs
11. PL/SQL cursor programs
12. Front end tools – Mini Project

COURSE OUTCOMES

CO1:	Identify the need of DML and DDL commands and Nested queries	**K3**
CO2:	Examine and compare various types of Joins and Set operators and write SQL queries	**K4**
CO3:	Design and develop Views, Triggers and Cursors using SQL	**K6**
CO4:	Test and solve various aggregate functions and built in functions using SQL	**K6**
CO5:	Discuss Roles and Privileges and develop a mini project using front end tool using SQL	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO2	2	3	3	3	3	3	3	1	2	2	2	2	3	2
CO3	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO4	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO5	2	3	3	3	2	3	3	1	2	2	2	2	3	2
Average	2.6	3	3	3	2.8	3	3	1	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		□	□	□
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
□			□	□

CSE	COMPUTER NETWORKS LAB	0	0	2	1

Course Objective:

To help the learner to understand the underlying concepts of networked systems and to be able to develop networking programs using Java.

Experiments:

1. Programs using TCP Sockets (like date and time server & client, echo server & client, etc..)
2. Programs using UDP Sockets (like simple DNS)
3. Programs using Raw sockets (like packet capturing and filtering)
4. Programs using RPC
5. Simulation of sliding window protocols
6. Experiments using simulators (like OPNET)
7. Performance comparison of MAC protocols
8. Implementing Routing Protocols
9. Performance comparison of Routing protocols
10. Implementation of Logical and Physical Address
11. Simulation of ARP/RARP Protocol
12. Study of UDP and TCP performance

TOTAL: 30 h

Text Book:

T1. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition,Tata McGraw-Hill, 2006.

Reference Books:

R1. Nader F. Mir, “Computer and Communication Networks”, Pearson Education, 2007
R2. Comer, “Computer Networks and Internets with Internet Applications”, Fourth Edition, Pearson Education, 2003.
R3. Andrew S. Tanenbaum, “Computer Networks”, Fourth Edition, 2003.William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000

Web Links:

1. https://www.cse.iitk.ac.in/users/dheeraj/cs425/

COURSE OUTCOMES

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Experiment with TCP, UDP and Raw socket programming	K3

CO2	Construct an application model for RPC	K6
CO3	Model the simulation of sliding window protocol and ARP/RARP	K3
CO4	Identify the Performance comparison of MAC protocols, Routing protocol	K3
CO5	Compose the implementation of Logical and Physical Address	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	3	3	3	2	2	-	1	2	2	3	2	3	2
CO2	3	3	3	3	2	2	-	1	2	2	3	2	3	2
CO3	3	3	3	3	2	2	1	1	2	2	3	2	3	2
CO4	3	3	3	3	2	2	-	1	2	2	3	2	3	2
CO5	2	3	3	3	2	2	1	1	2	2	3	2	3	2
Average	2.8	3	3	3	2	2	0.4	1	2	2	3	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	PERSONALITY DEVELOPMENT II	2	0	0	2

UNIT I SOFT SKILLS III 6

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNIT II QUANTITATIVE APTITUDE I 6

Percentage – Profit Loss –Discount – Ratio Proportion – Time & Work – Time, Speed & Distance. Problems relating to ages– Permutation & Combination–Probability

UNIT III QUANTITATIVE APTITUDE II 6

Mensuration – Clocks and Calendars – Boats – Simple Interest – Compound Interest – Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS 6

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

UNIT V LOGICAL PROBLEMS 6

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

TOTAL: 30 h

TEXT BOOKS:

T1. K. R. Dhanalakshmi and N S Raghunathan, Personality Enrichment, Margham Publications, 2012
T2. R. S. Agarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishers, 2017

REFERENCE BOOKS:

R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
R2. A.K Gupta, Logical and Analytical Reasoning (English), Ramesh Publishing House, 2022

COURSE OUTCOMES

CO1:	Discuss the basic, email, business, telephone and meeting etiquettes.	**K2**
CO2:	Solve problems on ratio proportion related to profit and loss, discounts, time and work, Time, speed and distance.	**K3**
CO3:	Work with fractions, decimals and square roots.	**K3**
CO4:	Analyze the cause, effect and course of action in logical problems.	**K4**
CO5:	Solve problems on the letter and symbol series.	**K3**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
			✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔	✔	

CSE	**ENVIRONMENTAL SCIENCE AND ENGINEERING**	3	0	0	3

Course Objectives

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future
- To provide understanding of component of environment, their function, quality, issues related to environment, effect of quality degradation on human beings and their solutions

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition – Scope and importance – Need for public awareness – Concepts of an Ecosystem – Structure and Function of an Ecosystem –Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Bio-geographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity – Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity. Field Study of Common Plants, Insects and Birds.

Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management:- Causes, Effects and Control Measures of municipal solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management - Floods, Earthquake, Cyclone and Landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 9

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction – Mining – Dams and their ground water – Floods – Drought – Conflicts over water –Dams – Benefits and Problems – Mineral Resources- Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies – Land Resources - Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of Resources for Sustainable Lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable To Sustainable Development – Urban Problems Related to energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, its Problems and Concerns, Case Studies Role of non – governmental organization - Environmental Ethics- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies –Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act –enforcement machinery involved in environmental Legislation – Central and state pollution control boards - Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population Growth, Variation among Nations – Population Explosion Family Welfare Programme – environment and Human Health – Human Rights –Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

TOTAL: 45 HOURS

Text Books:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw- Hill,NewDelhi, (2006).

Reference Books

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol.I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

Web Links:

1. https://onlinecourses.nptel.ac.in/noc20_ge16/preview
2. https://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/ENVIRONMENTAL-STUDIES/NPTEL-Link.pdf
3. http://eagri.org/eagri50/ENVS302/pdf/lec14.pdf
4. https://onlinecourses.nptel.ac.in/noc19_ge22/preview

COURSE OUTCOMES

At the end of this course the students will be able to,

CO 1: Understand the core concepts, methods of ecological and physical sciences, their application in environmental problem-solving.

CO 2: Apply system concepts and methodologies to analyse, understand the interactions between social and environmental processes.

CO 3: Apply the ethical, cross-cultural, and historical context of environmental issues and the link between human and natural systems.

CO 4: Develop the understanding based on the observations and illustration, drawn from the experiences of physical, biological, social and cultural aspects of life, rather than abstractions.

CO 5: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	1	1	1	-	1	-	-
CO2	1	1	-	-	-	-	-	1	1	-	-	-	-	-
CO3	-	1	-	-	-	-	-	2	-	1	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	2	1	1	-	1	-	-
Average	0.6	0.6	-	-	-	-	-	1.2	0.6	0.6	-	0.6	-	-

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		

CSE	GENDER INSTITUTION AND SOCIETY	2	0	0	0

Course Objective:

The course helps the student to understand concepts of social justice and gender justice. It provides the student with the knowledge of various institutions functioning worldwide which aim to eradicate discrimination against women. The course further aids students in understanding feminism and gender in relation to the society and to study the basic constitutional remedies available to women.

UNIT – I

Social Justice and Gender Justice – Theories relating to Social Justice – Theories relating to Gender Justice – Interrelationship between Gender justice and Social Justice

UNIT – II

International Conventions for protection of Women – Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) – National Commission for women – Constitutional remedies available for women under Indian Constitution.

UNIT – III

United Nations Entity for Gender Equality and the Empowerment of Women (UN Women) - Association for Women's Rights in Development (AWID) –Women kind worldwide – Centre for reproductive rights - Women's Environment and Development Organization (WEDO) - Global Fund for Women

UNIT – IV

International Center for Research on Women (ICRW) - European Institute for Gender Equality (EIGE) – Promundo - International Alliance of Women (IAW) - International Women's Development Agency (IWDA).

UNIT – V

World Health organisation – Sex and Gender – Feminism – Theories relating to Feminism – Gender and society

TEXT BOOKS

1. Law relating to Women and children, Mamta Rao
2. Gender, Politics and Institutions: Towards a Feminist Institutionalism, by Mona Lena krook and Fiano Mackay,2010
3. Gender Justice and Feminist Jurisprudence, Dr.Sheetal Kanwal,2015
4. Narain's Gender and society, P.Jain

REFERENCE BOOKS

1. Gender Justice and feminist Jurisprudence by Dr.Ishitha Chatterjee
2. Gender and Institutions, Moira Gatens and Alison Mackkinon

SUGGESTED READINGS:

1. Women and Gender : Society and Community , Siddhartha Sarkar

COURSE OUTCOMES:

After the completion of this Course, the student would be able to:

CO 1: Understand the Concept of Social Justice and Gender Justice.

CO 2: Learning the International Conventions and constitutional remedies available for women.

CO 3: Identify the various gender Institutions and its functions for the development of women.

CO 4: Assessing the International agencies.

CO 5: Summarising the study on feminism and relation of gender and society.

CSE	Java and Web Programming	3	0	0	3

Course Objectives

- Will gain knowledge in the basic concepts of Data Analysis
- To acquire skills in data preparatory and preprocessing steps
- To understand the mathematical skills in statistics
- To learn the tools and packages in Python for data science
- To gain understanding in classification and Regression Model
- To acquire knowledge in data interpretation and visualization techniques

UNIT I JAVA INTRODUCTION 9 Hours

Review of object oriented programming - Objects and classes in Java – Defining classes – Methods - Access specifiers – static members – static fields - static methods - static variables – constructors - Default constructor - parameterized constructor – finalize method – Arrays – Strings – Packages – user defined packages – Java Doc comments

UNIT II OBJECT-ORIENTED PROGRAMMING IN JAVA 9 Hours

Inheritance – class hierarchy – polymorphism - Runtime polymorphism - compile time polymorphisms– Encapsulation - static and dynamic binding – final keyword – abstract classes – the Object class: Method of object class – java Reflection – interfaces – Properties of interfaces – object cloning – inner classes – use of inner classes – proxies-Design Patterns in Java

UNIT III HTML,CSS CLIENT SIDE SCRIPTING 9 Hours

Understanding Internet - Understanding websites and web servers - HTML - – forms – frames – tables – web page design – CSS - Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions- JavaScript Events - Event Handling and Validation -Exception Handling-

UNIT IV SERVER SIDE PROGRAMMING 9 Hours

Understanding Java Server Pages-JSP Standard Tag Library(JSTL)-Creating HTML forms by embedding JSP code- Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server;- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP:.

UNIT V Web Applications development with Rest APIs 9 Hours

Rest API development with spring boot, Spring boot project with STS/MAVEN, Controller and Rest Controller annotations, RequestBody, ResponseBody annotations, Error handling with spring boot

TOTAL : 45 Hours

Text Books:

T3: Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.

T4: Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

Reference Books:

R3: Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.

R4: Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition,

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

COURSE OUTCOMES

CO1:	Develop Java programs using OOP principles	**K2**
CO2:	Develop Java programs with the concepts inheritance and interfaces	**K4**
CO3:	Design simple web pages using markup languages like HTML and XHTML.	**K3**
CO4:	Program server side web pages that have to process request from client side web pages.	**K4**
CO5:	Understand various web services and how these web services interact..	**K1**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	3
CO3	3	2	3	2	2	-	-	-	-	-	-	-	-	3
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	3
CO5	2	2	3	2	3	-	-	-	-	-	-	-	-	3
	2.8	2	2.6	2.2	2.4	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

√	√		√	√	√

CSE	**COMPUTER GRAPHICS AND MULTIMEDIA**	**3**	**1**	**0**	**4**

Course Objectives:

- To comprehend the fundamental concepts of graphics and multimedia.
- To gain and apply the acquired knowledge pertaining to 2D and 3D concepts in graphics
- programming.
- To understand the basic 3D modeling and rendering techniques.
- To realize the importance of multimedia towards building the virtual environment and communication.

UNIT I ILLUMINATION AND COLOR MODELS 12

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

UNIT II TWO-DIMENSIONAL GRAPHICS 12

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

UNIT III THREE-DIMENSIONAL GRAPHICS 12

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING 12

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies.

UNIT V HYPERMEDIA- CASE STUDIES 12

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

TEXT BOOKS:

T1. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT I – III]

T2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design‖, PHI, 2003. [UNIT IV,V]

REFERENCES:

R1: Judith Jeffcoate, —Multimedia in practice: Technology and Applications‖, PHI, 1998.

R2: Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.

R3: Jeffrey McConnell, —Computer Graphics: Theory into Practice, Jones and Bartlett Publishers,2006.

R4: Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.

R5: Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics, CRC Press, 2010.

R6: William M. Newman and Robert F.Sproull, —Principles of Interactive Computer Graphics, Mc Graw Hill 1978. https://www.blender.org/support/tutorials/

Course Outcomes

CO 1: Design two-dimensional graphics.

CO 2: Apply two dimensional transformations.

CO 3: Apply three dimensional transformations and clipping techniques to graphics

CO 4: Understood Different types of Multimedia File Format

CO 5: Design Basic 3d Scenes using Blender

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2
CO1	3	2	2	2	3	2	3	3	2	2	2	1	2	1
CO2	3	2	3	2	2	3	3	1	3	2	3	2	3	3
CO3	2	3	2	2	2	2	2	3	2	3	2	3	2	3
CO4	2	3	2	2	3	2	3	3	2	2	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	2.6	2.4	2.2	2.6	2.4	2.8	2.6	2.4	2.4	2.6	2.4	2.6	2.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	FUNDAMENTALS OF BLOCKCHAIN & USE CASES	3	0	0	3

Course Objectives

- To understand a broad overview of the essential concepts of blockchain technology
- To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming
- To learn about different types of blockchain and consensus algorithms

UNIT I Basics of Blockchain **9**

The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus. Technology Stack: Blockchain, Protocol, Currency

UNIT II Bitcoin Blockchain and Ethereum Blockchain **9**

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.

Ethereum Blockchain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

UNIT III Tiers of Blockchain Technology **9**

Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.

UNIT IV Types of Consensus Algorithms **9**

Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

UNIT V Blockchain Use Cases **9**

Industry applications of Blockchain-Blockchain in Government-Government use cases-Preventing Cybercrime through block chain-Block Chain in defense, Financial Services Related Use Cases, Revolutionization of Global Trade, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.

TOTAL : -- 45 hours

Text Books:

T1: Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).
T2: Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos O'Reilly, First Edition, 2014

Reference Books:

R1: Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
R2: Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
R3: Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).

Web Links:

1. https://www.coursera.org/specializations/blockchain.
2. https://nptel.ac.in/courses/106105184/
3. https://swayam.gov.in/nd1_noc20_cs01/preview

COURSE OUTCOMES

CO1:	Explain the basic notion of distributed systems & block chain technology stack	**K2**
CO2:	Analyze bitcoin and ethereum blockchain	**K4**
CO3:	Illustrate the essential tiers of a blockchain technology	**K2**
CO4:	Estimate the types of consensus algorithms	**K5**
CO5:	Apply Blockchain in future use cases for security	**K3**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	-	3
CO2	2	2	1	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	3	3	1	2	3	-	-	-	-	-	-	-	-	3
CO5	3	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

✔	✔		✔	✔	

CSE	JAVA AND WEB PROGRAMMING LAB	0	0	2	1

Course Objectives

- To be familiar with Web page design using HTML/XML and style sheets
- To learn to create dynamic web pages using server side scripting.
- To be exposed to creating applications with AJAX
- To be familiar in API development with Spring boot

Experiments:

1. Create a web page with HTML elements
2. Create a web page validating with Form Controls using DHTML
3. Create a web page with all types of Cascading style sheets.
4. Programs in Java using Servlets
5. Invoke servlets from HTML forms.
6. Three-tier applications using servlets, JSP and Databases.
7. Webservices -Consider a case where we have two web Services- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.
8. Get API development with Spring boot
9. Post API development -saving the data in database
10. Updating data in database with Put API
11. Response code 200, 400, 500 with spring boot

TOTAL : 30 hours

COURSE OUTCOMES

CO1:	Design simple web pages using markup languages like HTML and XHTML.	**K4**
CO2:	Create dynamic web pages using DHTML and java script that is easy to navigate and use.	**K6**
CO3:	Program server side web pages that have to process request from client side web pages.	**K6**
CO4:	Represent web data using XML and develop web pages using JSP.	**K4**
CO5:	Create Webservices for client server applications	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	3
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	3	3	-	-	-	-	-	-	-	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	-	3	1	3
AVG	2.2	2.2	2.2	2.4	-	-	-	-	-	-	-	2.2	2.4	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	**Computer Graphics and Multimedia Lab**	**0**	**0**	**2**	**1**

Course Objectives

- To make the students understand graphics concepts and develop, design and implement two- and three-dimensional graphical structures using OpenGL.
- To understand multimedia compression techniques and applications of multimedia.

Experiments:

1. Study of Fundamental Graphics Functions.
2. Implementation of Line drawing algorithms: DDA Algorithm, Bresenham's Algorithm
3. Implementation of Circle drawing algorithms: Bresenham's Algorithm, Mid-Point Algorithm.
4. Programs on 2D and 3D transformations
5. Write a program to implement Cohen Sutherland line clipping algorithm
6. Write a program to draw Bezier curve.
7. Using Flash/Maya perform different operations (rotation, scaling move etc..) on objects
8. To perform animation using any Animation software (Create Frame by Frame Animations using multimedia authoring tools)
9. To perform basic operations on image using any image editing software

TOTAL : --30 hours

COURSE OUTCOMES

CO1	Explain line drawing using programming language.	**K1**
CO2	Explain 2D and 3D transformations	**K3**
CO3	Demonstrate simple 2D animations using animation software.	**K4**
CO4	Prepare simple scenes using image editing software.	**K1**
CO5	Explain the linking between web and multimedia.	**K5**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	2	3	3	2	3	2	1	2	1
CO2	3	2	3	3	2	3	2	1	3	2	3	2	3	3
CO3	2	3	2	2	2	2	1	3	2	3	3	3	2	3
CO4	2	3	2	2	3	2	3	3	2	2	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3
AVG	2.4	2.6	2.4	2.4	2.6	2.4	2.4	2.6	2.4	2.6	2.8	2.4	2.6	2.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	**PERSONALITY DEVELOPMENT III**	**2**	**0**	**0**	**2**

COURSE OBJECTIVE:

- To enhance the communication, interpersonal, group skills.

UNIT I VERBAL APPTITUDE I 6

Phonetics / Neutral Accent / Pronunciation – Speech Mechanism / Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

UNIT II VERBAL APTITUDE II 6

Singular/plural – present tense / past tense – genders Prepositions – conjunctions – Choice of words – simple sentences – compound sentences – summarizing phrases Synonyms – Antonyms – Analogies – Similar Words.

UNIT III SOFT SKILLS 6

Attitude – Meaning–Features of attitude – Formation – Personality Factors –Types of attitude – change in attitude – developing Positive attitude.

UNIT IV TIME MANAGEMENT 6

Definition – Meaning–Importance, Value of time as an important resource – comparison of Time and Money – Circle of influence and circle of control – Definition of URGENT and IMPORTANT – Time Wasters and how to reduce – Procrastination – meaning and impact – 4 Quadrants.

UNIT V TEAM BUILDING 6

Meaning – Aspects of team building – Process of team building – Types of Teams – Team Ethics and Understanding – Team trust and commitment.

TOTAL: 30 h

TEXT/REFERENCE BOOKS:

T1. B N Ghosh, Managing Soft Skills and Personality, Mc graw Hill Publications

T2. Shejwalkar and Ghanekar,Principles and Practices of Management,Mc Graw Hill Latest.

T3. Roberta Roesch ,Time management for Busy people, Tata McGraw–Hill Edition

REFERENCE BOOKS:

R1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021

R2. Dr V M Selvaraj, Personality Development, Bhavani Publications

COURSE OUTCOMES

CO1:	Articulate by understanding the rate and flow of speech.	K3
CO2:	Choose words and phrases appropriately for any verbal communication.	K3
CO3:	Develop a positive attitude in handling diverse situations.	K4
CO4:	Prioritize important and urgent tasks using the four quadrants method.	K4
CO5:	Practice team ethics and understanding when working with teams.	K3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
			✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔	✔	

CSE	.NET ENVIRONMENT	3	0	0	3

Course Objectives

To assist the learner to understand the .NET Architecture, Object oriented concepts, to use ADO.NET for database connectivity and developing the ability to solve any type of problems by mapping with real world environment using ASP.NET and C#.

- Construct various applications using C# in .Net framework
- Familiar about Object Oriented concepts in C# language
- Demonstrate how to retrieve data from database using ADO.NET programming
- Create web based and windows based applications using ASP.NET
- Make the developer experience consistent across widely varying types of apps, such as Windows based apps and Web-based apps.

UNIT I INTRODUCTION TO C# 9

Introducing C# - Introduction to .Net framework and Architecture - Understanding .NET-Overview of C#-Literals Variables-Constant Variables – Scope of Variables – Boxing and Unboxing - Data Types-Operators- Expressions Branching- Looping- Methods- Arrays- Strings- Structures- Enumerations.

UNIT II OBJECT ORIENTED ASPECTS OF C# 9

Classes-Adding Variables – Adding Methods - Objects – Accessing class Members – Constructors – Abstract classes and Methods - Inheritance - Polymorphism – Interfaces - Operator Overloading - Delegates and Events - Errors and Exceptions.

UNIT III ADO.NET 9

ADO.NET Introduction - ADO.NET Architecture : Connected and Disconnected Architecture – Data Provider Connection Object, Command Object, Data Reader - Datasets : Data Table , Data Column , Data Row , Data Constraints , Data Relation , Data Adapters

UNIT IV WEB BASED APPLICATION DEVELOPMENT ON .NET 9

Building Windows Forms Applications -Programming Web Applications with Web Forms using ASP.NET - ASP.NET controls - Understand Data Binding and various Data Sources in ASP.NET - Understand the creation of Master Pages and themes - Configuration of web applications using IIS configurations - State management in ASP.NET Programming Web Services.

UNIT V MVC FRAMEWORK 9

MVC basics , MVC Architecture, Web forms vs MVC, Create a controller , Create models ,Create a view ,Add a service class ,Use dependency injection ,Finish the controller ,Update the layout

TOTAL:45 h

TEXT BOOKS:

T1: Balagurusamy. E, “Programming in C#”, Tata McGraw-Hill, 2004. (Unit I, II)

T2: Liberty.J, “Programming C#”, 2nd Edition., O’Reilly, 2002. (Unit III, IV, V)

T3: Bill Hamilton, Matthew MacDonald , “ ADO.NET in a Nutshell “ ,O'Reilly Media (Unit III)

T4: Jesse Liberty, Dan Maharry, Dan Hurwitz . “Programming ASP.NET 3.5” 4th Edition , O'Reilly Media (Unit IV)

REFERENCES:

R1: Herbert Schildt, “The Complete Reference: C#”, Tata McGraw-Hill, 2004.

