



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM - CHENNAI

ACCREDITED BY **NAAC** WITH '**A**' GRADE

*Marching Beyond **30** Years Successfully*

B. TECH - COMPUTER SCIENCE AND ENGINEERING
specialization with
ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

CURRICULUM AND SYLLABUS

REGULATION 2021

Based on Choice Based Credit System (CBCS)

and

Outcome Based Education (OBE))

Effective from the Academic year

2021-2022

DEPARTMENT
OF
COMPUTER SCIENCE AND 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 (PEOs)

PEO1: Graduates will formulate and solve complex intelligent computing and multidisciplinary problems using their analytical, decision-making, and prediction skills learned in AI and ML.

PEO2: Graduates will be building a successful career in IT/relevant industry or conducting research in advanced areas of Artificial Intelligence and addressing various societal issues

PEO3: Graduates will be able to adapt, contribute, and develop new technologies and systems in the key domains of AI and machine learning.

PEO4: Graduates train and prepare our students to perform effectively in a variety of roles related to their social, professional, and ethical obligations.

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 OUTCOME (PSO)

PSO 1: Apply a set of Artificial Intelligence principles, tools, and techniques to model various real- world business problems, analyse them, and suggest a suitable solution using appropriate Machine Learning techniques.

PSO 2: Apply Artificial Intelligence and Machine Learning skills in Health Care, Education, Agriculture, e-commerce, the financial sector, Smart Systems, and AI Multi-disciplinary areas.

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.
<p>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.</p>			
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 communication	10.3.1	Create engineering-standard figures, reports and drawings to complement writing and presentations
		10.3.2	Use a variety of media effectively to convey a message in a document or a presentation
<p>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.</p>			
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: Apply a set of Artificial Intelligence principles, tools, and techniques to model various real-world business problems, analyse them, and suggest a suitable solution using appropriate Machine Learning			
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: Apply Artificial Intelligence and Machine Learning skills in Health Care, Education, Agriculture, e- commerce, the financial sector, Smart Systems, and AI Multi-disciplinary areas.			
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 Vicky 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. Tech -Computer Science and Engineering Specialization with AI & ML										
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	10	10	4	7	-	-	-	-	31
3	ESC	8	8	3	-	-	-	-	-	19
4	PCC	-	-	13	15	13	9	4	-	54
5	PEC	-	-	-	-	3	7	7	3	20
6	OEC	-	-	-	-	3	3	6	6	18
7	Project	-	-	-	-	-	-	5	10	15
8	MC	-	-	2	-	-	-	-	-	2
	TOTAL	18	21	24	24	21	21	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

**VELS INSTITUTE OF SCIENCE, TECHNOLOGY
AND ADVANCED STUDIES (VISTAS)**

(MINIMUM CREDITS TO BE EARNED: 170)

B.Tech CSE AI & ML (Regulation 2021)								
Category	Course Title	Lecture	Tutorial	Practical	Credits	CA	SEE	Total
SEMESTER 1								
BSC	Chemistry	3	1	-	4	40	60	100
BSC	Mathematics – I (Calculus & Linear Algebra)	3	1	-	4	40	60	100
ESC	Programming for Problem Solving	3	-	-	3	40	60	100
BSC	Chemistry Laboratory	-	-	4	2	40	60	100
ESC	Programming for Problem Solving Laboratory	-	-	4	2	40	60	100
ESC	Workshop / Manufacturing Practices	1	-	4	3	40	60	100
		10	2	12	18			
SEMESTER II								
HSC	English	2	-	-	2	40	60	100
BSC	Physics (Semiconductor Physics)	3	1	-	4	40	60	100
BSC	Mathematics II (Probability and Statistics)	3	1	-	4	40	60	100
ESC	Basic Electrical Engineering	3	1	-	4	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 (Semiconductor Physics)	-	-	4	2	40	60	100