R2: Robinson et al, “Professional C#”, 2nd ed., Wrox Press, 2002.

R3: Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.

R4: ThamaraiSelvi, R. Murugesan, “A Textbook on C#”, Pearson Education

R5: ADO.NET in a Nutshell By Bill Hamilton, Matthew MacDonald Publisher: O'Reilly Media.

R6: Programming ASP.NET 3.5, 4th Edition By Jesse Liberty, Dan Maharry, Dan HurwitzPublisher: O'Reilly Media

Web Links:

W1: https://ict.iitk.ac.in/courses/introduction-to-c-sharp/

W2: https://www.btechguru.com/training--dot-net--c-sharp-dot-net--framework--c-sharp-programming-tutorial-part-1-video-lecture--11285--27--139.html

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1: Construct various applications using C# in .Net framework 1

CO2: Familiar about Object Oriented concepts in C# language 5

CO3: Demonstrate how to retrieve data from database using ADO.NET programming 3

CO4: Develop ASP.NET based web application using C# 2

CO5: Develop desktop based, modern web based applications using Model View Controller. 2

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	2	2	2	-	-	-	-	2	1	2
CO2	3	2	2	2	2	3	2	-	-	-	-	2	1	2
CO3	2	2	3	3	2	2	2	-	-	-	-	2	3	2
CO4	2	3	2	2	2	3	2	-	-	-	-	2	3	3
CO5	3	2	3	2	2	2	3	-	--	-	-	2	3	3
Average	**2.4**	**2.4**	**2.4**	**2.2**	**2**	**2.4**	**2.2**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2.4**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	THEORY OF COMPUTATION AND COMPILER DESIGN	3	0	0	3

Course Objectives

- Provides the required theoretical foundation for a computational model and compiler design
- Discuss Turing machines as an abstract computational model
- Compiler algorithms focus more on low-level system aspects..

UNIT I INTRODUCTION TO LANGUAGES AND GRAMMAR 12hours

Overview of a computational model - Languages and grammars – alphabets – Strings – Operationson languages, Introduction to Compilers - Analysis of the Source Program - Phases of a Compiler –Finite automata– DFA – NFA – Equivalence of NFA and DFA (With Proof) – Regular expressions – Conversion between RE and FA (With Proof) Lexical Analysis - Recognition of Tokens - Designing a Lexical Analyzer using finite automata.

UNIT II CFG, PDAS AND TURING MACHINES 12hours

CFG – Chomsky Normal Forms - NPDA – DPDA - Membership algorithm for CFG. SyntaxAnalysis - Top-Down Parsing - Bottom-Up Parsing - Operator-Precedence Parsing - LR Parsers -Turing Machines – Recursive and recursively enumerable languages – Linear bounded automata -Chomsky's hierarchy – Halting problem.

UNIT III INTERMEDIATE CODE GENERATION 12hours

Intermediate Code Generation - Intermediate Languages – Declarations - Assignment Statements -

Boolean Expressions - Case Statements – Backpatching - Procedure Calls.

UNIT IV CODE OPTIMIZATION 12 hours

Code Optimization - Basic Blocks and Flow Graphs – The DAG Representation of Basic Blocks -The Principal Sources of Optimization - Optimization of Basic Blocks - Loops in Flow Graphs -Peephole Optimization - Introduction to Global Data-Flow Analysis

UNIT V CODE GENERATION AND RUN TIME ENVIRONMENTS 12 hours

Code Generation – Issues in the Design of a Code Generator - The Target Machine - Run-Time Storage Management - Next-Use Information - Register Allocation and Assignment - A Simple Code Generator

- Generating Code from DAG - Runtime Environments – Source Language issues – Storage Organization – Activation Records- Storage Allocation strategies – Static Allocation – Stack Allocation – Heap Allocation - Access to non-local names – Parameter Passing.

TOTAL : -- 60 hours

Text Books:

1. Introduction to Automata Theory, Languages, and Computation (3rd Edition), John E Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Pearson education, 2013.

2. Principles of Compiler Design, Alferd V. Aho and Jeffery D. Ullman, Addison Wesley,2006

Reference Books:

1. Introduction to Languages and the Theory of Computation, John Martin, McGraw-Hill Higher Education,2010

2. Modern Compiler Implementation in Java, 2nd ed., Andrew W. AppelCambrdige University Press, 2012

Web Links:

1. **https://archive.nptel.ac.in/courses/106/105/106105183**

2. **https://nptel.ac.in/courses/106104148**

COURSE OUTCOMES

Course Outcome	**Description**	**Knowledge Level**
CO1	Analysis to visualize languages and finite state machines and their equivalence.	K4
CO2	Illustrate the translation of regular expression into parse tree using syntax analyzer	K2
CO3	Construct the intermediate representation considering with the type systems	K6
CO4	Learn to implement code optimization techniques	K4
CO5	Design a sample code generator.	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**

CO1	3	2	2	2	3	2	3	3	2	2	2	1	2	1
CO2	3	2	3	3	2	3	3	1	3	2	3	2	3	2
CO3	2	3	2	2	2	2	2	3	2	3	2	3	2	3
CO4	2	3	2	2	3	2	3	3	2	2	3	3	3	3
CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

Course Code	Compiler Design lab	0	0	2	1

Course Objectives

- To be familiar with Lexical Analyzer using Lex tool & parser using YACC Tool.
- To learn to create front end of the compiler by means of generating Intermediate codes.
- To be familiar in code optimization techniques.

List of Experiments:

1. Implementation of Symbol Table.
2. Implementation of Lexical Analyzer using Lex Tool
3. Develop a Lexical Analyzer to Recognize a few patterns In C
4. Generate Yacc Specification for a few syntactic categories.

a) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

b) Program to recognize a valid variable which starts with a letter followed by any number of letter or digits.

5. Implementation of calculator using Lex And Yacc
6. Implementation of Type Checking
7. Convert the BNF rules Into YACC Form and Write code to Generate Abstract Syntax Tree Using and YACC.
8. Implement Control Flow Analysis and Data Flow Analysis
9. Implement any one Storage Allocation Strategies (Heap,Stack,Static)
10. Construction of DAG
11. Implementation of Simple Code Optimization Techniques

TOTAL : --30 hours

COURSE OUTCOMES

CO1:	Design a compiler for a simple programming language	**K4**
CO2:	Apply the knowledge of Lex tool & Yacc tool to develop a scanner & parser.	**K6**
CO3:	Implement Optimization techniques and generate machine level code	**K6**
CO4:	Understand the importance of code optimization	**K4**
CO5:	Develop program for implementing symbol table.	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	-	-	-	-	-	-	-	2	3	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	3
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	2	2	3	3	-	-	-	-	-	-	-	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	-	3	1	3

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Observation**
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

CSE	.NET ENVIRONMENT LABORATORY	L	T	P	Credits
		0	0	2	1

LIST OF EXPERIMENTS

1.Implement C# program

a) Write a program in C# to count a total number of alphabets, digits and special characters in a string.

b) Write a program in C# to count a total number of duplicate elements in an array.

c) Design program to implement Stack in c#.

2.Basic C# program

(a) Calculate Hypotenuse of triangle using dynamic initialization of variables

(b) To get input from the user and perform calculations

(c) Calculate the quadrant for the coordinates using if..else…ladder

(d) Check whether the alphabet is a vowel or not using switch..case…

(e) To understand about for..each loop and strings

3.Create a login page using controls.

4.Create a registration page with all controls.

5.Establish database connection using ado.net

6.Create a page with control values fetching from database

7.Create a master page for college application.

8.Apply themes and different CSS in a form.

9.Create a crud application

10.Create a web application with MVC framework

Text Books:

T5: Balagurusamy. E, “Programming in C#”, Tata McGraw-Hill, 2004.
T6: Liberty.J, “Programming C#”, 2nd Edition., O’Reilly, 2002.

Reference Books:

R5: Herbert Schildt, “The Complete Reference: C#”, Tata McGraw-Hill, 2004.

R6: Robinson et al, “Professional C#”, 2nd ed., Wrox Press, 2002.

Web Links:

7. https://www.tutorialspoint.com/dot net/index.html
8. https://ict.iitk.ac.in/courses/introduction-to-c-sharp

Course Outcome	Description	Knowledge Level
CO1	Understanding the basic concepts, and programs in C#	K5
CO2	Establish database connection using ADO.Net	K1
CO3	Create user interactive web pages using ASP.net	K1
CO4	Applying themes and different CSS in a form	K4
CO5	Performing database operations for windows and web applications using MVC	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	2	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	2	1	2
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	2	2	3	-	-	-	-	-	-	-	3	2	3
Average	2.2	2.4	2	2.4	-	-	-	-	-	-	-	2.2	2	2.2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

Course Objectives

- Will gain knowledge in the basic concepts of Javascript
- To acquire skills in frontend using Angular
- To understand the concepts in NodeJS
- To implement using ExpressJS
- Create a web application with database

UNIT I **Javascript - Introduction** **9 Hours**

Purpose, architecture & debugging basics - Primitives & Non Primitives -Equality, Operators- Logic and Control Structures - Objects and Functions -Call, Apply and Bind - Callbacks & Promises - DOM handling - Error Handling - Array, String, Math, Date functions – Ajax -Browser storage techniques, webworkers

UNIT II **Angular Concepts** **9 Hours**

Angular App-component, Custom components, ngFor, ngIf, ngClass, ngStyle, ngSwitch, Pipes, HTTP client, Get Requests, Post requests

UNIT III **Node JS** **9 Hours**

Process Model - Callbacks & Events – Modules -Rest APIs-CLI application-Web sockets -File & Stream operations-Promises-Important Node libraries-NPM framework

UNIT IV **Ex** **9**

pr es s JS **H o ur s**

Rest APIs & Routing - Wriitng middlewares - Cookies & Session -Authentication and authorization - Error routing-JWT-Mongoose - MongoDB ORM-Sequelize - SQL ORM

UNIT V MongoDB **9 H o ur s**

Installation & setup - Mongo queries and CRUD - Aggregation framework - Replication & Sharding concepts

TOTAL : 45 Hours

CSE	**Full Stack Web Development**	**3**	**0**	**0**	**3**

Text Books:

T1: Amos Q. Haviv, MEAN Web Development,2nd Revised edition,Packt Publishing

T2: Ethan Brown,Web Development with Node and Express,Oreilly

Reference Books:

R1: Colin J Ihrig , Adam Bretz Full Stack JavaScript Development With MEAN,FirstEdition

Web Links:

1. https://angular.io/
2. https://nodejs.org/en/
3. https://expressjs.com/
4. https://www.mongodb.com/

COURSE OUTCOMES

CO1:	Understand Javascript principles	K1
CO2:	Develop Front end web page using Angular	K5
CO3:	Implement the web page using ExpressJS	K4
CO4:	Create backend application using NodeJS	K6
CO5:	Build a web application with MEAN	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	1	-	-	-	-	-	-	-	3	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO5	2	2	3	3	2	-	-	-	-	-	-	-	2	3
	2.8	2.6	2.6	3	1.8	-	-	-	-	-	-	-	2.8	3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
√	√	√	√	√	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
√	√	√	√	√	√

Course Code	Full Stack Web Development Lab	0	0	3	1

Course Objectives

- To implement Forms, inputs and Services using Angular JS
- To develop a simple web application using Nodejs; Angular JS and Express
- To implement data models using Mongo DB

List of Experiments:

1. Develop a Form and validate using Angular JS
2. Create and implement modules and controllers in Angular JS
3. Implement Error Handling in Angular JS
4. Create and implement Custom directives
5.web socket implemetation
6.rest api with node
7.implementing call back and events and promises in nodejs
8. Create a simple web application using Express, Node JS and Angular JS
9. Implement CRUD operations using MVC architecture
10. Implement MongoDB data models
11.Create a Web application of your own

TOTAL : --30 hours

COURSE OUTCOMES

CO1:	Design and Implement Forms, inputs and Services using Angular JS	**K3**
CO2:	Develop a simple web application using Nodejs; Angular JS and Express	**K4**
CO3:	Implementing call back and events and promises in nodejs	**K6**
CO4:	Implement CRUD operations using MVC architecture	**K4**
CO5:	Implement data models using Mongo DB	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	1	3	-	-	-	-	-	-	3	2	2
CO2	1	1	1	1	3	-	-	-	-	-	-	1	1	1

CO3	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**
CO4	**2**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
CO5	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**3**

CAT 1	CAT 2	Model Exam	End Semester Exams	Observation
		✔	✔	✔
Record	**MCQ**	**Projects**	**Viva**	**Demonstration / Presentation**
✔			✔	✔

LIST OF ALL PROFESSIONAL ELECTIVE COURSES

CSE	APPLIED CRYPTOGRAPHY	3	0	0	3

Course Objective:

- To understand the mathematical background for cryptography .
- To understand the taxonomy of cryptography primitives
- To understand the Symmetric key encryption system, public key encryption system
- To implement cryptographic algorithms

UNIT I - INTRODUCTION 9

Cryptography goals – Taxonomy of cryptography primitives – Background on functions – Basic terminology – Definition and examples – Block ciphers, stream cipher, substitution ciphers, transposition ciphers – Composition of ciphers – Digital signature – Construction of digital signature – Public key cryptography – Hash functions – Protocol and mechanism – Key establishment and management – Pseudo random numbers – Classes of attack.

UNIT II - NUMBER THEORY 9

Probability theory – Information theory – Complexity theory – Number theory – Abstract algebra – Finite fields – Primality test – Prime number generation – Irreducible polynomial.

UNIT III - RANDOM GENERATORS 9

Pseudo random bits and sequences – Random bit generation – Pseudorandom bit generation – statistical tests – Stream Cipher.

UNIT IV - ENCRYPTION ALGORITHMS 9

Block cipher – DES – FEAL – IDEA – SAFAR – Public key encryption – RSA – Rabin – Elgamal –Mc Eliece – Knapsack.

UNIT V - HASH ALGORITHMS 9

Hash function and data integrity – Classification and framework – Basic constructions and general results – Unkeyed hash functions – Keyed hash functions – data integrity and message authentication – Advanced attacks and hash function.

TOTAL: 45 h

TEXT BOOK :

1. A.Menezes, P.Van Oorschot and S. Vanstone, “Hand book of Applied Cryptography” CRC Press, Fifth Printing, 2001.

REFERENCEBOOKS :

1. Charlie Kaufman, Radia Perlman, Mike Speciner, “ Network Security, Private communication in public world” PHI 2nd edition 2002.

2. Bruce Schneier, Neils Ferguson, “Practical Cryptography”, Wiley Dreamtech India Pvt Ltd, 2003

3. Douglas R Simson “Cryptography – Theory and practice”, CRC Press 1995. 3. Stallings, “Cry ptography& Network

Security", Pearson Education, 4th Edition 2006.

Course Outcome	Description	Knowledge Level
CO1	Understand the basics of cryptographic algorithms and protocols	K3
CO2	Analyze the concept of Public key cryptography, Hash functions, Key establishment and management	K4
CO3	Acquire knowledge on encryption algorithms such as Block cipher, DES, FEAL, IDEA and SAFAR	K3
CO4	Evaluate the performance of Hash function, data integrity and message authentication	K5
CO5	Assess existing applications of cryptography and develop new protocols and applications that employ cryptography.	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	1	2	3	1	1	2	-	1	2	-
CO2	2	3	2	2	2	3	1	2	3	2	2	2	2	2
CO3	2	3	2	2	1	3	1	2	3	2	2	2	2	2
CO4	2	3	2	3	3	3	2	3	2	2	3	2	3	3
CO5	2	3	3	2	3	3	3	2	2	3	3	3	3	3
Average	2.2	2.8	2.4	2	2	2.8	2	2	2.2	2.2	2	2	2.4	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	Big Data Programming	3	0	0	3

Course Objectives

- To explore the fundamental concepts of big data analytics, Hadoop, R programming and HiveQL
- To learn big data analytics using R Programming

UNIT I Introduction to Big Data **9**

Introduction to Big Data Platform – Challenges of Conventional Systems - Nature of Data- Evolution Of Analytic Scalability - Intelligent data analysis- Analytic Processes and Tools - Analysis vs. Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error

UNIT II Hadoop **9**

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop-Analyzing the Data with Hadoop Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT III HiveQL **9**

Introduction to HiveQL- Databases in Hive-HiveQL: Queries- SELECT … FROM Clauses , Specify Columns with Regular Expressions , Computing with Column Values , Arithmetic Operators, Using Functions-Mathematical functions, Aggregate functions, Table generating functions, Other built-in functions ,LIMIT Clause ,Nested SELECT Statements, CASE … WHEN … THEN Statements, WHERE Clauses, Predicate Operators, LIKE and RLIKE, GROUP BY Clauses , HAVING Clauses ,JOIN Statements -Inner JOIN ,LEFT OUTER JOIN,RIGHT OUTER JOIN, FULL OUTER JOIN, Cartesian Product JOINs , Map-side Joins, ORDER BY and SORT BY, DISTRIBUTE BY with SORT BY , CLUSTER BY

UNIT IV Big Data Analytics Using R Programming **9**

Analyzing, Visualization and Exploring the Data, Statistics for Model Building and Evaluation, Introduction to R and RStudio, Basic analysis in R, Intermediate R, Intermediate analysis in R, Advanced Analytics - K-means clustering, Association rules-Speedup, Linear Regression, Logistic Regression, Naïve Bayes, Decision Trees, Time Series Analysis, Text Analysis

UNIT V Frameworks **9**

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services –- fundamentals of HBase and ZooKeeper - IBM InfoSphere BigInsights and Streams. Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications

TOTAL : -- 45 hours

Text Books:

T7: Prajapati, Big Data Analytics with R and Hadoop, 2014

T8: Stephan Kudyba, Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications, March 12, 2014 .

T9: Michael Minelli (Author), Michele Chambers (Author), Ambiga Dhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications,2013

T10: Jason Rutherglen, Dean Wampler and Edward Capriolo, Programming Hive, O'REILLY, 2012

Reference Books:

R7: Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, 2007.

R8: Tom White — Hadoop: The Definitive Guide‖ Third Edition, O'reilly Media, 2012.

R9: Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos, —Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data‖, McGraw Hill Publishing, 2012

R10: Anand Rajaraman and Jeffrey David Ullman, —Mining of Massive Datasets, Cambridge University Press, 2012.

R11: Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, JohnWiley& sons, 2012.

R12: Glenn J. Myatt, —Making Sense of Data, John Wiley & Sons, 2007

R13: Dr. Mark Gardener, Beginning R: The Statistical Programming Language (Wrox), 2013

R14: PeteWarden, —Big Data Glossary, O'Reilly, 2011.

R15: Jiawei Han, MichelineKamber —Data Mining Concepts and Techniques, Second Edition, Elsevier, Reprinted 2008.

R16: Da Ruan,Guoquing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer,2007

R17: Paul Zikopoulos ,Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.

R18: Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications,2013

R19: Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

COURSE OUTCOMES

CO1:	Identify the purpose and need of big data programming and compare it with conventional systems.	**K3**
CO2:	Examine and compare various Components of Hadoop and develop a Map Reduce application.	**K4**
CO3:	Develop Hive queries using HiveQL interface.	**K3**
CO4:	Discuss various statistics modeling techniques and its evaluation using R and other clustering methods.	**K6**
CO5:	Discuss various big data frameworks, Applications on Big Data Using Pig, fundamentals HBASE, Zookeeper, IBM Info Sphere Big Insights and also test Visual data analysis techniques	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO5	2	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

CSE	Bioinformatics	3	0	0	3

Course Objectives

- To study the scope of Bioinformatics, types of Databases and their uses, Tools and Algorithms
- To learn the Pair wise Sequence Alignment methods

UNIT I Bioinformatics: An Introduction **9**

Introduction-Historical Overview and Definition- Bioinformatics Applications - Major Databases in Bioinformatics- Data Management and Analysis- Molecular Biology and Bioinformatics- Central Dogma of Molecular Biology

UNIT II Databases **9**

Introduction- Characteristics of Bioinformatics Databases- Categories of Bioinformatics Databases- Navigating databases- Sequence Databases-Nucleotide sequence database- secondary Nucleotide sequence database – protein sequence databases- structure databases- Structure file formats- Protein Structure Database Collaboration- PDB- CATH –SCOP- Other databases- Enzyme Databases- MEROPS- Pathway Databases:CAZy

UNIT III Tools **9**

Introduction- Need for Tools- Knowledge Discovery- Data- Mining Tools- Data Submission tools- Nucleotide Sequence Submission and Protein Submission tools- Data Analysis tools- Prediction Tools- Phylogenetic trees and Phylogenetic Analysis- Modelling Tools

UNIT IV Algorithms **9**

Introduction- Classification of Algorithms- Biological Algorithms- Implementing Algorithms- Biological Algorithms- Bioinformatics Tasks and Corresponding Algorithms- Data Analysis Algorithms- Sequence Comparison Algorithms – Substitution Matrices Algorithms –Sequence Alignment Optimal Algorithms- Prediction Algorithms- Phylogenetic prediction Algorithm – Protein Structure Prediction

UNIT V Genome Analysis and Sequence Alignment **9**

Introduction- Genome Analysis- Genome mapping- The Sequence Assembly Problem- Genome Sequencing- Biological Motivation of Alignment Problems Methods of Sequence Alignments- Using Scoring matrices- Measuring Sequence Detection Efficiency- Working with FASTA and BLAST

TOTAL : -- 45 hours

Text Books:

T11: OrpitaBosu, Simminder KaurThukral , “Bioinformatics: Database, Tools, Algorithms”, Oxford University Press, Chennai, 2007. (Part B---Unit-II, Part C---Unit-III, Part D---Unit-IV)

T12: Rastogi S. C., Namita Mendiratta, Parag Rastogi, “Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery”, Third Edition, PHI Learning Pvt. Ltd., New Delhi, 2011. (Chapter-1---Unit-I, Chapter 3,4 and 6--Unit-V)

Reference Books:

R20: Bryan Bergeron, “Bioinformatics computing”, PHI Learning Pvt. Ltd, New Delhi, 2010.

R21: Rastogi S.C., Namita Mendiratta, Parag Rastogi, “Bioinformatics: Concepts”, Skills & Applications, Second Edition, CBS Publishers & Distributors Pvt. Ltd, 2009

R22: Arthur M. Lesk, “Introduction to Bioinformatics”, Third Edition, Oxford University Press, Chennai, 2010

R23: Gautham N., “Bioinformatics: Databases and Algorithms”, alpha Science 2006

Web Links:

1. http://staff.aub.edu.lb/~webbic/nemer/index.html
2. http://bip.weizmann.ac.il/education/course/introbioinfo/04/lect1/introbi oinfo04/index.html
3. http://engineeringppt.net/algorithms-in-bioinformatics-pdf-lecture- notes/

COURSE OUTCOMES

CO1:	Comprehend the data management and analysis of Bio Informatics	**K3**
CO2:	Understand the Structure Database Collaboration like PDB, CATH, SCOP	**K3**
CO3:	Analyze the various Tools for data mining, submission and prediction	**K4**
CO4:	Implement the Classification of Algorithms and prediction of protein structure	**K6**
CO5:	Measure sequence detection efficiency in bioinformatics	**K5**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO5	2	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

OCSE01	**CLOUD COMPUTING**	3	0	0	3

Course Objectives

- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize with the types of virtualization and the lead players in cloud.

UNIT I INTRODUCTION, PRINCIPLES AND ARCHITECTURE **9**

Cloud Computing : Vision, reference model, characteristics and challenges – historical development – building cloud computing environment – computing platforms and Technologies – Parallel Vs distributed computing – Elements of parallel and distributed computing – Technologies for distributed computing. Cloud Computing Architecture: Cloud reference model - NIST Cloud Computing Reference Architecture – types of Clouds - economics – open challenges.

UNIT II VIRTUALIZATION 9

Characteristics of virtualized environments - Taxonomy of virtualization techniques - Execution virtualization -Machine reference model - Hardware-level virtualization – Hypervisors - Hardware virtualization techniques -Operating system-level virtualization - Programming 210 language-level virtualization - Application-level virtualization - Other types - Virtualization and cloud computing - Pros and cons of virtualization - Technology examples - Xen: Paravirtualization - VMware: full virtualization - Full virtualization and binary translation - Microsoft Hyper-V.

UNIT III CLOUD INFRASTRUCTURE 9

Cloud Computing and Services Model – Public, Private and Hybrid Clouds – Cloud Eco System - IaaS - PaaS – SaaS. Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources. Case Study: Amazon Web Service reference, GoGrid, Rackspace

UNIT IV CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENT 9

Cloud capabilities and platform features – data features and databases - Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Dryad and DryadLINQ – sawzall and Pig Latin - Mapping Applications - Programming Support of Google App Engine - Amazon AWS –Microsoft Azure - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack. Case Study: Amazon Web Service reference, GoGrid, Rackspace.

UNIT V CLOUD PLATFORMS AND APPLICATION 9

Amazon web services - Compute services - Storage services - Communication services - Google AppEngine - Architecture and core concepts – Cloud Security and Trust management. Application life

cycle - Cost model – Observations - Microsoft Azure - SQL Azure – Scientific Applications –Business and Consumer Application – Energy efficiency in clouds - Market-based management of clouds - Federated clouds/InterCloud - Third-party cloud services.

TOTAL : 45 hours

Text Books:

T1: Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud

Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

T2: Rajkumar Buyya, Christian Vecchiola. S.Thamarai Selvi, "Mastering Cloud

Computing", McGraw Hill Education, 2013.

Reference Books:

R24: James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for

Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

R25: George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.

R26: Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.

R27: John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Web Links:

9. https://onlinecourses.nptel.ac.in/noc22_cs20/preview.

10. https://www.w3schools.in/cloud-computing.

COURSE OUTCOMES

CO1:	Understand the broad perspective of cloud architecture, key technologies, principles, strengths, limitations as well as the possible applications of the state-of-art of cloud computing.	K2, K3
CO2:	Gain a basic knowledge of virtualization and its categorization and Design & develop highly scalable cloud-based applications by creating and configuring virtual machines.	K3, K6
CO3:	Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real - world cloud computing problems.	K4
CO4:	Interpret some important cloud computing driven commercial systems such as: Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud	K5

	applications.	
CO5:	Build and deploy cloud application using popular cloud platforms.	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	0	3	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	-	3
CO4	2	2	2	3	0	-	-	-	-	-	-	-	-	3
CO5	0	2	3	3	3	-	-	-	-	-	-	-	-	3
	2.2	2	2.6	2.4	2.2	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔		✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		

OCSE01	CRYTOGRAPHY AND NETWORK SECURITY	3	0	0	3

Course Objectives

- To understand the fundamental principles, algorithms of cryptographic techniques and expose them to various scenarios of cyber crime with an introduction to cyber law along with a thrust on security on the internet
- To develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.

UNIT I INTRODUCTION 9 hours

OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – The strength of DES - Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Multiple Encryption and Triple DES – Placement of Encryption Function – Traffic Confidentiality – Key distribution – Random Number Generation

UNIT II PUBLIC KEY CRYPTOGRAPHY 9 hours

Key Management - Diffie- Hellman key Exchange – Elliptic Curve Arithmetic - Elliptic Curve Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography/RSA

UNIT III AUTHENTICATION AND HASH FUNCTION 9 hours

Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – CMAC Digital Signatures - Digital Signatures - Authentication Protocols – Digital Signature Standard.

UNIT IV NETWORK SECURITY 9 hours

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security: Pretty good privacy, S/MIME – IP Security – Web Security: Web security considerations, Secure socket layer and Transport layer Security – Authentication Header – Encapsulating Security Payload – Combining Security Associations – Key Management.

UNIT V SYSTEM LEVEL SECURITY 9 hours

Intruders: Intrusion detection – password management – Malicious software: Viruses and related Threats, Virus Counter measures, Distributed Denial of Service Attacks – Firewalls: Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation – Internet standards and internet security.

TOTAL : 45 hours

Text Books:

T1 William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

T2 Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2013

Reference Books:

R1 Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001.

R2 Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Third Edition, Pearson education

Web Links:

1. https://www.tutorialspoint.com/cryptography/index.html
2. https://onlinecourses.nptel.ac.in/noc21_cs16/preview

COURSE OUTCOMES

CO1:	Understand OSI security architecture and the design principles of Block cipher	K3
CO2:	Acquire knowledge on block cipher modes of operation	K3
CO3:	Describe key management in public key cryptography	K5
CO4:	Implement the Hash Functions and Authentication Protocols	K6
CO5:	Analyze the Electronic Mail Security and IP Security	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	3	-	3	-	-	-	-	-	-	-	2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	3	2
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	1
CO5	-	2	3	3	3	-	-	-	-	-	-	-	2	3
Aver age	2.2	2.2	2.6	2.4	2.2	-	-	-	-	-	-	-	2.4	2.2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

CSE	CYBER FORENSICS	3	0	0	3

Course Objective:

- To understand the fundamentals of Computer Forensics and computing Investigations.
- To recognize the legal underpinnings and critical laws affecting forensics
- To apply the tools and methods to uncover hidden information in digital systems.
- To learn about current licensing and certification requirements to build the career in digital forensic.

UNIT I INTRODUCTION **9**

The Scope of Computer Forensics - Windows Operating and File Systems –Handling Computer Hardware – Anatomy of Digital Investigation.

UNIT II INVESTIGATIVE SMART PRACTICES **9**

Forensics Investigative Smart Practices – Time and Forensics – Incident closure

UNIT III LAWS AND PRIVACY CONCERNS **9**

Laws Affecting Forensic Investigations – Search Warrants and Subpoenas – Legislated Privacy Concerns – The admissibility of Evidence – First Response and Digital Investigator

UNIT IV DATA ACQUISITION AND REPORT WRITING **9**

Data Acquisition – Finding Lost Files – Document Analysis – Case Management and Report Writing – Building a Forensics Workstation

UNIT V TOOLS AND CASE STUDIES **9**

Tools of the Digital Investigator - Licensing and Certification – Case Studies: E-mail Forensics – Web Forensics – Searching the Network – Excavating a Cloud – Mobile device Forensics.

TOTAL: 45 h

TEXT BOOKS:

1. Michael Graves, —Digital Archaeology: The Art and Science of Digital Forensics, Addison-Wesley Professional, 2014.

2. Darren R. Hayes, —Practical Guide to Computer Forensics Investigation, Pearson, 2015.

3. Albert J. Marcella and Frederic Guillossou, —Cyber Forensics: From Data to Digital Evidence —, Wiley, 2015.

REFERENCE BOOK:

1. Bill Nelson, Amelia Phillips and Christopher Steuart, —Guide to Computer Forensics and Investigations‖, Fourth Edition, Cengage, 2013.

Web Links:

https://nptel.ac.in/courses/106106129

https://www.techtarget.com/searchsecurity/definition/computer-forensics

COURSE OUTCOMES:

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Acquire knowledge on Forensic Investigative smart practices.	K3
CO2	Analyze the importance and need for smart practices in computer investigation.	K4
CO3	Analyze the ethical standards of the profession and apply those standards to all aspects of the study and practice of digital forensics.	K4
CO4	Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations.	K5
CO5	Describe web and mobile device forensics.	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	3	3	2	2	0	3	2	2	2	2	3	2
CO2	3	3	3	3	2	2	0	3	2	2	2	2	3	2
CO3	3	3	3	3	2	2	1	3	2	2	2	2	3	2
CO4	3	3	3	3	2	2	0	3	2	2	2	2	3	2
CO5	2	3	3	3	2	2	1	3	2	2	2	2	3	2
Average	**2.8**	**3**	**3**	**3**	**2**	**2**	**0.4**	**3**	**2**	**2**	**2**	**2**	**3**	**2**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**

			✔	✔

CSE	**DATA WAREHOUSING AND DATA MINING**	3	0	0	3

Course Objective:

✔ To introduce the concept of data warehousing with special emphasis on architecture and design.

✔ To introduce the concept of data mining with a detail coverage of basic tasks, metrics, issues, andimplication.

✔ To learn the core topics like classification, clustering and association rules.

UNIT I DATA WAREHOUSING **9**

Data warehousing Components:Data Warehouse Database**,** Sourcing, Acquisition, Cleanup and TransformationTool,Data Warehouse Administration and Management**, Information Delivery System** – Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

UNIT II BUSINESS ANALYSIS **9**

Reporting and Query tools and Applications – Tool Categories – The Need forApplications – Cognos Impromptu Online Analytical Processing (OLAP) – Need –Multidimensional Data Model – OLAP Guidelines –Multidimensional versusMultirelational OLAP – Categories of Tools – OLAP Tools and the Internet -Data CubeTechnology, From Data warehousing to Data Mining.

UNIT III DATA MINING **9**

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness ofPatterns – Classification ofData Mining Systems- comparison of classification and prediction methods – Data Mining Task Primitives –Integration of a Data Mining System with a Data Warehouse – Issues – DataPreprocessing.-, Mining Descriptive

Statistical Measures in Large Databases.

UNIT IV ASSOCIATION RULE MINING AND CLASSIFICATION **9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint BasedAssociation Mining – Classification and Prediction - BasicConcepts - Decision TreeInduction - Bayesian Classification – Rule Based Classification – ClassificationByBackpropagation – Support Vector Machines – Associative Classification – LazyLearners – Other Classification

Methods – Prediction

UNIT V CLUSTERING, APPLICATIONS AND TRENDS IN DATA MINING 9

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods –Hierarchical Methods - Density-Based Methods –GridBased Methods – Model-Based Clustering Methods –Clustering High Dimensional Data- Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.- Case Study.

TOTAL:45 h

TEXT BOOKS:

1. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMcGraw – Hill Edition,Tenth Reprint 2007.(I & II)
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", SecondEdition, Elsevier, 2007.(IIIto V)

REFERENCES:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction To Data Mining",Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory andPractice", Easter EconomyEdition, Prentice Hall of India, 2006.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter EconomyEdition, Prentice Hall of India,2006.
4. Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience, 2006.

Web Links:

W1:https://onlinecourses.nptel.ac.in/noc21_cs06/preview

Course Outcomes

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Apply the basic concepts of DBMS with datawarehousing and datamining	K3
CO2	Identify the datawarehouse components to build a data warehouse.	K3
CO3	Explain the functionalities and classifications of data mining systems	K5
CO5	Identify the issues and understand the integration of a data mining system with a datawarehouse	K3
CO5	Explain cluster analysis, outlier analysis and data mining applications	K5

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	1	1	2	2	2	2	3	2
CO2	2	3	3	3	3	2	1	1	2	2	2	2	3	2
CO3	3	3	3	3	3	2	1	1	2	2	2	2	3	2
CO4	3	3	3	3	3	2	1	1	2	2	2	2	3	2
CO5	2	3	3	3	3	2	1	1	2	2	2	2	3	2
	2.6	3	3	3	3	2	1	1	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

OCSE01	**E COMMERCE**	3	0	0	3

Course Objectives

- To understand the nature of e-Commerce and recognize the business impact and potential of e-Commerce
- To learn the technologies required to make e-Commerce viable.
- To know about the current drivers and inhibitors facing the business world in adopting and using e-Commerce

UNIT I Introduction **9**

Traditional commerce and Ecommerce - Categories of Electronic commerce – Business models – Revenue models – Business processes. Internet and WWW–role of WWW–value chains–strategic business – Revenue Strategy issues – Industry value chains - supply chain management–role of Ecommerce

UNIT II Infrastructure for E-Commerce **9**

Packet switched networks–Routing packets. TCP/IP protocol script: IP Addressing – Domain names – E-mail protocols. Internet utility programs–SGML,HTML and XML–web client and servers–Web client/server architecture– intranet and extranets – Public and private networks – Virtual private network

UNIT III Web Based Tools for E-Commerce **9**

Web server: Server computers –performance evaluation – Hardware architectures. Web server software feature sets–web server software and tools– Internet Utility programs – Data analysis software – Link checking utilities. web protocol–search engines–intelligent agents –EC software– webhosting–cost analysis

UNIT IV Security **9**

Computer security classification–copyright and Intellectual property–electronic commerce threats: Secrecy threats – Integrity threats – Necessity threats Encryption solutions. Protecting client computers–electronic payment systems– electronic cash–strategies for marketing–sales and promotion–cryptography – authentication

UNIT V Intelligent Agents **9**

Definition and capabilities–limitation of agents – History of software agents – Characteristics and

properties a of agents – Tele script Agent Language – safe-Tcl –security–web based marketing– search engines and Directory registration–online advertisements– Portables and info mechanics–website design issues.

TOTAL : -- 45 hours

Text Books:

T1 Ravi Kalakota, Andrew B. Whinston " Frontiers of Electronic Commerce",Pearson Education, 2008
T2 Gary PSchneider "Electronic commerce", Thomson learning & James TPeny Cambridge USA, 2001
T3 Manlyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2002.

Reference Books:

R1 Efraim TurvanJ.Lee, David Kug and Chung,"Electronic Commerce" Pearson EducationAsia2001.
R2 Brenda Kienew Ecommerce Business Prentice Hall,2001.

COURSE OUTCOMES

CO1:	Construct the implement various business models of E-Commerce	**K3**
CO2:	Develop a policy and regulatory issues in E-commerce	**K4**
CO3:	Evaluate the basic networking concepts	**K5**
CO4:	Make use of the web client server architecture	**K3**
CO5:	Develop and acquire knowledge on web server concepts and its performance evaluation	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO5	3	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔

Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✔	✔		✔	✔	

CSE	ETHICAL HACKING	3	0	0	3

Course Objectives

- To understand how intruders escalate privileges.
- To understand Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of Attacks and their protection mechanisms
- To learn about ethical laws and tests

UNIT I Ethical Hacking **9 hours**

Types of Data Stolen From the Organizations, Elements of Information Security, Authenticity and Non-Repudiation, Security Challenges, Effects of Hacking, Hacker – Types of Hacker, Ethical Hacker, Hacktivism - Role of Security and Penetration Tester, Penetration Testing Methodology, Networking & Computer Attacks – Malicious Software (Malware), Protection Against Malware, Intruder Attacks on Networks and Computers, Addressing Physical Security – Key Loggers and Back Doors

UNIT II Foot Printing and Social Engineering **9 hours**

Web Tools for Foot Printing, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Trojans & Backdoors, Virus & Worms, Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering – shoulder surfing, Dumpster Diving, Piggybacking

UNIT III Data Security **9 hours**

Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks, Wireless Hacking, Windows Hacking, Linux Hacking

UNIT IV Network Protection System & Hacking Web Servers **9 hours**

Routers, Firewall & Honeypots, IDS & IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Web Server, SQL Injection, Cross Site Scripting, Exploit Writing, Buffer Overflow, Reverse Engineering, Email Hacking, Incident Handling & Response, Bluetooth Hacking, Mobiles Phone Hacking

UNIT V Ethical Hacking Laws and Tests 9 hours

An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing

TOTAL : 45 hours

TEXT BOOKS:

T1: Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Network Defense", Second Edition, CENGAGE Learning, 2010.

REFERENCE BOOKS:

R1: Steven DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", CENGAGE Learning, 2009-11-01.

R2: Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series – Elsevier, August 4, 2011.

R3: Whitaker & Newman, " Penetration Testing and Network Defense" , Cisco Press, Indianapolis, IN, 2006

COURSE OUTCOMES

CO1:	Utilize the basics of ethical hacking, elements of Information Security, authenticity, non-repudiation and security challenges	K3
CO2:	Develop a acquire knowledge on Malicious Software (Malware), Protection Against Malware and Intruder Attacks on Computers	K4
CO3:	Evaluate the web tools for Foot Printing, Competitive Intelligence and Google Hacking.	K5
CO4:	Determine Proxy & Packet Filtering, Denial of Service, Sniffer, Social Engineering and shoulder surfing	K5
CO5:	Develop Analyze Attacks and enhance Physical Security, and Protection	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	-	3

CO 2	2	2	2	2	2	-	-	-	-	-	-	-	-	3
CO 3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO 4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO 5	2	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
□	□	□	□	□	□
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
□	□		□	□	

CSE	GAME PROGRAMMING	3	0	0	3

Course Objectives

- To provide an in-depth introduction to technologies and techniques currently used in the game industry
- To understand game design and development
- To understand the processes, mechanics, issues in game design, and game engine development
- To understand modeling, techniques, handling situations, and logic
- To build and then integrate technologies such as multimedia, artificial intelligence, and physics modeling into a cohesive, interactive game application.

UNIT I Introduction to Game Programming & Game engine architecture 9

Overview of game programming -Structure of a typical game team - game industry - game engine history -Real Time Game Architecture - Engine Support: Subsystem Start-Up and Shut-Down - Memory Management - Containers and Strings - Resource Management: File System, Resource Manager.

UNIT II Basics of 2D & 3D Graphics and Mathematics in Gaming & Rendering engine 9

2D Graphics: Sprites, Tiled Images and Backgrounds - 3D Graphics: 3D Graphics Pipeline, 3D Math, Coordinates and Coordinate Systems - Quaternion Mathematics - Transformations & Geometry - The Rendering Engine: Triangle Rasterization, The Rendering Pipeline

UNIT III Lighting and Texturing Effects in game environment 9

Ray Tracing - Lighting in Computer Graphics - Types of Light Sources - Light Models - Materials: Lambert Diffuse, Phong - Bump Mapping - Lighting Technique: Point Lights, Bloom - Shadows in Games: Real-Time Versus Preprocessed Shadows, Types of Shadows, Texture mapping techniques - Special Effects: Blurring, Particle Systems, Weapon Effects

UNIT IV Introduction to Artificial Intelligence in Game 9

Why Games for Artificial Intelligence - Why Artificial Intelligence for Games - Game AI Panorama: Methods (Computer) Perspective, End User (Human) Perspective, Player-Game Interaction Perspective.

UNIT V Solving search problems for Game move prediction and optimization using AI 9

Tree Search: Uninformed Search, Best-First Search, Minimax, Monte Carlo Tree Search - Evolutionary Algorithms - Supervised Learning: Artificial Neural Networks, Support Vector Machines.

TOTAL:45 h

TEXT BOOKS:

T1: Game Engine Architecture, 3rd Edition, Jason Gregory, A K Peters, 2019.
T2: Palmer G. Physics for game programmers. Berkeley: Apress; 2005
T3: Artificial Intelligence and Games, Georgios N. Yannakakis and Julian Togelius, January 26, 2018, Springer

REFERENCES:

R1: Sherrod A. Game Graphic Programming. Cengage Learning; 2008.
R2: McShaffry M. Game coding complete. Nelson Education; 2014
R3: Akenine-Mo, T., Haines, E. and Hoffman, N., 2018. Real-time rendering

Web Links:

L1: https://onlinecourses.nptel.ac.in/noc19_ge32/preview

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1: Understand the basics of Game Programming and Game Engine Architecture. 2
CO2: Develop 2D and 3D Images using Mathematical coordinates 4
CO3: Apply various Lighting and Texturing Effects in game environment. 3
CO4: Extend the Game Programming using Artificial Intelligence. 2
CO5: Solve search problems for Game move prediction and optimization using AI. 6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3	2	3	-	-	-	-	2	2	2
CO2	2	3	2	2	2	3	2	-	-	-	-	2	2	2
CO3	2	2	3	2	2	2	3	-	-	-	-	3	2	3
CO4	3	2	3	2	2	3	2	-	-	-	-	2	3	2
CO5	2	3	2	2	3	2	1	-	--	-	-	3	2	3

Average	**2.2**	**2.4**	**2.4**	**2**	**2.4**	**2.4**	**2.2**	**-**	**-**	**-**	**-**	**2.4**	**2.2**	**2.4**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	INFORMATION RETRIEVAL TECHNIQUES	3	0	0	3

COURSE OBJECTIVES

1. To understand the basics of information retrieval with pertinence to modeling
2. To understand various components of IR system
3. To understand machine learning techniques for text classification and clustering
4. To explore various IR applications.

UNIT I INTRODUCTION AND MODELING 9

Basic Concepts: Retrieval process – Architecture – Boolean retrieval; IR Models: Taxonomy and characterization of IR models – Classical IR models – Alternative algebraic models – Models for Browsing – Retrieval Evaluation: Performance evaluation.

UNIT II INDEXING AND QUERYING 9

Indexing: Inverted indices – Suffix trees – Suffix arrays – Compression; Querying: Query languages; Query Operations: Relevance feedback and query expansion – Automatic local and global analysis.

UNIT III SEARCHING 9

Searching: Sequential searching – Pattern matching; Searching the Web: Characteristizing the Web – Search engines – Browsing – Searching using hyperlinks.