ESC	Electrical Engineering Laboratory	-	-	2	1	40	60	100
		12	3	12	21			
SEMESTER III								
BSC	Mathematics III (Fourier Series and Transforms)	3	1	-	4	40	60	100
ESC	Digital Electronics	3	-	-	3	40	60	100
PCC	Operating Systems	3	-	-	3	40	60	100
PCC	Data Structures and Algorithms	3	1	-	4	40	60	100
PCC	Foundations of Artificial Intelligence and Machine Learning	3	-	2	4	40	60	100
PCC	Operating Systems Lab	-	-	2	1	40	60	100
PCC	Data Structures and Algorithms Lab	-	-	2	1	40	60	100
HSC	Personality Development I	2	-	-	2	40	60	100
MC	Basic Life Skills	2	-	-	2			100
		19	2	6	24			

SEMESTER IV								
BSC	Mathematics IV (Random Process & 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	Programming for AI and 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	Constitution of India	2	-	-	-			100
		22	1	6	24			
SEMESTER V								
PCC	Java and Web Programming	3	-	-	3	40	60	100
PCC	Mobile Application Development	3	-	-	3	40	60	100
PEC	Professional Elective Course - I	3	-	-	3	40	60	100
OEC	Open Elective Course - I	3	-	-	3	40	60	100
PCC	Deep Learning and Predictive modelling	3	-	2	4	40	60	100
PCC	Java and Web Programming Lab	-	-	2	1	40	60	100
PCC	Mobile Application Development Lab	-	-	2	1	40	60	100
HSC	Personality Development III	2	-	-	2	40	60	100
PCC	Industrial Training/ Mini Project/ MOOC Course (NPTEL/SWAYAM/Course	-	-	2	1			100

	Era/Math works) - Minimum 4 weeks							
		17	0	8	21			

SEMESTER VI

PCC	.Net Programming	3	-	-	3	40	60	100
PCC	Cognitive Learning	3	-	-	3	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	Cognitive Learning Lab	-	-	2	1	40	60	100
HSC	Personality Development - IV	2	-	-	2	40	60	100
PCC	Summer Internship (4 weeks)	-	-	2	1			100
		17	0	8	21			

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	Hours / Week			Credits
		Lecture	Tutorial	Practical	
BSC - 01	Physics	3	1	-	4
BSC - 02	Mathematics I (Calculus and Linear Algebra)	3	1	-	4
BSC - 03	Physics Laboratory (Semiconductor Physics)	-	-	4	2
BSC - 04	Chemistry	3	1	-	4
BSC - 05	Mathematics II (Probability and Statistics)	3	1	-	4
BSC - 06	Chemistry Laboratory	-	-	4	2
BSC - 07	Mathematics III (Fourier Series and Transforms)	3	1	-	4
BSC - 08	Environmental Science and Engineering	3	-	-	3
BSC - 09	Mathematics IV (Random Process and Queuing Theory)	3	1	-	4

LIST OF ALL HUMANITIES AND SOCIAL SCIENCES COURSES

S.NO	COURSE TITLE	Hours / Week			Credits
		Lecture	Tutorial	Practical	
HSC - 01	English	2	-	-	2
HSC - 02	English Laboratory	-	-	2	1
HSC - 03	Personality Development I	2	-	-	2
HSC- 04	Personality Development II	2	-	-	2
HSC - 05	Personality Development III	2	-	-	2
HSC - 06	Personality Development IV	2	-	-	2

LIST OF ALL ENGINEERING SCIENCE COURSES

S.NO	COURSE TITLE	Hours / Week			Credits
		Lecture	Tutorial	Practical	
ESC-01	Basic Electrical Engineering	3	1	-	4
ESC-02	Engineering Graphics and Design	1	-	4	3
ESC-03	Electrical Engineering Laboratory	-	-	2	1
ESC-04	Programming for Problem Solving	3	-	-	3
ESC-05	Workshop / Manufacturing Practices	1	-	4	3
ESC-06	Programming for Problem Solving Laboratory	-	-	4	2

LIST OF ALL PROFESSIONAL ELECTIVE COURSES

S.NO.	COURSE TITLE	Hours / Week			Credits
		Lecture	Tutorial	Practical	
	PROFESSIONAL ELECTIVE				
PEC-01	Applied Cryptography	3	-	-	3
PEC-02	Big Data Programming	3	-	-	3
PEC-03	Cloud Computing	3	-	-	3
PEC-04	Cryptography and Network Security	3	-	-	3
PEC-05	Cyber Forensics	3	-	-	3

PEC-06	Data Warehousing and Data Mining	3	-	-	3
PEC-07	E- Commerce	3	-	-	3
PEC-08	Ethical Hacking	3	-	-	3
PEC-09	Information Retrieval	3	-	-	3
PEC-10	Object Oriented Analysis and Design	3	-	-	3
PEC-11	Soft Computing	3	-	-	3
PEC-12	Software Engineering	3	-	-	3
PEC-13	Software Project Management	3	-	-	3
PEC-14	Software Quality Assurance	3	-	-	3
PEC-15	Software Testing	3	-	-	3
PEC-16	System Software	3	-	-	3
PEC-17	User Interface Design	3	-	-	3
PEC-18	Virtual Reality	3	-	-	3
PEC-19	Agile Methodologies	3	-	-	3
PEC-20	Information Security	3	-	-	3
PEC-21	Software Defined Networks	3	-	-	3
PEC-22	Block Chain Technologies	3	-	-	3
PEC-23	Natural Language Processing	3	-	-	3
PEC-24	Applications of AI	3	-	-	3
PEC-25	Artificial Intelligence for Cyber Security	3	-	-	3
PEC-26	Artificial Intelligence in Block chain	3	-	-	3
PEC-27	Text and Speech Analysis	3	-	-	3
PEC-28	Knowledge Engineering	3	-	-	3
PEC-29	Optimization Techniques	3	-	-	3
PEC-30	Ethics and AI	3	-	-	3

S.NO	Course Title	Hours / Week			Credits
		Lecture	Tutorial	Practical	
PEC – 31	Data Exploration and Visualization	3	-	2	4
PEC - 32	Big Data Analytics	3	-	2	4
PEC - 33	Python for Data Science	3	-	2	4
PEC - 34	Nosql Database	3	-	2	4

PEC - 35	Game Programming	3	-	2	4
PEC - 36	Robotics And Its Applications	3	-	2	4
PEC - 37	Concepts of Virtual and Augmented Reality	3	-	2	4
PEC - 38	Embedded Systems for Internet Of Things	3	-	2	4

LIST OF ALL MANDATORY COURSES

S. NO	Course Title	Hours / Week			Credits
		Lecture	Tutorial	Practical	
MC - 01	Constitution of India	2	-	-	-
MC - 02	Basic Life skills	2	-	-	2

LIST OF ALL OPEN ELECTIVE COURSES OFFERED FOR OTHER DEPARTMENTS

S. No	COURSE TITLE	Hours / Week			Credits
		Lecture	Tutorial	Practical	
OEC - 01	Internet Of Things	3	-	-	3
OEC - 02	Artificial Intelligence	3	-	-	3
OEC - 03	Introduction To Data Analytics	3	-	-	3
OEC-04	UI and UX Design	3	-	-	3
OEC-05	DevOps	3	-	-	3
OEC-06	Multimedia and Animation	3	-	-	3
OEC-07	Video Creation and Editing	3	-	-	3

BSC	Chemistry	3	1	0	4
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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 12

Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of di-atomics. 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 H₃, H₂F and HCN.