UNIT IV CLASSIFICATION AND CLUSTERING 9

Text Classification: Naive Bayes; Vector Space Classification: Rocchio – k-Nearest Neighbour; Flat Clustering: K-Means – Model-based clustering – Hierarchical clustering – Matrix decompositions and latent semantic indexing.

UNIT V APPLICATIONS 9

XML Retrieval – Multimedia IR – Parallel and Distributed IR – Digital Libraries – Social Media Retrieval – Content-based Image Retrieval – Online Public Access Catalogs (OPACs).

Total Periods: 45

TEXT BOOKS

1. Ricardo Baeza Yates, BerthierRibeiroNeto, “Modern Information Retrieval: The Concepts and Technology behind Search”, ACM Press Books, 2nd Edition, 2011.

2. Christopher D Manning, PrabhakarRaghavan, HinrichSchutze, “Introduction to Information Retrieval”, Cambridge University Press, 1st South Asian Edition, 2008.

REFERENCES

1. Stefan Buttcher, Charles L A Clarke, Gordon V Cormack,“Information Retrieval – Implementing and Evaluating Search Engines”, The MIT Press, Cambridge, Massachusetts London, England, 2010.

2. Cheng Xiang Zhai, Sean Massung, “Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining”, ACM Books, 2016.

3. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, “Social Media Mining: An Introduction”, 1st Edition, Cambridge University Press, 2014.

4. VipinTyagi, “Content-Based Image Retrieval: Ideas, Influences, and Current Trends”, 1st Edition, Springer, 2017.

5. Marcia J Bates, “Understanding Information Retrieval Systems: Management, Types, and Standards”, CRC Press, 2012.

COURSE OUTCOMES

After the completion of this course, students will be able to:

1. Describe various IR modeling techniques (K3)

2. Identify and design the various components of an Information Retrieval system (K3)

3. Apply machine learning techniques to text classification and clustering for efficient Information Retrieval (K3)

4. Describe various IR applications (K2)

5. Apply IR evaluation metrics to measure the performance of IR systems (K3).

CO PO MAPPING

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
		K3	K4	K5	K5	K6	-	-	-	-	-	-	-	K5	K3
CO1	K3	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO2	K3	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO3	K3	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO4	K2	2	1	1	-	1	-	-	1	1	1	-	1	1	2
CO5	K3	3	2	2	-	1	-	-	1	1	1	-	1	2	3

Score		15	11	10	-	6	-	-	5	5	5	-	5	10	15
Course Mapping		3	3	2	-	2	-	-	1	1	1	-	1	2	3

CSE	**Internet of Things**	3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of IoT and its application sectors
- To understand M2M and IoT
- To understand and become proficient in IoT platforms
- To understand and apply IoT protocols appropriately
- To design and develop IoT based applications

UNIT I INTRODUCTION AND CONCEPTS OF IOT 9 hours

Introduction to IOT, definition and characteristics of IOT - Architecture of Internet of Things, Physical and logical design of IOT, IOT enabling technologies, IOT levels and deployment templates-Domain specific IOTs, home automation, cities, environment, Domain specific IOTs, Energy, retail, agriculture, industry, health and lifestyle

UNIT II IOT AND M2M COMMUNICATION 9 hours

M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture -ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IOT, IOT system management, need for IOT system management -SNMP, Network operator requirements, NETCONF-YANG, IOT system management with NETCONF-YANG, IoT Design methodology-case study on IOT system for Weather Monitoring

UNIT III IOT PLATFORMS 9 hours

Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors -Introduction to Arduino, Pi, Spark, Intel Galileo

UNIT IV IOTTECHNICAL STANDARDS AND PROTOCOLS s 9 hours

RF Protocols: RFID, NFC;IEEE 802.15.4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL) -CoAP,XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH -Architectural Considerations in Smart Object Networking

UNIT V DEVELOPING INTERNET OF THINGS 9 hours

IoT platforms design methodology, IoT Physical devices and endpoints -IoT Systems: Logical design using Python, IoT physical servers and cloud offerings (Cloud computing for IoT)

TOTAL: 45 hours

TEXT BOOKS:

T1: ArshdeepBahga, Vijay Madisetti, “Internet of Things, A Hands -on Approach”, 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7

T2: Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”,1st Edition2015,ISBN: 978-81-265-5686-1

T3: Michael Miller, “The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World”, First edition ,2015, Pearson, ISBN:978-93-325-5245-6

WEB LINKS:

1. https://archive.nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/108108098
3. https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects
4. https://tools.ietf.org/html/rfc7452
5. http://dret.net/lectures/iot-spring15/protocols
6. http://iot.intersog.com/blog/overview-of-iot-development-standards-and-frameworks

COURSE OUTCOMES:

CO1:	Apply IOT architecture at various application domains	K3
CO2:	Examine M2M Communication and architecture	K4
CO3:	Experiment with various IoT platforms	K3
CO4:	Utilize different standards and protocols	K3
CO5:	Construct Cloud computing for IoT	K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	3	3	3	2	-	3	2	2	2	2	3	2
CO2	1	3	3	3	3	2	-	3	2	2	2	2	3	2
CO3	1	3	3	3	3	2	1	3	2	2	2	2	3	2
CO4	1	3	3	3	3	2	-	3	2	2	2	2	3	2
CO5	2	3	3	3	3	2	1	3	2	2	2	2	3	2
	1.2	2.8	3	3	3	2	0.4	3	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		

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OCSE01	OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	0	3

Course Objective:

• To understand the system modelling and design based on requirements, converting design to code.

• To use various UML design diagrams and to apply the appropriate design patterns.

• To learn the basic Object oriented analysis and design skills through an elaborate case study.

• To apply the process of OOAD in software development.

UNIT I INTRODUCTION **9**

Introduction to OOAD – What is OOAD? – What is UML? An Overview of Object Oriented Systems Development - Object Basics – Object Oriented Systems Development Life Cycle: The Software Development Process – Building High-Quality Software – OOSD: A Use-Case Driven Approach - Use case Modeling - Relating Use cases: include,extend and generalization.

UNIT II OBJECT ORIENTED METHODOLOGIES **9**

Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns – Frameworks – Unified Approach – Unified Modeling Language: Static and dynamic model – UML diagrams - UML class diagram – Use case diagramUML dynamic modeling (Sequence diagram, Collaboration Diagram, State Diagram) - Activity Diagram –Implementation diagrams (Component diagram, Deployment diagram).

UNIT III OBJECT ORIENTED ANALYSIS **9**

Identifying use cases : Business object analysis –The unified approach- Business process modeling – Use case model– Developing effective documentation - Object Analysis Classification : Classifications theory – Approaches foridentifying classes – Noun phrase approach – Common class patterns approach – Use case driven approach –Classes, responsibilities and collaborators – Naming classes - Identifying Object relationships, Attributes and Methods:Associations – Super sub class relationship – A part of relationships (aggregation) – Class responsibility – Objectresponsibility.

UNIT IV OBJECT ORIENTED DESIGN **9**

Design Axioms: The object oriented design process – Design axioms – Corollaries – Design patterns – Designing Classes: The process - Class visibility – Refining attributes – Designing methods and protocols.

Access Layer: Object Storage and Object Interoperability: DBMS – Distributed databases and client server computing – Object relational systems – Multidatabase systems – Designing Access layer classes.

UNIT V SOFTWARE QUALITY AND USABILITY 9

View Layer : Designing Interface Objects : Designing view layer classes – Macro level , Micro level process – Purpose of a view layer interface – Prototyping the user interface- Software Quality Assurance: Quality Assurance Tests – Testing strategies – Impact of Object Orientation – Test Cases – Test Plan – Myer's Debugging Principles – System Usability and Measuring User Satisfaction : Usability Testing – User Satisfaction Test (Test Templates) – Mappingdesign to code.

TOTAL: 45 h

TEXT BOOKS:

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999.

2. Craig Larman,"Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and iterativedevelopment", Third Edition, Pearson Education,2005.

REFERENCE BOOKS:

1. Mike O'Docherty, "Object-Oriented Analysis & Design: Understanding System Development with UML 2.0", JohnWiley& Sons, 2005.

2. James W- Cooper, Addison-Wesley, "Java Design Patterns – A Tutorial", 2000.

COURSE OUTCOMES

CO1 Construct the Software Development Process. K6

CO2 Analyzeobject oriented design methodologies. K5

CO3 Use Attributes and Methods in use case driven approach K3

CO4 Design Object relational and Multidatabase systems. K6

CO5 Be Familiar with thetest Cases, test Plan and Myer's Debugging Principles K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	3	2	3	3	2	2	2	1	2	1
CO2	3	2	3	3	2	3	3	1	3	2	3	2	3	2
CO3	2	3	2	2	2	2	2	3	2	3	2	3	2	3
CO4	2	3	2	2	3	2	3	3	2	2	3	3	3	3

CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	2.6	2.4	2.4	2.6	2.4	2.8	2.6	2.4	2.4	2.6	2.4	2.6	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

	SOFT COMPUTING	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

1. To learn the basic concepts of Soft Computing
2. To study various Artificial Neural network architectures
3. To learn fuzzy sets, fuzzy logic and fuzzy inference system
4. To understand genetic algorithm for global optimization
5. To learn hybrids of neuro, fuzzy and genetic algorithm, and their applications.

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Introduction: Neural networks – Fuzzy logic – Genetic algorithm – Hybrid systems; Artificial Neural Network: Fundamental concepts – Evolution of neural networks – Basic modals of ANN – McCulloch and Pitts neuron – Linear separability – Hebb network.

UNIT II SUPERVISED, UNSUPERVISED, AND ASSOCIATIVE LEARNING NETWORKS 9

Supervised Learning Network: Perceptron networks – Adaptive linear neuron – Multiple adaptive linear neurons – Back propagation networks – Radial bias function network; Associative Memory Networks: Autoassociative memory network – Bidirectional associative memory – Hopfield networks; Unspervised Learning Networks: Hamming network – Kohonen neural network – Learning vector quantization – Adaptive resonance theory networks.

UNIT III FUZZY SYSTEMS 9

Introduction to fuzzy logic – Classical sets – Fuzzy sets – Fuzzy relations – Membership functions – Defuzzification methods – Fuzzy arithmetic – Fuzzy measures – Fuzzy rule base and approximate reasoning – Fuzzy decision making.

UNIT IV GENETIC ALGORITHMS 9

Genetic Algorithm and search space – General genetic algorithm – Operators – Stopping condition – Constraints – Classification – Genetic programming; Applications of genetic algorithm.

UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS 9

Neuro-Fuzzy hybrid systems – Genetic neuro hybrid systems – Genetic fuzzy hybrid and fuzzy genetic hybrid systems; Applications of Soft Computing: A fusion approach of multispectral images with SAR – Optimization of Traveling Salesman Problem using genetic algorithm – Soft computing based hybrid fuzzy controllers.

Total Periods: 45

COURSE OUTCOMES

Upon completion of this course, the students should be able to:

1. Understand various soft computing techniques (K2)
2. Design and develop different neural network algorithms (K3)
3. Analyse and apply fuzzy logic and fuzzy inference system (K3)
4. Solve problems using Genetic Algorithms (K3)
5. Apply various soft computing techniques for complex problems (K3).

TEXT BOOKS

1. S N Sivanandam, S N Deepa, “Principles of Soft Computing”, Wiley India, 2nd Edition, 2011.

2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2002.

REFERENCES

1. Kwang H Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.

2. George J Klir, Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1996.

3. James A Freeman, David M Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

4. S Rajasekaran, G A VijayalakshmiPai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.

5. N P Padhy, S P Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.

CO PO MAPPING

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	K 2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	K 3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	K	3	-	-	-	-	-	-	-	-	-	-	-	2	-

	3														
CO4	K 3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	K 3	3	3	3	-	2	-	-	-	-	-	-	-	3	-
Score		15	9	3	-	3	-	-	-	-	-	-	-	14	-
Course Mapping		3	3	3	-	2	-	-	-	-	-	-	-	3	-

CSE	SOFTWARE ENGINEERING	3	0	0	3

Course Objective:

• To understand the phases in a software project

• To understand the fundamental concepts of requirements engineering and Analysis Modeling.

• To understand the various software design methodologies

• To learn various testing and maintenance measures

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, PetriNets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V PROJECT MANAGEMENT **9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Total: 45h

TEXT BOOKS:

1. Roger S. Pressman, —Software Engineering – A Practitioner‟s Approach, Seventh Edition, Mc Graw-Hill International Edition, 2010.

2. Ian Sommerville, —Software Engineering, 9th Edition, Pearson Education Asia, 2011.

REFERENCE BOOKS:

1. Rajib Mall, —Fundamentals of Software Engineering‖, Third Edition, PHI Learning PrivateLimited, 2009.

2. Pankaj Jalote, —Software Engineering, A Precise Approach‖, Wiley India, 2010.

3. Kelkar S.A., —Software Engineering, Prentice Hall of India Pvt Ltd, 2007.

4. Stephen R.Schach, —Software Engineering, Tata McGraw-Hill Publishing Company Limited,2007.

Course Outcome Description Knowledge Level

CO1 Identify the key activities in managing a software project. K2

CO2 Compare different process models. K4

CO3 Apply systematic procedure for software design and deployment. K3

CO4 Compare and contrast the various testing and maintenance. K4

CO5 Manage project schedule, estimate project cost and effort required. K3

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2

CO1	3	3	2	2	2	2	3	3	2	2	2	1	2	1
CO2	2	2	3	2	3	3	3	1	3	2	3	2	3	3
CO3	3	2	2	2	2	2	1	3	3	3	2	3	2	3
CO4	2	3	3	2	3	2	3	3	2	2	3	3	3	3
CO5	2	3	3	2	3	3	3	3	3	3	3	3	3	3
Average	2.4	2.6	2.6	2	2.6	2.4	2.6	2.6	2.6	2.4	2.6	2.4	2.6	2.6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	SOFTWARE PROJECT MANAGEMENT	3	0	0	3

Course Objective:

• To understand the basic knowledge of software management principles.

• To familiarize in choosing an appropriate project development methodology and identifying project risks, monitoring and tracking project deadlines.

• To develop the capability to work in a team environment and be aware of different modes of communications.

UNIT I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT 9

Project Definition – Contract Management – Activities Covered by Software Project Management – Plans, Methods and Methodologies – Management – Objectives – Stakeholders – Requirement Specification – Management control – Activities Covered By Software Project Management – Overview Of Project Planning – Stepwise Project Planning.

UNIT II PROJECT EVALUATION 9

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques : Net Profit – Payback Period – Return on Investment – Net Present Value – Internal Rate of Return – Risk Evaluation : Identification and Ranking – Cost-benefit Analysis – Risk Profile Analysis – Using Decision Trees.

UNIT III ACTIVITY PLANNING 9

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning and Control.

UNIT IV MONITORING AND CONTROL 9

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting Project Back to Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT V MANAGING PEOPLE AND ORGANIZING TEAMS 9

Introduction – Understanding Behavior – Organizational Behaviour : a Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation– The Oldman – Hackman Job

Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health and Safety – Case Studies.

TOTAL : 45 h

TEXT BOOK:

1. Bob Hughes, Mikecotterell, “Software Project Management”, Third Edition, Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
2. Royce, “Software Project Management”, Pearson Education, 1999.
3. Jalote, “Software Project Manangement in Practive”, Pearson Education, 2002.

COURSE OUTCOMES

CO1:	Determine the Plans, Methods and Methodologies of Software project Management	**K5**
CO2:	Assess the project evaluation techniques based on cost and risk	**K5**
CO3:	Elaborate the Sequencing and Scheduling Activities & Hazards	**K6**
CO4:	Examine the Stages In Contract Placement	**K4**
CO5:	Organize people in team and develop decision making skills	**K3**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	-	-	-	1	-	-	-	2	3
CO2	3	2	2	3	3	-	-	-	1	-	-	-	2	3
CO3	3	3	3	3	3	-	-	-	1	-	-	-	2	3
CO4	3	3	2	3	3	-	-	-	1	-	-	-	2	3
CO5	2	2	3	3	3	-	-	-	1	-	-	-	2	3
	2.8	2.6	2.6	3	3	-	-	-	1	-	-	-	2	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/**	**Open book**

				Presentation	**test**
✔	✔	✔	✔	✔	

CSE	**SOFTWARE QUALITY ASSURANCE**	3	0	0	3

Course Objective:

- To understand the quality management processes and to distinguish between various activities of quality assurance, quality planning and quality control.
- To know the importance of standards in the quality management process and their impact on the final product.
- To understand the SQA processes from planning till execution.

UNIT I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9

The Role of SQA: Objectives – Benefits – Goals – Role – Process - SQA Plan : Need and Content of SQA Plan – SQA considerations – SQA people : Roles and Responsibilities of SQA People – Characteristics of Good SQA Engineer – Quality Management – Software Configuration Management : SCM Plan – Roles – Activities – Baselines – Requirement Phase – Implementation Phase.

UNIT II MANAGING SOFTWARE QUALITY 9

Managing Software Organizations: Commitment – Management System – Managing Software Quality: Measurement Criteria – Establishing a Software Quality Program – Estimating Software Quality – Removal Efficiency – Quality Goals and Plans – Tracking and Controlling Software Quality – Defect Prevention - Software Quality Assurance Management.

UNIT III SOFTWARE QUALITY ASSURANCE METRICS 9

Software Quality : Views – Measuring Quality – Criteria - Total Quality Management (TQM) : Principles – Cost – TQM Implementation Approaches – Ways of Improving Quality – Methods for Generating Ideas – Advantages – Barriers – Software Quality Metrics: Product Quality – In-Process – Maintenance quality – Software Quality Metrics Analysis.

UNIT IV SOFTWARE QUALITY PROGRAM 9

Software Quality Program Concepts – Establishment of a Software Quality Program: Tasks – Scope – Minimal Quality Assurance Effort – Quality Plan – Software Quality Assurance Planning: An Overview – Purpose & Scope: Management – Documentation – SPCM – Reviews and Audits – Validation, Verification and Testing – Problem Reporting.

UNIT V SOFTWARE QUALITY ASSURANCE STANDARDIZATION 9

Software Standards–ISO 9000 Quality System Standards : Process Model - Capability Maturity Model and the Role of SQA in Software Development Maturity – SEI CMM Level 5 –Comparison of ISO 9000 Model with SEI's CMM : Model Orientation – ISO 9000 Weaknesses – CMM Weaknesses - SPICE (Software Process Improvement and Capability Determination).

TOTAL : 45 h

TEXT BOOKS:

1. Mordechai Ben-Menachem / Garry S Marliss, "Software Quality", Vikas Publishing House, Pvt, Ltd., New Delhi.(UNIT III to V), 2007.

2. Watts S Humphrey, " Managing the Software Process", Pearson Education Inc. (UNIT I and II)

REFERENCE BOOKS:

1. Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition, Artech House Publishers 2007.

2. Nina S Godbole, "Software Quality Assurance: Principles and Practice", Alpha Science International, Ltd, 2004.

Course Outcomes

At the end of this course the students will be able to,

Course Outcome	**Description**	**Knowledge Level**
CO1	Identify the roles and responsibilities of SQA(software quality assurance)people	K3
CO2	Create and apply a software quality assurance plan for all software projects.	K5

CO3	Maintain appropriate metrics to measure and maintain quality	K6
CO4	Facilitate inspections, product reviews, walk-throughs, and audits.	K5
CO5	Discuss the roles of SQA in software development maturity models	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO2	2	3	3	3	3	3	3	1	2	2	2	2	3	2
CO3	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO4	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO5	2	3	3	3	2	3	3	1	2	2	2	2	3	2
Avg	2.6	3	3	3	2.8	3	3	1	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔	✔	

CSE	SOFTWARE TESTING	3	0	0	3

Course Objectives

- To learn the principles of validation testing, defect testing, system and component testing
- To understand the strategies for generating system test cases
- To understand the essential characteristics of tool used for test automation

UNIT I Introduction 9

Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.

UNIT II TEST CASE DESIGN **9**

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing –— Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing– cause effect graphing – error guessing - compatibility testing – user documentation testing – domain testing Using White–Box Approach to Test design – Test Adequacy Criteria –static testing vs. structural testing – code functional testing - Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.

UNIT III LEVELS OF TESTING **9**

The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests. The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing – defect bash elimination -System Testing – types of system testing - Acceptance testing –performance testing - Regression Testing – internationalization testing – ad-hoc testing -Alpha – Beta Tests – testing OO systems – usability and accessibility testing

UNIT IV TEST MANAGEMENT **9**

People and organizational issues in testing – organization structures for testing teams –testing services - Test Planning – Test Plan Components – Test Plan Attachments –Locating Test Items – test management – test process - Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the testspecialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V CONTROLLING AND MONITORING **9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation- Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – evaluating software quality – defect prevention – testing maturity Model.

TOTAL : -- 45 hours

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, " Software Testing – Principles and Practices", Pearson education, 2006.

2. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education,2008.

REFERENCE BOOKS:

1. Boris Beizer, "Software Testing Techniques", Second Edition, Dreamtech, 2003

2. Elfriede Dustin, "Effective Software Testing", First Edition, Pearson Education, 2003.

3. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill,

COURSE OUTCOMES

CO1:	Identify the defects by applying the testing principles	**K3**
CO2:	Develop test strategies and test cases to prioritize and execute them	**K6**
CO3:	Apply the testing techniques in an effective manner	**K3**
CO4:	Design and implement comprehensive test plans	**K6**
CO5:	Assess the various test metrics and measurements.	**K5**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO2	2	3	3	3	3	3	3	1	2	2	2	2	3	2
CO3	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO4	3	3	3	3	3	3	3	1	2	2	2	2	3	2
CO5	2	3	3	3	2	3	3	1	2	2	2	2	3	2
	2.6	3	3	3	2.8	3	3	1	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/**	**Open book**

				Presentation	**test**
✔	✔	✔	✔	✔	

CSE	**SYSTEM SOFTWARE**	3	0	0	3

Course Objectives

- To understand the relationship between system software and machine architecture.
- To know the design and implementation of assemblers, linkers and loaders.
- To understand the macroprocessors, system software tools and internal working of hardware and software interface of a typical system.

UNIT I INTRODUCTION **9**

System software and machine architecture – The Simplified Instructional Computer (SIC) Machine architecture: Memory- Registers-Data and instruction formats - addressing modes -instruction sets – Input / Output – SIC/XE Machine Architecture: Memory-Registers- Data and instruction formats - addressing modes -instruction sets – Input / Output – Programming examples.

UNIT II ASSEMBLERS **8**

Basic assembler functions : A simple SIC assembler – Assembler algorithm and data structures - Machine dependent assembler features : Instruction formats and addressing modes – Program relocation - Machine independent assembler features : Literals –Symbol-defining statements – Expressions – Assembler Design Options : One pass assemblers and Multi pass assemblers - Implementation example : MASM assembler.

UNIT III LOADERS AND LINKERS **8**

Basic loader functions: Design of an Absolute Loader – A Simple Bootstrap Loader -Machine dependent loader features: Relocation – Program Linking – Algorithm and Data Structures for a Linking Loader - Machineindependent loader features: Automatic Library Search – Loader Options - Loader design options: Linkage Editors - Dynamic Linking – Bootstrap Loaders.

UNIT IV MACRO PROCESSORS & VIRTUAL MACHINES **10**

Basic macro processor functions : Macro Definition and Expansion – Macro Processor Algorithm and data structures - Machine-Independent Macro Processor Features : Concatenation of Macro Parameters – Generation of Unique Labels – Conditional Macro Expansion – Keyword Macro Parameters - Macro within Macro - Implementation example : MASM Macro Processor - Introduction to Virtual Machines (VM) – Computer Architecture- Virtual machine basics – Process virtual machines – System virtual machines

UNIT V SYSTEM SOFTWARE TOOLS **10**

Database Management Systems : Basic concept of a DBMS – Levels of Data Description – Use of a DBMS - Text editors : Overview of the Editing Process - User Interface – Editor Structure - Interactive debugging systems: Debugging functions and capabilities – Relationship with other parts of the system – User Interface Criteria- Instruction Set Issues – Profiling – Code optimization.

TOTAL: 45 hours

Text Books:

T1: Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson education Asia, 2006.

T2: John R. Levine, "Linkers & Loaders", Morgan Kauffman, 2003.

Reference Books:

R1: John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 2000.

R2: D. M. Dhamdhere, "Systems Programming and Operating Systems", Second Revised Edition, Tata McGraw Hill, 2000.

R3: John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2000.

R4: Srimanta Pal, " Systems Programming " , Oxford University Press, 2011.

COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Demonstrate the machine architecture of SIC and SIC/XE.

CO2: Identify the different assembler modes and features.

CO3: Analyse different loaders with various linkage methods.

CO4: Identify the functionalities of macro processing and analyse the virtual machine imeplementation.

CO5: Apply the basic concepts of data base management systems with programming coding standards.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	2	1	-	-	-	-	-	-	2	2	1
CO2	2	1	3	3	3	-	-	-	-	-	-	3	2	2
CO3	2	2	2	2	3	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	1	3	3	3
CO5	3	2	3	3	2	-	-	-	-	-	3	3	3	3
Average	**2.40**	**1.80**	**2.60**	**2.60**	**2.40**	-	-	-	-	-	**0.80**	**2.60**	**2.60**	**2.40**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**

			✔	✔

CSE	INTRODUCTION TO DATA ANALYTICS	3	0	0	3

Course Objectives

- To provide the knowledge and expertise to become a proficient data scientist
- To explore the fundamental concepts of big data & data analytics.
- To gain knowledge on Hadoop related tools such as MongoDB, Cassandra, Pig, and Hive for big data analytics

UNIT I Introduction to Big Data **9 hours**

Types of Digital Data-Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Non Definitional traits of Big Data – Business Intelligence vs. Big Data – Data warehouse and Hadoop environment – Coexistence.

UNIT II Big Data Analytics **9 hours**

Classification of analytics – Data Science – Terminologies in Big Data – CAP Theorem – BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL – SQL vs. NOSQL vs NewSQL

UNIT III Introduction to Hadoop **9 hours**

Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Interacting with Hadoop Eco systems

UNIT IV No SQL databases **9 hours**

Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

UNIT V Hadoop Eco systems **9 hours**

Hive – Architecture – data type – File format – HQL – SerDe – User defined functions – Pig: Features – Anatomy – Pig on Hadoop – Pig Philosophy – Pig Latin overview – Data types – Running pig – Execution modes of Pig – HDFS commands – Relational operators – Eval Functions – Complex data type – Piggy Bank – User defined Functions – Parameter substitution – Diagnostic operator

TOTAL : -- 45 hours

TEXT BOOKS:

T1: Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015

REFERENCE BOOKS:

R1: Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons, Inc., 2013.

R2: Tom White, “Hadoop: The Definitive Guide”, O’Reilly Publications, 2011.

R3: Kyle Banker, “Mongo DB in Action”, Manning Publications Company, 2012.

R4: Russell Bradberry, Eric Blow, “Practical Cassandra A developers Approach“, Pearson Education, 2014

COURSE OUTCOMES

CO1:	Identify the need of big data	K3
CO2:	Interpret basic concepts of data analytics	K5
CO3:	Analyze the framework for storing the data	K4
CO4:	Examine about NoSQL databases	K4
CO5:	Choose an appropriate framework to solve real world problems	K3

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	3	3	3	3	2	-	-	-	-	-	-	-	-	3
CO 2	2	2	2	2	2	-	-	-	-	-	-	-	-	3
CO 3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO 4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO 5	3	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔

Quiz	MCQ	Projects	Seminars	Demonstration/ Presentation	Open book test
✔	✔		✔	✔	

OCSE01	USER INTERFACE DESIGN	3	0	0	3

Course Objectives

- To gain knowledge about how to create a User Interface, how to use different type of controls, Menu usage.
- To learn different types and components, different methodologies used to implement User Interface and how to use multimedia, prototypes and analyzing different types of testing

UNIT I INTRODUCTION 9

Human Computer Interface – A brief History of Screen Design - Characteristics Of Graphics Interface – Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic of Web Interface Principles of User Interface Design

UNIT II HUMAN COMPUTER INTERACTION 9

User Interface Design Process – Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed–Business Functions and Requirement Analysis : Direct Methods and Indirect Methods – Basic Business Functions -Design Standards – System Training – Structures Of Menus – Functions Of Menus–Contents Of Menu– Formatting-Phrasing The Menu – Selecting Menu Choice–navigating Menus– Kinds of Graphical Menus.

UNIT III WINDOWS 9

Window Characteristics– Components– Presentation Styles– Types– Managements– Organizations– Operations– Web Systems– Device Based Controls Characteristics–Screen Based Controls Characteristics – Operate Control – Text Entry Controls – Selection Control–Combination Control– Custom Control– Presentation Control.

UNIT IV MULTIMEDIA 9

Text For Web Pages – Providing the Proper Feedback– Guidance & Assistance–International Consideration – Accessibility– Icons– Image– Multimedia – Coloring.

UNIT V WINDOWS LAYOUT– TEST 9

Prototypes – Kinds Of Tests – Analyze ,Modify and Retest – Evaluating the Working System - Information Search – Visualization –Hypermedia – Software Tools : Interface Design Tools,Software Testing Tools

TOTAL:45 h

TEXT BOOKS:

T1: Wilbent. O. Galitz ,"The Essential Guide To User Interface Design", John Wiley& Sons, 2007.

T2: Ben Sheiderman, "Design The User Interface", Pearson Education, 2008.

REFERENCES:

R1: Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd.,2002

Web Links:

L1: https://onlinecourses.nptel.ac.in/noc21_ar05/preview

L2: https://www.coursera.org/specializations/user-interface-design

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1: Identify the concept of Human Computer Interface and Direct Manipulation Graphical System.

CO2: Discuss User Interface Design Process, Obstacles andUsability

CO3: Compare Window Characteristics, Presentation Styles, Organizations andOperations.

CO4: Discuss International Consideration and Accessibility ofmultimedia

CO5: Analyze the concept of Visualization and Hypermedia

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	2	-	-	-	-	-	-	3	2	3
CO2	1	3	2	-	3	-	-	-	-	-	-	2	3	2
CO3	3	2	3	-	2	-	-	-	-	-	-	1	2	2
CO4	2	2	2	-	2	-	-	-	-	-	-	2	2	2
CO5	3	3	1	-	1	-	-	-	-	-	-	3	3	3
Average	**2.2**	**2.4**	**2.2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2.4**	**2.4**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration /**

				Presentation
			✔	✔

CSE	**VIRTUAL REALITY**	3	0	0	3

Course Objectives

- To understand geometric modeling and Virtual environment.
- To study about Virtual Hardwares and Softwares
- To develop Virtual Reality applications

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation – Virtual environments –requirement – benefits of virtual reality- Historical development of VR : Introduction-Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image.

UNIT II GEOMETRIC MODELLING 9

Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction – VR Systems.

UNIT III VIRTUAL ENVIRONMENT 9

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and nonlinear translation - shape & object inbetweening – free from deformation – particle system- Physical Simulation : Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT IV VR HARDWARES & SOFTWARES 9

Human factors : Introduction – the eye - the ear- the somatic senses - VR Hardware : Introduction – sensor hardware - Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT V VR APPLICATION 9

Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction.

TOTAL: 45 h

TEXT BOOK :

T1: John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

REFERENCE BOOKS:

R1: Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.

R2: Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.

R3: William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

Web Links:

L1: https://nptel.ac.in/courses/106106138

L2: www.vresources.org

L3: www.vrac.iastate.edu

L4: www.w3.org/MarkUp/VRML

COURSE OUTCOMES

At the end of this course the students will be able to,

CO1:Assess the concept of Virtual Reality, Virtual Environment and 3D Computer Graphics Shading algorithms

CO2:Explain Geometric Modelling Know ,Geometric Transformations and Generic VR system

CO3:Appraise the details of Physical Simulation in Virtual Environment

CO4:Explain Integrated VR systems, VR Software and VRML

CO5:Develop a Virtual Reality Applications with different modes of interaction

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	2	3	2	-	-	2	-	2	3	2
CO2	2	2	2	2	2	2	2	-	-	2	-	2	3	3
CO3	3	2	2	2	2	2	2	-	-	2	-	2	2	2
CO4	2	2	3	3	2	3	2	-	-	3	-	2	3	2
CO5	2	3	2	3	2	2	3	-	-	3	-	3	1	3

Average	**2.4**	**2.2**	**2.2**	**2.4**	**2**	**2.4**	**2.2**	**-**	**-**	**2.4**	**-**	**2.2**	**2.4**	**2.4**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	**AGILE METHODOLOGIES**	3	0	0	3

Course Objectives

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.
- To understand Agile development and testing.

UNIT I AGILE METHODOLOGY 9 Hours

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES 9 Hours

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9 Hours

Agile Information Systems – Agile Decision Making - Earl‘S Schools of KM – Institutional Knowledge

Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9 Hours

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE 9 Hours

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

TOTAL : -- 45 Hours

Text Books:

T2: David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
T3: Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

Reference Books:

R4: Craig Larman, "Agile and Iterative Development: A Manager's Guide", Addison-Wesley, 2004.
R5: Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.

Web Links:

11. https://www.guru99.com/scrum-testing-beginner-guide.html
12. https://www.inflectra.com/Ideas/Whitepaper/Introduction%20to%20Agile%20Development%20Methods.aspx

COURSE OUTCOMES

CO1:	Realize the importance of interacting with business stakeholders in determining the requirements for a software system	**K4**

CO2:	Perform iterative software development processes: how to plan them, how to execute them.	**K3**
CO3:	Point out the impact of social aspects on software development success	**K1**
CO4:	Develop techniques and tools for improving team collaboration and software quality.	**K6**
CO5:	Perform Software process improvement as an ongoing task for development teams.	**K3**

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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	2	3	2	3	3	-	-	-	-	-	-	-	-	3
CO5	1	2	3	3	3	-	-	-	-	-	-	-	-	3
	2.4	2.6	2.6	3	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	**√**
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
√	**√**		**√**	**√**	**√**

CSE	INFORMATION SECURITY	3	0	0	3

Course Objective:

- To understand the basics of Information Security and to know the legal, ethical and professional issues in Information Security.
- To know the aspects of risk management and to become aware of various standards and the technological aspects of Information Security.

UNIT I INTRODUCTION **9**

Information security: Definition, History, Critical Characteristics of Information-NSTISSC Security Model-Components of an Information System- Securing the Components-Balancing Security and Access-The System Development Life Cycle- The Security System Development Life Cycle

UNIT II SECURITY INVESTIGATION **9**

Need for Security- Business Needs: protecting the functionality of an organization, enabling the safe operation of an application, protecting the data that organization collects and use, safeguarding technology assets in organization- Threats-Attacks- Legal, Ethical and Professional Issues: Law and ethics in Information security, relevant U.S Laws, International laws and legal bodies, ethics and information security, codes of ethics and professional organization.

UNIT III SECURITY ANALYSIS **9**

Risk Management: Introduction- Risk Identification: plan and organize the process, asset identification and inventory, classifying and prioritizing information assets, information assets valuation, identifying and prioritizing threats, vulnerability identification and Assessing Risk, Assessing and Controlling Risk

UNIT IV LOGICAL DESIGN **9**

Blueprint for Security- Information Security Policy, Standards and Practices- ISO17799/BS 7799-NIST Models-VISA International Security Model- Design of Security Architecture- Planning for Continuity: Business impact analysis, incident response planning, disaster recovery planning, business continuity planning, crisis management, model for a consolidated contingency plan, law enforcement involvement.

UNIT V PHYSICAL DESIGN 9

Security Technology- IDS- Scanning and Analysis Tools-Cryptography: Foundation of cryptology, cipher methods, cryptographic algorithms, cryptographic tools, protocols for secure communications, attacks on cryptosystems- Access Control Devices- Physical Security-Security and Personnel

TOTAL: 45h

TEXT BOOK:

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

REFERENCE BOOKS:

1. Micki Krause, Harold F. Tipton, “ Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.

2. Stuart Mc Clure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw- Hill, 2003

3. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002

Web Links:
http://web.cse.ohio-state.edu/~champion.17/4471/
https://slideplayer.com/slide/4409575/

COURSE OUTCOMES:

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Discuss the development Life Cycle and components of the information security system	K6
CO2	Assess the protection of functionalities in an organization with Ethical and Professional Issues	K5
CO3	Examine the information assets Risk Assessment and Controlling of Risk	K4
CO4	Evaluate the Standards and Practices of various security models with Planning for Continuity	K5
CO5	Elaborate Scanning and Analysis Tools and cryptographic	K6

	algorithms	

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	3	3	2	-	3	2	2	2	2	3	2
CO2	3	3	3	3	3	2	-	3	2	2	2	2	3	2
CO3	3	3	3	3	3	2	1	3	2	2	2	2	3	2
CO4	3	3	3	3	3	2	-	3	2	2	2	2	3	2
CO5	2	3	3	3	3	2	1	3	2	2	2	2	3	2
Average	**2.8**	**3**	**3**	**3**	**3**	**2**	**0.4**	**3**	**2**	**2**	**2**	**2**	**3**	**2**

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

OCSE01	**SOFTWARE DEFINED NETWORKS**	3	0	0	3

Course Objectives

- To learn about the use and application of SDN in Data centers
- To understand the separation of the data plane and the control plane

UNIT I INTRODUCTION **9 hours**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes

UNIT II OPEN FLOW & SDN CONTROLLERS **9 hours**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

UNIT III DATA CENTERS **9 hours**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network –

VLANs – EVPN – VxLAN – NVGRE

UNIT IV SDN PROGRAMMING **9 hours**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

UNIT V SDN **9 hours**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

TOTAL : -- 45 hours

Text Books:

1. Thomas D. Nadeau, Ken Gray, —SDN: Software Defined Networks, O'Reilly Media, 2013.
2. Paul Goransson and Chuck Black, —Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.

Reference Books:

1. Siamak Azodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, —SDN and Open Flow for Beginners, Amazon Digital Services, Inc., 2013.

Web Links:

13. https://opennetworking.org/wp-N_ARCH_1.0_06062014.pdfOnline
14. https://www.ciena.com/insights/what-is/What-Is-SDN.html

COURSE OUTCOMES

CO1:	Integrating the conventional networking approaches with SDN	K3
CO2:	Articulate the design of open flow specification of SDN via Hypervisor	K3
CO3:	Hypothesizing the Virtualized Multitenant Data Center SDN and VxLAN	K5
CO4:	Implementing the Composition of SDNs in python programming	K3
CO5:	Mind mapping the view of IETF SDN Framework and Data Center Orchestration	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**

CO1	3	2	3	2	3	-	-	-	1	1	2	1	2	2
CO2	3	2	2	2	2	-	-	-	1	1	2	1	2	2
CO3	2	2	2	2	3	-	-	-	1	1	2	1	2	2
CO4	2	2	2	2	2	-	-	-	1	1	2	1	2	2
CO5	2	2	3	2	3	-	-	-	1	1	2	1	2	2
	2.4	2	2.4	2	2.6	-	-	-	1	1	2	1	2	2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔			✔		

OCSE01	**APPLICATIONS OF AI**	3	0	0	3

Course Objectives

- To give deep knowledge of AI and how AI can be applied in various fields to make the life easy

UNIT I **9hours**

Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

UNIT II **9hours**

Emotion Recognition using human face and body language, AI based system to predict the diseases

early, Smart Investment analysis, AI in Sales and Customer Support

UNIT III **9hours**

Robotic Processes Automation for supply chain management.

UNIT IV **9 hours**

AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology & Security using AI.

UNIT V **9hours**

Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Block chain and AI.

TOTAL :45 hours

Text Books:

T1: Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.

T2: Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published July 2018.

T3: Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, published March 2017.

T4: Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

Reference Books:

R6: Somogyi, Zoltán. The Application of Artificial Intelligence: Step-by-Step Guide from Beginner to Expert. Switzerland, Springer International Publishing, 2022.

R7: Artificial Intelligence Applications in Information and CommunicationTechnologies. Germany, Springer International Publishing, 2015.

COURSE OUTCOMES

CO1:	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	K 3
CO2:	To apply the Basic Concepts of Machine Learning	K4
CO3:	To build various machine learning algorithms using Linear models	K5
CO4:	To apply ML techniques to application and evaluate the models	K4
CO5:	Apply basic principles of AI and ML in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	-	2	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	2	3
CO4	3	3	2	2	3	-	-	-	-	-	-	-	2	3
CO5	2	2	3	2	3	-	-	-	-	-	-	-	2	3
	2.8	2.6	2.6	2.2	2.4	-	-	-	-	-	-	-	2	3

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

PEC	QUANTUM COMPUTING	3	0	0	3

COURSE OBJECTIVES:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS **9**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superpositions

UNIT II QUANTUM GATES AND CIRCUITS **9**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

UNIT III QUANTUM ALGORITHMS **9**

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

UNIT IV QUANTUM INFORMATION THEORY **9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT V QUANTUM CRYPTOGRAPHY **9**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

TOTAL : 45 hours

COURSE OUTCOME:

CO1:	Understand the basics of quantum computing.	K3
CO2:	Understand the background of Quantum Mechanics.	K5
CO3:	Analyze the computation models.	K4
CO4:	Model the circuits using quantum computation. environments and frameworks.	K6
CO5:	Understand the quantum operations such as noise and error–correction.	K5

TEXTBOOKS:

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).

2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information",Tenth Edition, Cambridge University Press, 2010.

3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.

2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	2	1	3	2	1	1
CO2	3	3	1	2	3	-		-	2	3	2	3	1	2
CO3	3	3	1	2	3	-		-	1	2	2	3	2	2
CO4	3	2	1	2	3	-		-	2	3	2	3	3	2
CO5	3	2	1	2	2	-		-	3	3	2	3	3	3
AVG	1.8	2.4	1.6	1.4	1.4	0	0	0	2	2.4	1.6	1.6	2.2	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**GREEN COMPUTING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To examine the power management in computing devices.
- To emphasize skill in energy saving practices in their use of hardware.
- To explore the technology tools that can reduce paper waste and carbon footprint.
- To understand how to minimize equipment disposal requirements.

UNIT I INTRODUCTION 9

Reputation as Motivation-Avoiding Green wash-Green Recruiting and Retention-Money saving efforts-Implementing Energy Efficiency-Current Devices –Digitizing NON-IT Functions.

UNIT II GREEN COMPUTING ENVIRONMENT 9

Environmental Drivers-Green Agenda-Roots of Environmentalism-Environmentalism and IT-Imperative of Climate Change-Go Green-A New vision of Computing-Efficiency and cloud Computing-Green ability-responsibility-usability-the Zen of green computing

UNIT III GREEN DEVICES 9

Device purchases-Dimension of Device pyramid greenness-Green computing-Embodied Energy-Device Green-Supplier Green-Buying principles-Desktop computers-Laptops.

UNIT IV GREEN DATACENTERS 9

Green Data Centers – Model - Power supply considerations – servers – storage - networking - datacenter suppliers - saving Energy-Cost Savings -Risk Reduction - Carbon Footprint Reduction-Focusing on solar power.

UNIT V FUTURE AND REDUCTION OF GREEN HOUSE GAS AND RESOURCE USAGE 9

Sources and sinks of greenhouse gases and Warming-Planned Obsolescence and Resource Use-Deep Green Computing.

TOTAL HOURS-45

TEXT BOOKS:

1. Bud E. Smith,"Green Computing: Tools and Techniques for Saving Energy, Money, and Resources",CRC Press,1st Edition,ISBN:9781466503410,2014

REFERENCES: 1. Wu Chun Fang, "Green computing Book", CRC Press,1st Edition, ISBN:9781439819876, 2014. 2. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff/IBM rebook, 2011.ISBN-13: 978-0470587522

COURSE OUTCOMES:

After completion of the course, students will be able to
CO1: Describe the resources pertaining to greenhouse gases and warming.
CO2: Develop energy efficient computing applications.
CO3: Analyze the consumption of power in data centers.
CO4: Evaluate deep green computing use in relation to environmental perspectives.
CO5: Discuss how the choice of hardware and software can facilitate a more sustainable operation.

Mapping Of Course Outcomes to Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**
CO1	1	3	1	1	1	-		-	2	1	3	2	1	1
CO2	3	3	2	2	3	-		-	2	3	2	2	1	2
CO3	3	3	2	2	3	-		-	1	2	2	1	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	3	2
CO5	3	2	2	2	2	-		-	3	3	2	3	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	2	2.2	1.6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**CLOUD SECURITY**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the basics of cloud computing and security.
- To improve the cloud security issues and architectures.
- To understand the data security and data storage in cloud.
- To acquire knowledge on threats, risks, vulnerabilities in cloud.
- To explore the structure of information security.

UNIT I INTRODUCTION TO CLOUD COMPUTING AND SECURITY 9

Understanding Cloud Computing - The IT Foundation for Cloud –Cloud Computing Architecture - Cloud Reference Architecture - Control over Security in the Cloud Model - Cloud Deployment - Services Models – Cloud creation and Key examples – Real – world Cloud Usage Scenarios.