UNIT II Spectroscopic techniques and applications 12

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 12

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 12

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 12

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

Total Hours: 60

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. Vollhardt 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/10210304>
3. [4/pdf/mod2.pdf](#)
4. [https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Thermodynamics/Chemical_Energetics/Free_Energy_and_Equilibrium)
5. [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](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)
6. <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	K3
CO2	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.	K2
CO3	Analyze bulk properties and processes using thermodynamic considerations	K3
CO4	Classify the properties and reactivity of different types of elements based on the periodic table	K3
CO5	Apply the basic terms involved in an Organic reactions and synthesis of a drug molecule.	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	1	3	1	3	1	-	-	1	-	3	1
CO 2	3	3	2	2	3	2	3	2	-	-	2	-	3	2
CO 3	3	3	2	2	2	2	2	2	-	-	2	-	3	2
CO 4	3	3	2	2	2	2	2	2	-	-	2	-	3	2
CO 5	3	3	2	2	3	2	3	2	-	-	2	-	3	2

ASSESSMENT METHODS:

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

BSC	Mathematics-I (Calculus and Linear Algebra)	3	1	0	4
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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

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 12

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

Unit-III: Sequence and series 12

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**

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**

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:**

- T1 G.B.Thomas and R.L.Finney, Calculus and Analytic geometry, 9thEdition,Pearson,Reprint, 2002.
 T2 Ramana B.V., Higher Engineering Mathematics,Tata McGraw Hill New Delhi, 11, Reprint,2010
 T3 N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Reference books:

- R1 P. Sivaramakrishna Das and C. Vijayakumari, Mathematics-I, First Edition, Pearson India Education services Pvt. Ltd.
 R2 Erwinkreyszig, Advanced Engineering Mathematics, 9 Edition, John Wiley&Sons, 2006.
 R3 VeerarajanT.,Engineering Mathematics for firstyear,TataMcGraw-Hill,NewDelhi,2008.
 R4 D.Poole, LinearAlgebra: A ModernIntroduction,2nd Edition, Brooks/Cole,2005.
 R5 B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition,2010.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc20_ma37/preview

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	PO10	PO11	PO12	PSO1	PSO2
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

ESC	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	3
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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

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

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

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

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

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 Hours: 45

Text Books:

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

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Prentice Hall of India
2. Yashavant Kanetkar, “Let Us C”, BPB Publications
3. 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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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
			✓	✓

BSC	CHEMISTRY LABORATORY	0	0	4	2
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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.

Total Hours: 30

Text Books

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

Reference Books

1. Vogel's – "Textbook of qualitative organic Analysis", Longmann, 12th edition, 2011
2. 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.	K2
CO2	Find the viscosity and to test the purity of the compound	K3
CO3	Estimate the amount of chlorine content present in drinking water and to know the conductance of a solution.	K4
CO4	Develop a small drug molecule and to know the saponification of an oil.	K3
CO5	Find out the unknown element by Potentiometric method and to remove some of the toxic chemical by charcoal method.	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	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	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration / Presentation
✓			✓	✓

ESC	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	0	0	4	2
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COURSE OBJECTIVE:

- To design and develop C Programs for various applications

LIST OF 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

Total Hours: 30

Text Books:

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

Reference Books:

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

Web Links:

1. <https://www.edx.org/course/c-programming-getting-started>

COURSE OUTCOMES

CO1	Determine the advanced features of the C language	K5
CO2	Develop the model data using primitive and structured types.	K5
CO3	Construct programs that demonstrate effective use of C features including arrays, structures, pointers and files.	K4
CO4	Develops the ability to analyze a problem, develop an algorithm to solve it.	K5
CO5	Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.	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	3	-	-	-	-	-	-	2	3	2
CO2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
CO3	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO4	2	2	3	3	3	-	-	-	-	-	-	2	3	2
CO5	2	3	2	3	3	-	-	-	-	-	-	3	1	3

ASSESSMENT METHODS:

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

ESC	WORKSHOP / MANUFACTURING PRACTICES	1	0	4	3
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COURSE OBJECTIVS:

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**
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** **9**
To make square, V joint in bench fitting as per the given dimension and tolerances, Tools and demonstration of producing model
3. **Carpentry** **9**
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**
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 per the given Dimensions.
5. **Plumbing Works** **9**
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 Hours: 45

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 connections with different joining components	K 1

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

Web Links:

1. <https://nptel.ac.in/courses/112105127>

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
				✓	✓

HSC	ENGLISH	2	0	0	2
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COURSE OBJECTIVES:

- 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 6

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 6

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 6

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 6

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

UNIT V Writing Practices 6

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 Hours - 30

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:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. 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

CO1	Improve the language proficiency of a technical under-graduate in English with emphasis on Learn, Speak, Read and Write skills.	K 1
CO2	Develop listening skills for academic and professional purposes.	K 5
CO3	Acquire the ability to speak effectively in English in real life situations	K 2
CO4	Provide learning environment to practice listening, speaking, reading and writing skills.	K 5
CO5	Variety of self-instructional modes of language learning and develop learner autonomy.	K 1

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	-

Assessment Methods:

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

BSC	PHYSICS (Semiconductor Physics)	3	1	0	4
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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 12

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 12

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 12

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 12

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 Hours: 60

Text books:

1. Rajendran V, and Marikani A, ‘Materials Science’ Tata McGraw Hill publications, New Delhi 2011.

- Vijaya, M. and Rangarajan G, 'Materials Science' Tata McGraw Hill publications, New Delhi 2006.
- Dr. Mani P , 'A text book of Engineering Physics – II' Shri Dhanam Publilsher, Chennai 2016
- Murugesan R, Kiruthiga Sivaprasath, 'Modern Physics' S Chand Publisher 2016

Reference Books:

- S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
- Charles Kittel 'Introduction to Solid State Physics', John Wiley and sons, 7th edition, Singapore 2008.
- Kasap S.O, "Principles of Electronic Materials", 3rd edition, McGrawHill Higher Education, 2005.
- Pradeep T, "A text book of Nanoscience and Nano technology, McGrawHill Higher Education, 2012.
- Palanisamy P.K, 'Materials Science', Scitech publications, Chennai, 2007.
- J. Singh, Semico*nductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
- P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

Web Links:

- <https://nptel.ac.in/courses/115102026/2>
- <https://nptel.ac.in/courses/115102026/15>
- <http://textofvideo.nptel.ac.in/115102026/lec18.pdf>
- <https://nptel.ac.in/courses/122103010/34>
- <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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

ASSESSMENT METHODS:

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

BSC	MATHEMATICS –II (Probability and Statistics)	3	1	0	4
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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**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.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Web links

1. https://onlinecourses.nptel.ac.in/noc20_ma17

COURSE OUTCOME:

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

CO1	Apply the fundamental concepts of probability	K 1
CO2	Understand of standard distributions which can describe real life phenomenon.	K 5
CO3	Understand and critically discuss the issues surrounding of correlation and Regression	K 2
CO4	Evaluate the underlying assumptions of analysis tools of measures of central tendency and dispersion	K 5
CO5	Analyze the uses and limitations of Testing of hypothesis used in engineering	K 1

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	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	3	3	-	-	-	-	-	-	3	-	3	3
CO5	-	3	3	3	-	-	-	-	-	-	3	-	-	2

ASSESSMENT METHODS:

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

ESC	BASIC ELECTRICAL ENGINEERING	3	1	0	4
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COURSE OBJECTIVES

- To obtain basic knowledge on electrical quantities such as current, voltage, power and energy.
- To provide 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.
- To emphasize the importance of transformers in transmission and distribution of electric power.

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. Time-domain analysis of first-order RL and RC circuits..

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 Electrical Installations

12

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Total Hours: 60

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989

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 analyze DC circuits	K2,K4
CO2	Understand and analyze AC circuits	K2,K4
CO3	Explain the construction, operation and characteristics of transformer and classify the types of three –phase transformer connections.	K2,K5
CO4:	Understand and Examine the various electrical machines and converter circuits	K2,K4
CO5:	Identify the use of low tension switchgears and Classify the various types ofwires, cables, batteries and earthing.	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
✓	✓			✓	✓

ESC	ENGINEERING GRAPHICS AND DESIGN	1	0	4	3
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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

9

Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid, Epicycloid, Hypocycloid – construction of involutes of square 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

9

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 9

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 PROJECTION OF SECTION OF SOLIDS AND DEVELOPMENT OF SURFACE 9

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 PROJECTION OF ORTHOGRAPHIC AND ISOMETRIC 9

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 Hours: 45

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).