UNIT II SECURITY RISK ISSUES ANDARCHITECTURE 9

Cloud Computing: Security Concerns – Assessing Your Risk Tolerance in Cloud Computing - Legal and Regulatory Issues - Security Requirements for the Architecture – Security Patterns and Architectural Elements-Cloud Security Architecture – Planning Key Strategies for Secure Operation.

UNIT III SECURING THE CLOUD: DATASECURITY 9

Overview of Data Security in Cloud Computing - Data Encryption: Applications and Limits - Cloud Data Security: Sensitive Data Categorization - Cloud Data Storage – Cloud Lock – in – Securing the Cloud: Key Strategies and Best Practices- Overview of Security Controls- The Limits of Security Controls-Security Monitoring.

UNIT IV SECURITY CRITERIA: BUILDING AN INTERNAL CLOUD 9

Private Clouds: Motivation and Overview - Security Criteria for Ensuring a Private Cloud-Security Criteria: Selecting an External Cloud Provider-Selecting a CSP: Overview of Assurance - Overview of Risks-Security Criteria.

UNIT V EVALUATING CLOUD SECURITY: AN INFORMATION SECURITY FRAMEWORK 9

Evaluating Cloud Security - Checklists for Evaluating Cloud Security- Metrics for the Check lists - Operating a Cloud - From Architecture to Efficient and Secure Operations - Security Operations Activities

TOTAL HOURS – 45

TEXT BOOKS:

1. Winkler, VicJR. “Securing the Cloud: Cloud computer Security techniques and tactics”, Netherlands, First edition, 2011.

2. Cope, Robert, et al. Cloud Computing Design Patterns. United Kingdom, Pearson Education, Netherlands, Second edition, 2015.

REFERENCES:

1. Mather, Tim, Subra Kumaraswamy, and Shahed Latif, “Cloud security and privacy: an enterprise perspective on risks and compliance”, O'Reilly Media, Inc.", California, First edition, 2009.
2. Krutz, Ronald L., and Russell Dean Vines, “Cloud security: A comprehensive guide to secure cloud computing”, Wiley Publishing, New Jersey, First edition, 2010.

COURSE OUTCOMES:

After completion of the course, students should be able to
CO1: Illustrate the basics of cloud computing architectures.
CO2: Describe cloud security architecture, challenges and requirements.
CO3: Explain the data security in cloud computing.
CO4: Identify the best practices and strategies for a secure cloud environment.
CO5: Demonstrate the efficient and secure operations in cloud computing.

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	2	1	3	1	1	1
CO2	3	3	2	2	3	-		-	2	3	2	2	1	2
CO3	3	3	2	2	3	-		-	1	2	2	2	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	3	2
CO5	3	2	2	2	2	-		-	3	3	2	2	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	1.4	2.2	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/**	**Open book**

				Presentation	test
✔	✔		✔	✔	

PEC	WEB ANALYTICS AND SOCIAL MEDIA MINING	3	0	0	3

COURSE OBJECTIVES:

- To comprehend the web analytics tools and its behaviour.
- To study the Facebook APIs and the extraction process.
- To learn the clustering of LinkedIn contacts and Google+.
- To explore mining strategies for web page content mining.
- To learn the contents of GitHub and generate interest graphs.

UNIT I MINING TWITTER AND FACEBOOK 9

Twitter Terminologies, Twitter API connectivity, Exploring trending topics, Searching for tweets, Extraction and frequency analysis, Examining patterns, Visualization, Facebook social graph API, Open graph protocol, Analyzing facebook pages, Examining friendships.

UNIT II MINING LINKED IN AND GOOGLE+ 9

Making LinkedIn API Requests, Downloading LinkedIn Connections, User Experiences and clustering, Measuring Similarity, Clustering Algorithms, Exploring the Google+ API, Term Frequency and Inverse Document Frequency, Natural Language Tool kit, Finding Similar Documents, Analyzing Bigrams in HumanLanguage.

UNIT III MININGWEBPAGES 9

Scraping, Parsing,and Crawling the Web, Breadth – First Search in Web Crawling, Discovering Semantics by Decoding Syntax, Sentence Detection in Human Language Data, Document Summarization, Entity-Centric Analysis, Quality of Analytics for Processing Human Language Data.

UNIT IV MININGMAILBOXES 9

Unix Mailboxes, Getting the Enron Data, Converting a Mail Corpus to a Unix Mailbox, Converting Unix Mailboxes to JSON, JSONified Mail Corpus into MongoDB, Accessing MongoDB with Python, Analyzing the Enron Corpus, Discovering and VisualizingTime – Series Trends, Analyzing Your Own Mail Data.

UNIT V MININGGITHUB 9

Creating a GitHub API Connection, Making Git Hub API Requests, Modeling Data with Property Graphs, Seeding an InterestGraph, Computing Graph Centrality Measures, Extending the Interest Graphwith “Follows” Edges for Users, Using Nodes as Pivots for More Efficient Queries, Visualizing Interest Graphs, Case Study.

TOTAL HOURS – 45

TEXT BOOKS AND REFERENCES:

1. Matthew A Russell, “Mining the Social Web”, O′Reilly Publications, 2nd edition, ISBN-13: 978-1449367619, 2013.

2. Reza Zafarani, “Social Media Mining”, Cambridge University Press, ISBN-13: 978-1107512818, 2015.
3. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Sybex Publication, 3rd revised edition edition, ISBN-13: 978- 1118168448, March 2012.

COURSE OUTCOMES:

After completion of the course, students should be able to
CO1: Use appropriate web analytics tool for social media analysis.
CO2: Analyze Facebook and its contents and discover patterns.
CO3: Construct a clustering model to explore LinkedIn and Google+ connectivity patterns and user groups.
CO4: Formulate mining strategies to perform content mining on web pages.
CO5:Interpret the interest graphs generated by mining the contents of GITHUB

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	2	1	3	1	1	1
CO2	3	3	2	2	3	-		-	2	3	2	2	2	2
CO3	3	3	2	2	3	-		-	1	2	2	2	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	2	2
CO5	3	2	2	2	2	-		-	3	3	2	2	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	1.4	1.6	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	VIRTUALIZATION TECHNIQUES	3	0	0	3

COURSE OBJECTIVES:

- To comprehend the fundamentals of virtualization and the significance of it.
- To gain knowledge about the fundamentals needed to create virtual machines.
- To examine concern virtual machine instances leveraging platforms.
- To learn about optimal utilization of CPU and Memory for virtual machine.
- To expose the students to create and manage storage and network resources in a virtual machine.

UNIT I OVERVIEW OF VIRTUALIZATION 9

Describing Virtualization - Moore's Law - Importance of Virtualization –Types - Current Trends - Virtualization and Cloud Computing - Virtualization Software Operation - Virtualizing Servers - Virtualizing Desktops - Virtualizing Applications - Hypervisor - Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor - Resource Allocation - Current Hypervisors - VMware ESX - Microsoft Hyper V

UNIT II INTRODUCTION TO VIRTUAL MACHINES 9

Virtual Machine - Examining CPUs in a Virtual Machine - Examining Memory in a Virtual Machine - Examining Network Resources in a Virtual Machine - Examining Storage in a Virtual Machine - Working with Virtual Machines - Virtual Machine Clones - Templates - Snapshots - Containers.

UNIT III VIRTUAL MACHINE CREATION 9

Performing P2V Conversions - Investigating the Physical-to-Virtual Process - Hot and Cold Cloning - Loading the Environment - VMware Workstation Player - Loading Virtual Box - Building a new Virtual Machine.

UNIT IV MANAGING CPU AND MEMORY FOR VIRTUAL MACHINE 9

CPU Virtualization - Configuring VM CPU Options - Tuning Practices for VM CPUs - Choosing Multiple CPUs - Hyper-Threading - Memory Virtualization - Configuring VM Memory Options - Tuning Practices for VM Memory - Calculating Memory Overhead - Memory Optimizations.

UNIT V MANAGING STORAGE AND NETWORKING FOR A VIRTUAL MACHINE 9

Storage Virtualization – Configuring VM Storage Options - Tuning Practices for VM Storage - Network Virtualization - Configuring VM Network Options - Tuning Practices for Virtual Networks - Deploying Applications in a Virtual Environment- Designing Virtual Networks for Security- Securing Hypervisor.

TOTAL HOURS –45

TEXT BOOKS:

1. Matthew Portnoy, "Virtualization Essentials", Wiley, Second edition, ISBN : 9788126564668, 2016

REFERENCES:

1. Daniel Kusnetzky, "Virtualization: A Manager's Guide", O'Reilly Media, Illustrated, 9781449306458 2012.
2. Tom White, “Hadoop: The Definitive Guide Storage and Analysis at Internet Scale” O'Reilly Media Press, ISBN: 9781449311520, 2012. 3. Dave Shackleford, “Virtualization security Protecting Virtualized Environments”, Sybex Publishers, First Edition, ISBN : 978118288122, 2012.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the virtualization concepts and their role in elastic computing.

CO2: Articulate the main concepts, architecture, taxonomy, key technologies, strengths, and limitations of Virtualization.

CO3: Analyze different types of virtualizations with performance metrics.

CO4: Analyze the constraints and techniques in setting up virtualization through its enabling technologies.

CO5: Design virtualization infrastructure solutions and give recommendations based on the need.

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	2	1	3	3	1	1
CO2	3	3	2	2	3	-		-	2	3	2	3	2	2
CO3	3	3	2	2	3	-		-	1	2	2	3	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	2	2
CO5	3	2	2	2	2	-		-	3	3	2	2	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	2.4	1.6	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**

✔	✔		✔	✔	

PEC	**DISTRIBUTED COMPUTING**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the architecture of distributed computing and virtualization.
- To get familiar with various types of communication in distributed systems.
- To gain knowledge on naming and coordination schemes in distributed environment.
- To impart basics of various distributed consistency and replication models.
- To acquire understanding of fault tolerance and security mechanisms in distributed computing environment.

UNIT I DISTRIBUTED COMPUTING ARCHITECTURE 9

Design goals-Types of distributed system-Architecture styles-Middleware organization-System architecture -Threads-Virtualization.

UNIT II COMMUNICATIONS 9

Layered protocols-Types of communication-Remote procedure call-Message oriented communication-Multicast communication.

UNIT III NAMING AND CO-ORDINATION 9

Flat Naming-Structured Naming-Attribute-based Naming-Clock Synchronization Logical Clocks-Mutual Exclusion-Election Algorithms-Distributed event matching Gossip based coordination.

UNIT IV CONSISTENCY AND REPLICATION 9

Introduction-Data-Centric consistency models- Client-Centric consistency models-Replica Management-Consistency protocols-Caching and replication in web.

UNIT V FAULT TOLERANCE AND SECURITY 9

Failure Models-Process Resilience-Reliable Client-server Communication-Reliable Group Communication-Distributed Commit-Recovery-Security threats Cryptography-Secure Channel-Access control-Secure Naming-Security Management.

TOTAL HOURS –45

TEXT BOOKS AND REFERENCES:

1. Andrew S Tanenbaum, Maartenvan Steen, "Distributed Systems – Principles and Paradigms", 2nd Edition, Pearson Education, ISBN=1543057381, 2017.

2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, ISBN=8120313801,2008.

3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, ISBN=0321263545,2009.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Elucidate the organization of distributed systems and virtualization.

CO2: Describe various communication techniques employed in distributed computing environment.
CO3: Demonstrate the working of naming and coordination schemes in distributed computing systems.
CO4: Illustrate the functionalities of consistency and replication techniques.
CO5: Apply suitable fault tolerance and security mechanism in distributed application development.

Mapping Of Course Outcomes to Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**
CO1	1	3	1	1	1	-		-	2	1	3	1	1	1
CO2	3	3	2	2	3	-		-	2	3	2	2	2	2
CO3	3	3	2	2	3	-		-	1	2	2	2	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	2	2
CO5	3	2	2	2	2	-		-	3	3	2	2	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	1.4	1.6	1.6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**CYBER LAWS AND ETHICS**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the fundamentals of cyber security and the importance of securing information and systems..
- To explore the awareness about the various amendments and laws in IT.
- To expose the theoretical and practical aspects of cyber law
- To gain knowledge on Cyber security regulation and policy.
- To learn the importance of ethical values in digital age.

UNIT I CYBER SECURITY 9

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT II INFORMATION TECHNOLOGY ACT 9

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

UNIT III CYBER LAW AND RELATED LEGISLATION 9

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

UNIT IV CYBERSPACE AND THE LAW & CYBER FORENSICS 9

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

UNIT V CYBER ETHICS 9

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to BLOCKCHAIN Ethics.

TOTAL HOURS –45

REFERENCES:

1. Mark Grabowski, Eric P. Robinson, Cyber Law and Ethics: Regulation of the Connected,Taylor& Francis Publications, 1st Edition, July 2021.
2. Sushma Arora and Raman Arora, Cyber Crimes & Laws, Taxmann Publications, 4th Edition, 2021. 3. Richard A. Spinello, Cyber Ethics-Morality and Law in cyberspace‖, Jones and Bartlett Learning, 7th Edition, Jones and Bartlett Publishers, 2020.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Explain the concepts and assess various harmful acts in cyber space.
CO2: Develop skills of using IT ACT for solving practical problems.
CO3: Demonstrate a thorough understanding of cyber law and their scope and limitations.
CO4: Analyze the significance of cyber security policy and regulation.
CO5 Identify the importance of ethics in addressing the challenges.

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	2	1	3	1	1	1
CO2	3	3	2	2	3	-		-	2	3	2	2	2	2
CO3	3	3	2	2	3	-		-	1	2	2	2	2	2
CO4	3	2	2	2	3	-		-	2	3	2	2	2	2
CO5	3	2	2	2	2	-		-	3	3	2	2	3	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	2	2.4	1.6	1.4	1.6	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**OPEN-SOURCE TECHNOLOGIES**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the content and operation of free open-source software.
- To understand the principles of GNU/Linux and distributions.
- To acquire programming skills in Python.
- To provide knowledge on PostgreSQL
- To explore the programming languages like PHP and Perl.

UNIT I INTRODUCTION 9

The concept of software freedom – Modifications – consequences of the freedom of software – Free software before free software – The beginning -BSD,GNU –Free software licenses – Free software and public administrations.

UNIT II GNU LINUX 9

GNU/Linux – Introduction – Installation and File System hierarchy - General Overview – Kernel Mode and User Mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux .

UNIT III PROGRAMMINGLANGUAGUE- PYTHON 9

Introduction to Python – Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – UNITs – Classes and OOP – Execution Environment.

UNIT IV DATABASE – POSTGRESQL 9

Key Features of PostgreSQL - Environment Setup - Syntax - Data Types - Working with Databases - Basic operators , Expressions , Queries - Case Study.

UNIT V PHP AND PERL 9

Introduction to PHP – Programming in Web Environment – Variables – Constants – Data Type – Operators – Statements – Functions – Arrays OOP – String Manipulation and Regular Expression-Perl Backgrounder – Perl Overview – Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines, Packages and UNITs.

TOTAL HOURS –45

TEXT BOOKS:

1. Richard Petersen, “Linux: The Complete Reference”,, Sixth Edition 6thEdition,ISBN-13: 978-0071492478,ISBN-10: 007149247X,2016.

2. Sandeep Koranne, “Handbook of Open Source Tools”, Springer, ISBN-13: 978-1441977182, ISBN-10: 144197718X, 2011.

REFERENCES:

1. KY Cheung, “Scientific Database and Programming Examples Using PHP, MySQL, XML, MATLAB, Python, Perl Hardcover”, Xlibris Corporation, Import, 27 Sep 2011

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the open-source software and its license.

CO2: Illustrate the advanced concepts in Linux environment.

CO3: Implement basic python programs.

CO4: Write the database applications using PostgreSQL.

CO5: Develop web applications using PHP and Perl.

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	1	3	1	1	1	-		-	1	1	3	1	1	1
CO2	3	3	2	2	3	-		-	3	3	2	2	2	2
CO3	3	3	2	2	3	-		-	3	2	2	2	2	2
CO4	3	2	2	2	3	-		-	3	3	2	2	2	2
CO5	3	2	2	2	2	-		-	2	3	2	2	2	3
AVG	1.8	2.4	1.4	1.4	1.4	0	0	0	1.4	2.4	1.6	1.4	1.4	1.6

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PROFESSIONAL ELECTIVE COURSE (BLENDED)

CSE	**DATA EXPLORATION AND VISUALIZATION**	3	0	0	3

Course Objectives

- To understand the basics of Data Explorations and the concepts of Data visualization
- To explore and apply various data visualization techniques for a variety of tasks using R language

UNIT I INTRODUCTION TO DATA EXPLORATION 9 hours

Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9 hours

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatter plots and Resistant Lines – Transformations - Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data.

UNIT III BASICS OF DATA VISUALIZATION 9 hours

The Seven Stages of Visualizing Data - Getting Started with Processing - Mapping - Time Series - Connections and Correlations - Scatter plot Maps - Trees, Hierarchies, and Recursion - Networks and Graphs – Acquiring Data – Parsing Data

UNIT IV DATA EXPLORATION AND DATA VISUALIZATION IN R 9 hours

Introduction to R and Studio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data

UNIT V TECHNIQUES AND APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION IN R 9 hours

Basic Data Exploration Techniques – Basic Data Visualization Techniques - Visualizing Geographic Data with ggmap - R Markdown - Case Study – Wildfire Activity in the Western United States - Case Study – Single Family Residential Home and Rental Values

TOTAL : 45 hours

Text Books:

T4: Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.

T5: Visualizing Data: Exploring and Explaining Data with the processing Environment, O Reily Publications, 2007

T6: Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019

Reference Books:

R8: Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003

R9: Eric Pimple, Data Visualization and Exploration with R, Geo Spatial Training service, 2017

Web Links:

15. https://onlinecourses.nptel.ac.in/noc22_mg09/preview
16. www.geeksforgeeks.org/data-visualization-in-r/

COURSE OUTCOMES

CO1:	Demonstrate the basic of Data Exploration	**K3**
CO2:	Analyze the use of univariate and Multivariate Analysis for Data Exploration	**K4**
CO3:	Identify the various Data Visualization methods	**K2**
CO4:	Apply the concept of Data Visualization on various datasets	**K3**
CO5:	Apply the data visualization techniques using R language	**K3**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	-	-	-	-	-	-	-	-	1	3
CO2	3	2	3	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	1
CO4	2	3	3	3	3	-	-	-	-	-	-	-	3	1
CO5	3	3	2	3	3	-	-	-	-	-	-	-	3	3
AVG	2.6	2.6	2.6	2.4	2.4	-	-	-	-	-	-	-	2.6	2.2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

CSE	BIG DATA ANALYTICS	3	0	0	3

Course Objectives:

1. To understand the need of Hadoop framework to process the Big Data

2. Introduction to theoretical techniques and practical tools used in data analytics

3. Applications in various engineering and scientific domains.

UNIT I Introduction Big Data and Hadoop Framework 12 hours

Data Storage and Analysis - Characteristics of Big Data – Big Data Analytics - Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics –
Need of big data frameworks, Introduction to Hadoop ecosystems. Hadoop Framework: Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system - Hadoop Components –Hadoop Daemon's – Working with HDFS Commands

UNIT II Mapreduce Programming 6 hours

Map Reduce working principle, Map Reduce types and formats, MapReduce features, Combiner optimization,Map side join, Reduce SideJoin, Secondary sorting, Pipelining MapReduce jobs.

UNIT III R Programming 9 hours

History and overview of R , Install and configuration of R programming environment , Basic language elements and data structures, Data input/output, Data storage formats , Subsettingobjects.

UNIT IV Visualization Using R 6 hours

Vectorization, Control structures, Functions, Scoping Rules, Loop functions, R Graphs and visualization using lattice, ggplot2

UNIT VSpark Framework and Data Analysis Models 12 hours

Overview of Spark – Hadoop vs Spark – Cluster Design – ClusterManagement – performance,Application Programming interface(API): Spark Context, Resilient Distributed Datasets, Creating RDD,RDD Operations, Saving RDD - Lazy Operation – Spark Jobs-spark ML library.
Association and correlation analysis- regression models- Predictive analytics -Exploratory analysis. Prescriptive analysis.

Lab session: Recent Trends 2 hours

Projects may be given as group projects.

The project component should be taken as real time applications like e-commerce, social medial, streaming data and so on . The students should use the technologies learnt in theory to develop and implement the project.

Total Lecture Hours: **45 hours**

Text Book(s)

1. Garrett Grolemund, “Hands-On Programming with R” , O'Reilly Media, Inc, 2014.

2. Seema Acharya, SubhashiniChellapan, “Big Data and Analytics”, Wiley, 2015.

3. Mike Frampton, “Mastering Apache Spark”, Packt Publishing, 2015.

Reference Books

1. Nick Pentreath, Machine Learning with Spark, Packt Publishing, 2015.

2. Donald Miner, Adam Shook, “MapReduce Design Pattern”, O’Reilly, 2012

3. Raj Kamal, PreetiSaxena ,”Big Data Analytics:Introduction to Hadoop, Spark, and Machine-Learning”, McGraw-Hill Education, 2019.

Web links:

W1:https://nptel.ac.in/courses/106104189

W2: https://nptel.ac.in/courses/106106142

Course Outcomes

At the end of this course the students will be able to,

Course Outcome	Description	Knowledge Level
CO1	Discuss the challenges and their solutions in Big Data and work on Hadoop Framework	k1
CO2	Understand the concepts of R programming and its applications.	k2
CO3	Implement different statistical methods on sample data using R Programming library.	k5
CO4	Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark framework.	k4
CO5	Demonstrate spark programming with different programming languages	k5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	0	1	2	2	2	2	3	2
CO2	3	3	3	3	2	2	0	1	2	2	2	2	3	2

CO3	3	3	3	3	2	2	1	1	2	2	2	2	3	2
CO4	3	3	3	3	2	2	0	1	2	2	2	2	3	2
CO5	2	3	3	3	2	2	1	1	2	2	2	2	3	2
AVG	2.8	3	3	3	2	2	0.4	1	2	2	2	2	3	2

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

CSE	**NOSQL DATABASE**	3	0	0	3

Course Objectives

- To explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems
- To understand the architectures and common features of the main types of NoSQL databases (key-value stores, document databases, column-family stores, graph databases)
- To discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases

UNIT I NOSQL DATA ARCHITECTURE PATTERNS 12 hours

NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model- Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads, Database distributed queries to Data nodes.

UNIT II KEY VALUE DATA STORES 12 hours

From array to key value databases, Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Architecture and implementation Terms, Designing Structured Values, Limitations of Key- Value Databases, Design Patterns for Key-Value Databases, Case Study: Key-Value Databases for Mobile Application Configuration

UNIT III DOCUMENT ORIENTED DATABASE 12 hours

Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharding, Consistency Implementation: Distributed consistency, Eventual Consistency, Capped Collection, Case studies: document oriented database: Mongo DB and/or Cassandra

UNIT IV COLUMNAR DATA MODEL 12 hours

Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive Indexing and Database Cracking. Advanced techniques: Vectorized Processing, Compression, Write penalty, Operating Directly on Compressed Data Late Materialization Joins , Group-by, Aggregation and Arithmetic Operations, Case Studies

UNIT V DATA MODELING WITH GRAPH **12 hours**

Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection

TOTAL : -- 60 hours

Text Books:

T1 Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, An introduction to Information Retrieval, Cambridge University Press

T2 Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of Modern Column-Oriented Database Systems, Now Publishers.

Reference Books:

R1 Guy Harrison, Next Generation Database: NoSQL and big data, Apress

Web Links:

L1 https://www.mongodb.com/

L2 https://university.mongodb.com/

L3 https://www.ibm.com/cloud/learn/nosql-databases

L4 https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp

COURSE OUTCOMES

CO1:	Differentiate and identify right database models for real time applications	**K4**
CO2:	Outline Key value architecture and characteristics	**K2**
CO3:	Design Schema and implement CRUD operations, distributed data operations	**K6**
CO4:	Compare data ware housing schemas and implement various column store internals	**K4**
CO5:	Develop Application with Graph Data model	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	3	3	3	3	-	-	-	-	-	-	-	3	3
CO2	2	2	2	3	3	-	-	-	-	-	-	-	3	3

CO3	2	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	2	3	2	3	3	-	-	-	-	-	-	-	3	3
CO5	1	2	3	3	3	-	-	-	-	-	-	-	3	3
	1.8	2.6	2.6	3	3	-	-	-	-	-	-	-	3	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
√	**√**	**√**	**√**	**√**	**√**
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
√	**√**		**√**	**√**	**√**

	ROBOTICS AND ITS APPLICATION	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

1. To understand the basic concepts associated with the design, functioning, applications and social aspects of robots
2. To study about the electrical drive systems and sensors used in robotics for various applications
3. To learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector
4. To learn about various motion planning techniques and the associated control architecture
5. To understand the implications of AI and other trending concepts of robotics.

UNIT I FOUNDATION 9

Introduction – Brief history – Definition – Anatomy – Types – Classification – Specification and need based applications – Role and need of robots for the immediate problems of the society – Future of mankind and automation-ethical issues – Industrial scenario local and global – Case studies on mobile robot research platform and industrial serial arm manipulator.

UNIT II BUILDING BLOCKS OF A ROBOT 9

Types of electric motors : DC – Servo – Stepper; Specification – Drives for motors – Speed & direction control and circuitry – Selection criterion for actuators – Direct drives – Non-traditional actuators - Sensors for localization – Navigation – Obstacle avoidance and path planning in known and unknown environments – Optical – Inertial – Thermal – Chemical – Biosensor – Other common sensors – Case study on choice of sensors and actuators for maze solving robot and self driving cars.

UNIT III KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS 9

Robot kinematics – Geometric approach for 2R, 3R manipulators – homogenous transformation using D-H representation – Kinematics of WMR – Lagrangian formulation for 2R robot dynamics – Mechanical design aspects of a 2R manipulator, WMR – End-effector : Common types and design case study.

UNIT IV NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE 9

Mapping & Navigation – SLAM, Path planning for serial manipulators – Types of control architectures – Cartesian control – Force control and hybrid position/force control – Behaviour based control – Application of Neural network, fuzzy logic, optimization algorithms for navigation problems – Programming methodologies of a robot.

UNIT V AI AND OTHER RESEARCH TRENDS IN ROBOTICS 9

Application of Machine learning – AI – Expert systems – Tele-robotics and Virtual reality – Micro &Nanorobots – Unmanned vehicles – Cognitive robotics – Evolutionary robotics – Humanoids.

Total Periods: 45

COURSE OUTCOMES

After the completion of this course, students will be able to:

1. Understand the concepts of industrial robots(K2)
2. Examine different sensors and actuators for applications like maze solving and self driving cars (K2)
3. Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots (K3)
4. Understand the navigation and path planning techniques for robot motion planning (K2)
5. Undertstand the impact and progress of AI in the field of robotics (K2).

TEXT BOOKS

1. Saeed B Niku, “Introduction to Robotics, Analysis, System, Applications”, Pearson educations, 2002.
2. Roland Siegwart, Illah Reza Nourbakhsh, “Introduction to Autonomous Mobile Robots”, MIT Press, 2011.

REFERENCES

1. Richard David Klafter, Thomas A Chmielewski, Michael Negin, “Robotic engineering: An Integrated Approach”, Prentice Hall, 1989.
2. Craig, J J, “Introduction to Robotics: Mechanics and Control”, 2nd Edition, Addison-Wesley, 1989.

3. K S Fu, R C Gonzalez and C S G Lee, “Robotics: Control, Sensing, Vision and Intelligence”, McGraw-Hill, 1987.
4. Wesley E Snyder R, “Industrial Robots, Computer Interfacing and Control”, Prentice Hall International Edition, 1988.
5. Robin Murphy, “Introduction to AI Robotics”, MIT Press, 2000.

6. CO PO MAPPING

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	K2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	K2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	K3	3	2	-	-	-	-	-	-	-	-	-		3	-
CO4	K2	3	2	-	-	-	-	-	-	-	3	-	3	3	-
CO5	K2	3	2	-	-	-	-	-	-	-		-		3	3
Score		15	8	-	-	-	-	-	-	-	3	-	3	13	3
Course Mapping		3	2	-	-	-	-	-	-	-	3	-	3	3	3

CSE	**CONCEPTS OF VIRTUAL AND AUGMENTED REALITY**	3	0	0	3

Course Objectives

- To learn about the principles and multidisciplinary features of virtual reality.
- To study the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
- To teach students the technology for managing large scale VR environment framework development tools in real time.

UNIT I Virtual reality and virtual environments: **9 hours**

The historical development of VR, scientific landmarks computer graphics, real-time computer graphics, virtual environments, requirements for VR, benefits of virtual reality. Hardware technologies for 3D user interfaces: visual displays, auditory displays, hap tic displays, choosing output devices for 3D user interfaces.

UNIT II 3D user interface input hardware and Software technologies: **9 hours**

Input device characteristics, desktop input devices, tracking devices, 3d mice, special purpose input devices, direct human input, home - brewed input devices, choosing input devices for 3D interfaces. Software technologies: database - world space, world coordinate, world environment, objects - geometry, position / orientation, hierarchy, bounding volume, scripts and other attributes, VR environment - VR database, tessellated data, LODs, Cullers and Occluders, lights and cameras, scripts, VR toolkits, available software in the market.

UNIT III 3D interaction techniques: **9 hours**

3D manipulation tasks, interaction techniques for 3D manipulation, design guidelines – 3D travel tasks, travel techniques, design guidelines - theoretical foundations of wayfinding, user centered wayfinding support, environment centered wayfinding support, evaluating wayfinding aids, design guidelines - system control, classification, graphical menus, voice commands, Gestrual commands, tools, multimodal system control techniques, design guidelines.

UNIT IV Advances in 3D user interfaces: **9 hours**

3D user interfaces for the real world, AR interfaces as 3D data browsers, 3D augmented reality interfaces, augmented surfaces and tangible interfaces, agents in AR, transitional AR-VR interfaces - 3d interaction techniques, 3d UI design and development, 3D UI evaluation and other issues.

UNIT V Virtual reality applications: **9 hours**

Engineering, architecture, education, medicine, entertainment, science, training.

TOTAL : -- 45 hours

Text Books:

1. Paul Mealy, Virtual & Augmented Reality for Dummies, John Wiley & Sons.
2. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach".
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA

Web Links:

17. https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality
18. https://www.intel.com/content/www/us/en/tech-tips-and-tricks/virtual-reality-vs-augmented-reality.html

COURSE OUTCOMES

CO1:	Articulate the historical development of VR and design of visual displays.	K3
CO2:	Integrating the 3D user interface input hardware and Software technologies	K3
CO3:	Hypothesizing the interaction techniques for 3D manipulation, design guidelines	K5
CO4:	Implement the AR-VR interfaces in 3d UI interaction techniques	K3
CO5:	Mind mapping the view of Virtual reality applications in Engineering, architecture, entertainment.	K4

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	-	--	-	1	1	2	1	2	2
CO2	3	2	2	2	2	-	-	-	1	1	2	1	2	2
CO3	2	2	2	2	3	-	-	-	1	1	2	1	2	2
CO4	2	2	2	2	2	-	-	-	1	1	2	1	2	2
CO5	2	2	3	2	3	-	-	-	1	1	2	1	2	2

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
			✔		

CSE	DIGITAL IMAGE PROCESSING	3	0	0	3

Course Objective:

- Understand the digital image fundamentals.
- Improve their ability in image enhancement and restoration.
- Equip themselves with image segmentation and compression techniques
- Familiarize with the image representation and recognition
- Develop codes for various image processing techniques/applications using MATLAB Image Processing Toolbox

UNIT I: DIGITAL IMAGE FUNDAMENTALS **9**

Introduction -Origin – Fundamental Steps in Digital Image Processing – Components – Elements of Visual Perception -Image Sensing and Acquisition – Image Sampling and Quantization -Relationships between pixels -Introduction to Image processing toolbox in MATLAB

UNIT II: IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing -Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering -**Frequency Domain:** Basics of filtering **–** Smoothing and Sharpening frequency domain filters. -MATLAB code for histogram equalization, spatial and frequency domain filter.

UNIT III: IMAGE RESTORATION AND SEGMENTATION **9**

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Inverse Filtering – Wiener -**Segmentation:** Point, Line, and Edge Detection- Marr-Hildreth & Canny edge detector -–Edge Linking and Boundary detection Local & Regional processing – Region based segmentation -Morphological processing – Watershed segmentation algorithm. -MATLAB code for restoring an image after degradation using adaptive and wiener filter – Edge detection operators

UNIT IV: WAVELETS AND IMAGE COMPRESSION **9**

Wavelets – Sub band coding – Multi resolution expansions -**Compression:** Fundamentals – Image Compression methods – Huffman, Arithmetic coding -LZW coding, Run Length Encoding, Block Transform coding, Wavelet coding, JPEG standard. -MATLAB code for image compression: Huffman coding , Arithmetic coding, wavelet coding

UNIT V: IMAGE REPRESENTATION AND RECOGNITION **9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments - Boundary description – Shape number – Fourier Descriptor -Patterns and Pattern classes – Recognition based on matching -MATLAB code for image boundary segments, Fourier Descriptor, Recognition based on matching

TOTAL : 45 h

TEXT BOOK:

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

REFERENCE BOOKS:

1. Rafael C.Gonzalez, Richard E.Woods, Steven L. Eddins, “Digital Image Processing using Matlab”, Third Edition, Tata McGraw Hill Pvt. Ltd, 2011.

2. William K Pratt, Digital Image Processing, John Willey (2001).

Web Links:
L1: https://nptel.ac.in/courses/117105135

COURSE OUTCOMES:
At the end of this course the students will be able to,

Course	Description	Knowledge

Outcome		Level
CO1	Develop various algorithms for restoring an image after degradation.	K6
CO2	Apply image compression & segmentation	K3
CO3	Apply various coding techniques to perform image compression	K3
CO4	Design matlab code to perform histogram equalization in spatial and frequency domain	k6
CO5	Elaborate boundary segments and recognize based on matching	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	1	2	3	2	3	3	2
CO2	3	3	3	3	3	2	-	1	2	3	2	3	3	2
CO3	3	3	3	3	3	2	1	1	2	3	2	3	3	2
CO4	3	3	3	3	3	2	-	1	2	3	2	3	3	2
CO5	2	3	3	3	3	2	1	1	2	3	2	3	3	2
Average	**2.8**	**3**	**3**	**3**	**3**	**2**	**0.4**	**1**	**2**	**3**	**2**	**3**	**3**	**2**

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments
✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration / Presentation**
			✔	✔

OPEN ELLECTIVE COURSES

OCSE01	**Data Structures and Algorithms**	3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of data structures and algorithms.
- To differentiate linear and non-linear data structures and the operations upon them.
- To perform sorting and searching in a given set of data items.
- To comprehend the necessity of time complexity in algorithms.

UNIT I Introduction to Algorithms and Analysis 9 hours

Overview and importance of algorithms and data structures. Fundamentals of algorithm analysis, Space and time complexity of an algorithm, Types of asymptotic notations and orders of growth,

Algorithm efficiency – best case, worst case, average case, Analysis of non-recursive and recursive algorithm

UNIT II Linear Data Structures 9 hours

Array- 1D and 2D array, Stack - Applications of stack: Expression Evaluation - Conversion of Infix to postfix and prefix expression, Tower of Hanoi. Queue - Types of Queues: Circular Queue, Double Ended Queue (deQueue), Applications – Priority Queue using Arrays - List - Singly linked lists – Doubly linked lists - Circular linked lists

UNIT III Sorting and Search Techniques 9 hours

Searching - Linear Search and binary search, Applications - Finding square root of 'n'-Longest Common Prefix- Sorting – Insertion sort - Selection sort – Bubble sort – Quick sort- Merge sort, Analysis, Applications

UNIT IV Non-linear Data Structures 9 hours

Tree, Binary Tree – Terminology and Properties, Tree Traversals, Binary Search Trees – operations in BST – insertion, deletion, finding min and max, Applications - Graph – basic definition and Terminology – Representation of Graph – Graph Traversal: Breadth First Search (BFS), Depth First Search (DFS) - Minimum Spanning Tree: Prim's, Kruskal's Algorithm.

UNIT V Hashing and Balanced Binary Search Trees 9 hours

Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing, extendible hashing, Applications - AVL trees – Terminology - basic operations (rotation, insertion and deletion) - Recent trends in algorithms and data structures

TOTAL: 60 hours

TEXT BOOKS:

T3: Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

T4: Mark A. Weiss,Data Structures & Algorithm Analysis in C++, 3rd edition, 2008, PEARSON.

REFERENCE BOOKS:

R2: Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Sturctures, The Basic Toolbox, Springer-Verlag Berlin Heidelberg, 2008.

R3: Horowitz, Sahni, and S. Anderson-Freed, Fundamentals of Data Structures in C UNIVERSITIES PRESS,Second Edition,2008.

WEB LINKS:

2. https://nptel.ac.in/courses/106102064
3. https://archive.nptel.ac.in/courses/106/106/106106127/

COURSE OUTCOMES:

CO1:	Understand the fundamental analysis and compute time complexity for a given problem	K3
CO2:	Articulate linear data structures and perform various operations permitted on them	K2
CO3:	Design and applya suitable algorithm for searching and sorting problems	K6
CO4:	Develop an algorithm using non-linear data structures	K6
CO5:	Understand and apply appropriate hashing techniques to find solutions for practical problems	K6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

OCSE02	INTERNET OF THINGS	3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of IoT and its application sectors
- To understand M2M and IoT
- To understand and become proficient in IoT platforms
- To understand and apply IoT protocols appropriately
- To design and develop IoT based applications

UNIT I INTRODUCTION AND CONCEPTS OF IOT 9 hours

Introduction to IOT, definition and characteristics of IOT - Architecture of Internet of Things, Physical and logical design of IOT, IOT enabling technologies, IOT levels and deployment templates-Domain specific IOTs, home automation, cities, environment, Domain specific IOTs, Energy, retail, agriculture, industry, health and lifestyle

UNIT II IOT AND M2M COMMUNICATION 9 hours

M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture -ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IOT, IOT system management, need for IOT system management -SNMP, Network operator requirements, NETCONF-YANG, IOT system management with NETCONF-YANG, IoT Design methodology-case study on IOT system for Weather Monitoring

UNIT III IOT PLATFORMS 9 hours

Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors -Introduction to Arduino, Pi, Spark, Intel Galileo

UNIT IV IOTTECHNICAL STANDARDS AND PROTOCOLS s 9 hours

RF Protocols: RFID, NFC;IEEE 802.15.4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL) -CoAP,XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH -Architectural Considerations in Smart Object Networking

UNIT V DEVELOPING INTERNET OF THINGS 9 hours

IoT platforms design methodology, IoT Physical devices and endpoints -IoT Systems: Logical design using Python, IoT physical servers and cloud offerings (Cloud computing for IoT)

TOTAL: 45 hours

TEXT BOOKS:

T4: ArshdeepBahga, Vijay Madisetti, “Internet of Things, A Hands -on Approach”, 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7

T5: Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”,1st Edition2015,ISBN: 978-81-265-5686-1

T6: Michael Miller, “The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World”, First edition ,2015, Pearson, ISBN:978-93-325-5245-6

WEB LINKS:

7. https://archive.nptel.ac.in/courses/106/105/106105166/
8. https://nptel.ac.in/courses/108108098
9. https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects
10. https://tools.ietf.org/html/rfc7452
11. http://dret.net/lectures/iot-spring15/protocols
12. http://iot.intersog.com/blog/overview-of-iot-development-standards-and-frameworks

COURSE OUTCOMES:

CO1:	Apply IOT architecture at various application domains	K3
CO2:	Examine M2M Communication and architecture	K4
CO3:	Experiment with various IoT platforms	K3
CO4:	Utilize different standards and protocols	K3
CO5:	Construct Cloud computing for IoT	K3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		

OCSE03	PYTHON PROGRAMMING	3	0	0	3

COURSE OBJECTIVES:

- To understand the basic and advanced features of core language built in functions
- To handle and control system/OS level features
- To communicate using sockets, write client and server-side scripts
- To design and implement basic applications with database connectivity

UNIT I PYTHON BASICS 9 hours

Introduction to Python, Python Interpreter and its working, Syntax and Semantics- Data Types: Booleans - Numbers - Lists - Tuples – Set - Dictionaries - Comprehensions - Assignments and Expressions, Control Flow Statements - Functions and lambda expressions

UNIT II PYTHON ADVANCED FEATURES 9 hours

Iterations and Comprehensions - Handling text files - Modules, Classes and OOP - Exception Handling - Strings and Regular Expressions

UNIT III SYSTEM PROGRAMING 9 hours

System tools: OS and Sys modules - Directory Traversal tools - Parallel System tools: threading and queue, Program Exits

UNIT IV NETWORK AND WEB PROGRAMMING 9 hours

Socket Programming: Handling Multiple Clients - Client side scripting, urlib - Server Side Scripting: CGI Scripts with User Interaction, Passing Parameters

UNIT V GUI PROGRAMMING AND DATABASE CONNECTIVITY 9 hours

Introduction to tkinter, Top Level Windows, Dialogs, Message and Entry - Event Handling, Menus, Listboxes and Scrollbars, Text - SQL Database interfaces with sqlite3: Basic operations and table load scripts

TOTAL: 45 hours

TEXT BOOKS:

T1: Allen B. Downey, “Think Python: How to Think Like a Computer Scientist’’, 2nd edition, Shroff/O’Reilly Publishers, 2016.

T2: Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python” –Network Theory Ltd., 2011.

REFERENCE BOOKS:

R1: Mark Lutz, “Learning Python”, O Reily, 4thEdition, 2009, ISBN: 978-0-596 15806-4,5th edition, 2013

R2: Mark Lutz, “Programming Python”, O Reily, 4thEdition, 2010

R3: Tim Hall and J-P Stacey, “Python 3 for Absolute Beginners” , 2013

R4: Magnus Lie Hetland , “Beginning Python: From Novice to Professional”, 3rd Edition, 2013

WEB LINKS:

1. http://greenteapress.com/wp/think-python/
2. https://archive.nptel.ac.in/courses/106/106/106106182/

COURSE OUTCOMES:

CO1:	To build programs using List,Tuples,Set,Dictionary	K3
CO2:	To Utilize string functions and regular expression	K3
CO3:	To performdirectory traversalsand parallel processing	K4
CO4:	To develop server side and client side scripting	K3
CO5:	To create programs with database connectivity	K6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

OCSE04	ARTIFICIAL INTELLIGENCE	3	0	0	3

COURSE OBJECTIVES:

- To know about the basic knowledge representation, problem solving and learning methods,
- To design an intelligent agent that can solve ontological problems and to learn about the search strategies,
- To learn the applicability, strengths and weaknesses to solve particular engineering problems.

UNIT I INTRODUCTION **9 hours**

Artificial Intelligence: Definition-Turing Test-Relation with other Disciplines-History of AI Applications-Agent: Intelligent Agent-Rational Agent - Nature of Environments-Structure of Agent-Problem Solving Agent - Problems: Toy Problems and Real-world Problems-Uninformed Search Strategies: BFS, DFS, DLS, IDS, Bidirectional Search - comparison of uninformed search strategies

UNIT II PROBLEM SOLVING **9 hours**

Informed Search Strategies-Greedy best-first search-A* search-Heuristic functions-Local search Algorithms and Optimization problems - Online Search Agent-Constraint Satisfaction Problems-Backtracking Search for CSP's – Local Search for Constraint Satisfaction Problems-Structure of Problems -Adversarial Search-Optimal Decision in Games-Alpha-Beta Pruning-Imperfect Real Time Decisions-Games that Include an Element of Chance

UNIT III KNOWLEDGE REPRESENTATION **9 hours**

First-Order Logic:Syntax and Semantics of First-Order Logic: Models for first-order logic, Symbols and Interpretations, Terms, Atomic sentences, Complex sentences, Quantifiers, Equality - Using First-Order-Logic-Knowledge Engineering in First-Order-Logic- Inference in First-Order Logic: Inference rules-Unification and Lifting-Forward Chaining-Backward Chaining-Resolution

UNIT IV LEARNING **9 hours**

Learning from Observations: Forms of Learning - Learning Decision Trees: Decision Trees as Performance elements, Expressiveness of decision trees, Inducing decision trees from examples, Choosing Attribute tests, Assessing the performance of the learning algorithm, Noise and Overlifting, Broadening the applicability of decision trees – Ensemble Learning - A Logical Formulation of Learning - Knowledge in Learning - Explanation-Based Learning - Learning using Relevance Information - Inductive Logic Programming

UNIT V APPLICATIONS **9 hours**

Communication –Communication as action -A formal grammar for a fragment of English – Syntactic Analysis – Augmented Grammars – Semantic Interpretation – Ambiguity and Disambiguation – Discourse Understanding – Grammar Induction. Perception –Image Formation –Early Image Processing Operations – Extracting Three Dimensional Information – Object Recognition – Using Vision for

Manipulation and Navigation

TOTAL: 45 hours

TEXT BOOKS:

T1: Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education/ Prentice Hall of India 2010

T2: Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press

T3: Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd, 2003.

REFERENCE BOOKS:

R1: Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.

R2: Luger, G.F. 2008. Artificial Intelligence -Structures and Strategies for Complex Problem Solving, 6th edition, Pearson

WEB LINKS:

1. https://nptel.ac.in/courses/106105078
2. https://nptel.ac.in/courses/106105079

CO1:	Evaluate Artificial Intelligence (AI) methods and describe their foundations.	K5
CO2:	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.	K3
CO3:	Interpret the knowledge representation and reasoning for solving real world problems	K2
CO4:	Formulate a learning framework involving AI methods	K5
CO5:	Determinean efficient strategy for various applications of AI	K6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		✔

OCSE05	CLOUD COMPUTING	3	0	0	3

Course Objectives

- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize with the types of virtualization and the lead players in cloud.

UNIT I	INTRODUCTION, PRINCIPLES AND ARCHITECTURE	9

Cloud Computing : Vision, reference model, characteristics and challenges – historical development – building cloud computing environment – computing platforms and Technologies – Parallel Vs distributed computing – Elements of parallel and distributed computing – Technologies for distributed computing. Cloud Computing Architecture: Cloud reference model - NIST Cloud Computing Reference Architecture – types of Clouds - economics – open challenges.

UNIT II	VIRTUALIZATION	9

Characteristics of virtualized environments - Taxonomy of virtualization techniques - Execution virtualization -Machine reference model - Hardware-level virtualization – Hypervisors - Hardware virtualization techniques -Operating system-level virtualization - Programming 210 language-level virtualization - Application-level virtualization - Other types - Virtualization and cloud computing - Pros and cons of virtualization - Technology examples - Xen: Paravirtualization - VMware: full virtualization - Full virtualization and binary translation - Microsoft Hyper-V.

UNIT III	CLOUD INFRASTRUCTURE	9

Cloud Computing and Services Model – Public, Private and Hybrid Clouds – Cloud Eco System - IaaS - PaaS – SaaS. Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources. Case Study: Amazon Web Service reference, GoGrid, Rackspace

UNIT IV	CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENT	9

Cloud capabilities and platform features – data features and databases - Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Dryad and DryadLINQ – sawzall and Pig Latin - Mapping Applications - Programming Support of Google App Engine - Amazon AWS –Microsoft Azure - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack. Case Study: Amazon Web Service reference, GoGrid, Rackspace.

UNIT V	CLOUD PLATFORMS AND APPLICATION	9

Amazon web services - Compute services - Storage services - Communication services - Google AppEngine - Architecture and core concepts – Cloud Security and Trust management. Application life cycle - Cost model – Observations - Microsoft Azure - SQL Azure – Scientific Applications –Business and Consumer Application – Energy efficiency in clouds - Market-based management of clouds - Federated

clouds/InterCloud - Third-party cloud services.
TOTAL : 45 hours

Text Books:

T1: Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud

Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

T2: Rajkumar Buyya, Christian Vecchiola. S.Thamarai Selvi, "Mastering Cloud

Computing", McGraw Hill Education, 2013.

Reference Books:

R10: James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for

Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

R11: George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.

R12: Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010.

R13: John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Web Links:

19. https://onlinecourses.nptel.ac.in/noc22_cs20/preview.

20. https://www.w3schools.in/cloud-computing.

COURSE OUTCOMES

CO1:	Understand the broad perspective of cloud architecture, key technologies, principles, strengths, limitations as well as the possible applications of the state-of-art of cloud computing.	K2, K3
CO2:	Gain a basic knowledge of virtualization and its categorization and Design & develop highly scalable cloud-based applications by creating and configuring virtual machines.	K3, K6
CO3:	Compare, contrast, and evaluate the key trade-offs between multiple approaches to cloud system design, and Identify appropriate design choices when solving real - world cloud computing problems.	K4
CO4:	Interpret some important cloud computing driven commercial systems such as: Google Apps, Microsoft Azure and Amazon Web Services and other businesses cloud	K5

	applications.	
CO5:	Build and deploy cloud application using popular cloud platforms.	K6

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	0	3	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	-	3
CO4	2	2	2	3	0	-	-	-	-	-	-	-	-	3
CO5	0	2	3	3	3	-	-	-	-	-	-	-	-	3
	2.2	2	2.6	2.4	2.2	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔		✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔		

OCSE01	**E COMMERCE**	3	0	0	3

Course Objectives

- To understand the nature of e-Commerce and recognize the business impact and potential of e-Commerce
- To learn the technologies required to make e-Commerce viable.
- To know about the current drivers and inhibitors facing the business world in adopting and using e-Commerce

UNIT I Introduction **9**

Traditional commerce and Ecommerce - Categories of Electronic commerce – Business models – Revenue models – Business processes. Internet and WWW–role of WWW–value chains–strategic business – Revenue Strategy issues – Industry value chains - supply chain management–role of Ecommerce

UNIT II Infrastructure for E-Commerce **9**

Packet switched networks–Routing packets. TCP/IP protocol script: IP Addressing – Domain names – E-mail protocols. Internet utility programs–SGML,HTML and XML–web client and servers–Web client/server architecture– intranet and extranets – Public and private networks – Virtual private network

UNIT III Web Based Tools for E-Commerce **9**

Web server: Server computers –performance evaluation – Hardware architectures. Web server software feature sets–web server software and tools– Internet Utility programs – Data analysis software – Link checking utilities. web protocol–search engines–intelligent agents –EC software– webhosting–cost analysis

UNIT IV Security **9**

Computer security classification–copyright and Intellectual property–electronic commerce threats: Secrecy threats – Integrity threats – Necessity threats Encryption solutions. Protecting client computers–electronic payment systems– electronic cash–strategies for marketing–sales and promotion–cryptography – authentication

UNIT V Intelligent Agents **9**

Definition and capabilities–limitation of agents – History of software agents – Characteristics and properties a of agents – Tele script Agent Language – safe-Tcl –security–web based marketing– search engines and Directory registration–online advertisements– Portables and info mechanics–website design issues.

TOTAL : -- 45 hours

Text Books:

T1 Ravi Kalakota, Andrew B. Whinston " Frontiers of Electronic Commerce",Pearson Education, 2008
T2 Gary PSchneider "Electronic commerce", Thomson learning & James TPeny Cambridge USA, 2001
T3 Manlyn Greenstein and Miklos "Electronic commerce" McGraw-Hill, 2002.

Reference Books:

R1 Efraim TurvanJ.Lee, David Kug and Chung,"Electronic Commerce" Pearson EducationAsia2001.
R2 Brenda Kienew Ecommerce Business Prentice Hall,2001.

COURSE OUTCOMES

CO1:	Construct the implement various business models of E-Commerce	**K3**
CO2:	Develop a policy and regulatory issues in E-commerce	**K4**
CO3:	Evaluate the basic networking concepts	**K5**
CO4:	Make use of the web client server architecture	**K3**
CO5:	Develop and acquire knowledge on web server concepts and its performance evaluation	**K6**

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	2	-	-	-	-	-	-	-	-	3
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	3
CO3	3	3	3	2	2	-	-	-	-	-	-	-	-	3
CO4	2	3	2	2	3	-	-	-	-	-	-	-	-	3
CO5	3	2	3	2	3	-	-	-	-	-	-	-	-	3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

OCSE08	BLOCK CHAIN TECHNOLOGIES	3	0	0	3

Course Objectives

- To introduce Bit coin and other crypto currencies
- To study the algorithms and techniques in block chain
- To understand the practical aspects in the design of crypto currency
- To understand the function of Block chains as a method of securing distributed ledgers
- To design, code, deploy and execute a smart contract

UNIT I Introduction to Blockchain 9 hours

Basics of blockchain-Public Ledgers-Block Chain as Public Ledgers-Types of Block chains- Pillars of Block chain-Government Initiatives of BlockChain-Bitcoin-SmartContracts

UNIT II Architecture and Conceptualization of Block Chain, Crypto Currencies 9 hours

Block in a Block chain-find Transactions-Distributed Consensus-Proof of work, Stake, Space-Attacks on POW-Ethereum-Pos/POW Hybrids-Crypto currency to block chain 2.0, Model of Blockchain-Algorand

UNIT III Crypto Primitives, Securing and Interconnecting Public and Private Block Chains 9 hours

Hash Function and Merle Tree-Security Properties-Security Considerations for block chain-Digital Signature-Public Key Cryptography-Bit coinblock chain incentive structures- Nash Equilibriums-evolutionary stable strategies, and Pareto- efficiency (game theory) Weaknesses and news Points of Failure- Mitigation Methods-Redundancies and fall-back methods

UNIT IV Mining and Crypto Currencies - How to use and Interact 9 hours

Mining-Pools-Impact of CPU and GPU-Transaction in Bit coin Network- Block Mining-Block propagation and block relay

UNIT V Blockchain Use Cases-Applications in Different Areas 9 hours

Industry applications of Blockchain-Blockchain in Government-Government use cases-Preventing Cybercrime through block chain-Block Chain in defense, tax payments

TOTAL :45 hours

TEXT BOOKS:

T1: Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos O'Reilly, First Edition, 2014.

T2: Blockchain by Melanie Swa, O'Reilly Media 2015

T3: Zero to Block chain - An IBM Redbooks course, by Bob Dill, David Smits

REFERENCE BOOKS:

R1: The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, 2018 by Antony Lewis

R2: The Truth Machine: The Blockchain and the Future of Everything Paperback – 5 March 2019

COURSE OUTCOMES

CO1:	Explain the structure of a block chain	K5
CO2:	Analyze the incentive structure in a block chain based system	K4
CO3:	Judge the scenario where “smart” contract is most appropriate	K5
CO4:	Identify basic knowledge of Bitcoin, Ethereum	K3
CO5:	Apply Blockchain in future use cases for security	K3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

OCSE09	INTRODUCTION TO DATA ANALYTICS	3	0	0	3

Course Objectives

- To provide the knowledge and expertise to become a proficient data scientist
- To explore the fundamental concepts of big data & data analytics.
- To gain knowledge on Hadoop related tools such as MongoDB, Cassandra, Pig, and Hive for big data analytics

UNIT I Introduction to Big Data **9 hours**

Types of Digital Data-Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Non Definitional traits of Big Data – Business Intelligence vs. Big Data – Data warehouse and Hadoop environment – Coexistence.

UNIT II Big Data Analytics **9 hours**

Classification of analytics – Data Science – Terminologies in Big Data – CAP Theorem – BASE Concept. NoSQL: Types of Databases – Advantages – NewSQL – SQL vs. NOSQL vs NewSQL

UNIT III Introduction to Hadoop **9 hours**

Features – Advantages – Versions – Overview of Hadoop Eco systems – Hadoop distributions – Hadoop vs. SQL – RDBMS vs. Hadoop – Hadoop Components – Architecture – HDFS – Map Reduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression. Hadoop 2 (YARN): Architecture – Interacting with Hadoop Eco systems

UNIT IV No SQL databases **9 hours**

Mongo DB: Introduction – Features – Data types – Mongo DB Query language – CRUD operations – Arrays – Functions: Count – Sort – Limit – Skip – Aggregate – Map Reduce. Cursors – Indexes – Mongo Import – Mongo Export. Cassandra: Introduction – Features – Data types – CQLSH – Key spaces – CRUD operations – Collections – Counter – TTL – Alter commands – Import and Export – Querying System tables.

UNIT V Hadoop Eco systems **9 hours**

Hive – Architecture – data type – File format – HQL – SerDe – User defined functions – Pig: Features – Anatomy – Pig on Hadoop – Pig Philosophy – Pig Latin overview – Data types – Running pig – Execution modes of Pig – HDFS commands – Relational operators – Eval Functions – Complex data type – Piggy Bank – User defined Functions – Parameter substitution – Diagnostic operator

TOTAL : -- 45 hours

TEXT BOOKS:

T2: Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015

REFERENCE BOOKS:

R5: Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons, Inc., 2013.
R6: Tom White, “Hadoop: The Definitive Guide”, O’Reilly Publications, 2011.
R7: Kyle Banker, “Mongo DB in Action”, Manning Publications Company, 2012.
R8: Russell Bradberry, Eric Blow, “Practical Cassandra A developers Approach“, Pearson Education, 2014

COURSE OUTCOMES

CO1:	Identify the need of big data	K3
CO2:	Interpret basic concepts of data analytics	K5
CO3:	Analyze the framework for storing the data	K4
CO4:	Examine about NoSQL databases	K4
CO5:	Choose an appropriate framework to solve real world problems	K3

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

OCSE10	Fundamentals of AI and ML	3	0	0	3

Course Objectives

- To understand the basics of Machine Learning (ML)
- To program in Python ML Packages
- To understand the methods of Machine Learning
- To visualize a dataset

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9 hours

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents- Structure of agents – Problem solving agents –Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search

UNIT II INTRODUCTION TO MACHINE LEARNING 9 hours

Machine learning: Types of Machine Learning - Understanding data – Continuous variable, categorical variable, Independent variable, dependent variable -Regression and classification- linear regression - Machine Learning Life cycle - Data Preprocessing techniques – Feature selection

UNIT III MACHINE LEARNING ALGORITHMS 9 hours

Classification and Regression- Naïve bayes- Decision trees- Support Vector Machine (SVM) – Random forest- Linear Regression-Logistic Regression - Unsupervised learning - K-means clustering- Principal component analysis

UNIT IV MODEL EVALUATION 9 hours

Model Evaluation and Selection methods, Precision-Recall and ROC Curves Confusion Matrices, Regression Evaluation, Optimizing Classifiers for Different Evaluation Metrics

UNIT V MACHINE LEARNING APPLICATIONS 9 hours

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis

TOTAL: 45 hours

TEXT BOOKS:

T1: Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

T2: SebastainRaschka, “Python Machine Learning”, Packt publishing (open source).

REFERENCE BOOKS:

R1: Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009

R2: Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning" (2nd ed)., Springer, 2008

WEB LINKS:

1. https://machinelearningmastery.com/types-of-learning-in-machine-learning/Online
2. https://www.coursera.org/learn/machine-learning
3. https://nptel.ac.in/courses/106/106/106106139/
4. https://www.timberlake.co.uk/machinelearning

COURSE OUTCOMES:

CO1:	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	K3
CO2:	To apply the Basic Concepts of Machine Learning	K4
CO3:	To build various machine learning algorithms using Linear models	K5
CO4:	To apply ML techniques to application and evaluate the models	K4
CO5:	Apply basic principles of AI and ML in solutions that require problem solving, inference, perception, knowledge representation, and learning.	K4

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔	✔	✔	✔	✔

PEC	KNOWLEDGE ENGINEERING	3	0	2	4

Course Objectives

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning

UNIT I : REASONING UNDER UNCERTAINTY 9

Introduction to Uncertainty in AI – Abductive reasoning – Probabilistic reasoning Approaches: Enumerative Probabilities – Subjective Bayesian Reasoning – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering for Uncertain Reasoning.

UNIT II : METHODOLOGY AND MODELING 9

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III ONTOLOGIES –DESIGN AND DEVELOPMENT 9

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV REASONIING WITH ONTOLOGIES AND RULES 9

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V LEARNING AND RULE LEARNING 9

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning

TEXT BOOKS:

TOTAL HOURS : 45

PRACTICAL EXERCISES: 15 PERIODS

1. Perform operations with Evidence Based Reasoning.

2. Perform Evidence based Analysis.

3. Perform operations on Probability Based Reasoning.

4. Perform Believability Analysis.

5. Implement Rule Learning and refinement.

6. Perform analysis based on learned patterns.

7. Construction of Ontology for a given domain.

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9)

REFERENCE BOOKS:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

COURESE OUTCOME:

CO1:	Understand the basics of Knowledge Engineering.	K3
CO2:	Apply methodologies and modelling for Agent Design and Development.	K5

CO3:	Design and develop ontologies.	K3
CO4:	Apply reasoning with ontologies and rules.	K4
CO5:	Understand learning and rule learning.	K5

Mapping Of Course Outcomes to Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	1	1	1	1	1		-	2	1	3	2	1	1
CO2	3	3	3	2	3			-	2	1	2	3	1	2
CO3	3	3	2	2	3			-	1	1	2	3	2	2
CO4	2	3	3	2	3			-	2	1	2	3	3	2
CO5	2	3	3	2	2			-	3	1	2	3	3	3
AVG	2.4	1.8	2.4	1.4	1.4	0.2	0	0	2	1.6	1.6	1.6	2.2	1.6

ASSESSMENT METHODS:

CAT 1	**CAT 2**	**Model Exam**	**End Semester Exams**	**Assignments**	**Case Studies**
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**STREAM PROCESSING**	**3**	**0**	**2**	**4**

Course Objectives

- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I : FOUNDATIONS OF DATA SYSTEMS 9

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II: REAL-TIME DATA PROCESSING 9

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing,Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III : DATA MODELS AND QUERY LANGUAGES 9

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Many- to-One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV : EVENT PROCESSING WITH APACHE KAFKA 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V : REAL-TIME PROCESSING USING SPARK STREAMING 9

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

TOTAL HOURS : 45

PRACTICAL EXERCISES: 15 PERIODS

1. Install MongoDB
2. Design and Implement Simple application using MongoDB
3. Query the designed system using MongoDB
4. Create a Event Stream with Apache Kafka
5. Create a Real-time Stream processing application using Spark Streaming
6. Build a Micro-batch application
7. Real-time Fraud and Anomaly Detection,
8. Real-time personalization, Marketing, Advertising

TEXT BOOKS:

1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly

Media

3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCE BOOKS:

1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

COURESE OUTCOME:

CO1:	Understand the applicability and utility of different streaming algorithm	K3
CO2:	Describe and apply current research trends in data-stream processing	K5
CO3:	Analyze the suitability of stream mining algorithms for data stream systems	K3
CO4:	Program and build stream processing systems, services and applications.	K6
CO5:	Solve problems in real-world applications that process data streams	K5

Mapping Of Course Outcomes to Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**
CO1	3	3	2	3	1	-	-	-	2	3	1	2	1	3
CO2	2	1	1	2	2	-	-	-	3	2	2	3	1	2
CO3	3	1	2	3	3	-	-	-	2	2	1	1	2	2
CO4	2	1	3	3	3	-	-	-	3	3	1	1	1	2
CO5	3	3	1	2	2	-	-	-	3	3	2	3	2	3
AVG	2.6	1.8	1.8	2.6	2.2	-	-	-	2.6	2.6	1.4	2	1.4	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	SECURITY AND PRIVACY IN CLOUD	3	0	2	4

Course Objectives

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I : FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II: SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III : ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options- OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV : CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V : MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL HOURS : 45

PRACTICAL EXERCISES: 15 PERIODS

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. simulate resource management using cloud sim
3. simulate log forensics using cloud sim
4. simulate a secure file sharing using a cloud sim

5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario
9. Implement an attribute-based access control mechanism based on a particular scenario
10. Develop a log monitoring system with incident management in the cloud

TEXT BOOKS:

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, "Cloud Computing:", Wiley 2013
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY 2011

REFERENCE BOOKS:

1. Mark C. Chu-Carroll "Code in the Cloud",CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

COURESE OUTCOME:

CO1:	Understand the cloud concepts and fundamentals.	K3
CO2:	Explain the security challenges in the cloud.	K5
CO3:	Define cloud policy and Identity and Access Management.	K3
CO4:	Understand various risks and audit and monitoring mechanisms in the cloud.	K4
CO5:	Define the various architectural and design considerations for security in the cloud.	K5

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	3	3	3	1	2	-	-	-	1	1	1	3	3	1
CO2	1	3	2	3	1	-	-	-	2	2	3	2	3	1
CO3	3	2	2	3	2	-	-	-	3	1	1	2	2	3
CO4	2	1	2	3	3	-	-	-	3	2	3	3	1	1
CO5	1	3	3	1	1	-	-	-	2	3	3	2	2	3
AVG	2	2.4	2.4	2.2	1.8	-	-	-	2.2	1.8	2.2	2.4	2.2	1.8

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**
✔	✔		✔	✔	

PEC	**ROBOTIC PROCESS AUTOMATION**	**3**	**0**	**2**	**4**

Course Objectives

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and maintain the software bot.

UNIT I : INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II: AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III : APP INTEGRATION, RECORDING AND SCRAPING 9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV : EXCEPTION HANDLING AND CODE MANAGEMENT 9

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V : DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

TOTAL HOURS : 45

PRACTICAL EXERCISES: 15 PERIODS

Setup and Configure a RPA tool and understand the user interface of the tool:

1. Create a Sequence to obtain user inputs display them using a message box;

2. Create a Flowchart to navigate to a desired page based on a condition;

3. Create a State Machine workflow to compare user input with a random number.

4. Build a process in the RPA platform using UI Automation Activities.

5. Create an automation process using key System Activities, Variables and Arguments

6. Also implement Automation using System Trigger

7. Automate login to (web)Email account

8. Recording mouse and keyboard actions.

9. Scraping data from website and writing to CSV

10. Implement Error Handling in RPA platform

11. Web Scraping

12. Email Query Processing

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

REFERENCE BOOKS:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

COURESE OUTCOME:

CO1:	Enunciate the key distinctions between RPA and existing automation techniques and platforms.	K3
CO2:	Use UiPath to design control flows and work flows for the target process	K5
CO3:	Implement recording, web scraping andprocess mining by automation	K4
CO4:	Use UIPath Studio to detect, and handle exceptions in automation processes	K5
CO5:	Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.	K6

Mapping Of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	3	2	2	1	3	-	-	-	1	3	3	2	2	2
CO2	1	1	2	3	3	-	-	-	1	2	3	1	3	2
CO3	2	3	2	3	3	-	-	-	2	3	1	1	3	3
CO4	1	2	1	2	2	-	-	-	1	2	1	3	3	3
CO5	3	3	3	3	3	-	-	-	3	1	1	1	3	2
AVG	2	2.2	2	2.4	2.8	-	-	-	1.6	2.2	1.8	1.6	2.8	2.4

ASSESSMENT METHODS:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies

✔	✔	✔	✔	✔	✔
Quiz	**MCQ**	**Projects**	**Seminars**	**Demonstration/ Presentation**	**Open book test**