Weblinks:

https://onlinecourses.nptel.ac.in/noc21_me128/preview

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
				✓

HSC	ENGLISH LABORATORY	0	0	2	1
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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

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

Total Hours: 30

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:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
3. 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.	K2
CO2	Use appropriate pronunciation and rhythm of spoken language in oral communication	K3
CO3	Draft and interpret the written communication in official contexts like narrative, descriptive, creative, critical and analytical reports.	K3
CO4	Infer implied meanings of different genres of texts and critically analyze	K3

	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.	K4

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
✓		✓	✓	✓

BSC	PHYSICS LABORATORY (Semiconductor Physics)	0	0	4	2
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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

Total Hours: 30

Text Books:

1. C. C. Ouseph, U. J. Rao, V. Vjiayendran, Practical Physics, 1st Edition, 2015.
2. Biswajit Saha, Practical Physics Book, LAP LAMBERT Academic Publishing, 1st Edition, 2020.

Reference Books:

1. G.L. Squires, Practical Physics, 4th Edition, Cambridge University Press, 2001.
2. 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.	K2
CO2	Analyze the coefficient of viscosity of a liquid	K3
CO3	Estimate the band gap energy of given semiconductor material.	K3
CO4	Determine the compressibility of the liquid using ultrasonic interferometer	K4
CO5	Measure the Young’s modulus of the given solid materials	K4

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	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

ASSESSMENT METHODS:

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

ESC	ELECTRICAL ENGINEERING LABORATORY	0	0	2	1
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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**Text Books:**

- 1: D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- 2: D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

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 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
✓			✓	✓

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

Weblinks:

<https://nptel.ac.in/courses/122103012>

COURSE OUTCOME:

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

CO1	Develop Fourier series for different types of functions.	K4
CO2	Acquaint the student with Fourier Transform techniques used in wide variety of situations	K3
CO3	Introduce the basic concepts of Partial differential equations for solving standard Partial differential equations	K4
CO4	Analyze the student with Fourier series techniques in solving heat flow problems used in various situations	K2
CO5	Understand the z-transforms and its properties	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	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	Observation
		✓	✓	✓
Record	MCQ	Projects	Viva	Demonstration /

				Presentation
✓			✓	✓

ESC	DIGITAL ELECTRONICS	3	0	0	3
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COURSE OBJECTIVES:

1. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
2. To introduce the methods for simplifying Boolean expressions
3. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits
4. To introduce the concept of memories and programmable logic devices.

UNIT I LOGIC GATES, BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES 9

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De-Morgan's Theorem, Minimum of Boolean Expressions, Minterm, Maxterm, Sum of Products (SOP) & Product of Sums (POS) forms, Canonical forms, Karnaugh maps, Quine McCluskey method of minimization

UNIT II COMBINATIONAL LOGIC DESIGN 9

Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Adder/ Subtractor, Code Converters, Magnitude Comparator, Multiplexer, Demultiplexer, Encoder, Decoder.

UNIT III SEQUENTIAL LOGIC DESIGN 9

Flip Flop design: SR, JK, D and T Flip Flop, Realization of Flip flops, Counters: Modulo N Counter, UP/DOWN Counter, Ripple Counter, Ring Counter, Shift registers- SISO, SIPO, PIPO, PISO, Races, Hazards.

UNIT IV MEMORIES, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES 9

Memories: ROM, PROM, EPROM, EEPROM, RAM, Static RAM cell, Bipolar RAM cell, MOSFET RAM cell, Dynamic RAM CELL. Programmable logic devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Array (FPGA).

UNIT V VHDL CONCEPTS IN DIGITAL DESIGN 9

Design entry: Different modeling styles in VHDL, Dataflow, Behavioral and Structural Modeling, VHDL constructs and codes for combinational and sequential circuits.

Total Hours: 45

COURSE OUTCOME:

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

COURSE OUTCOME:

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

CO1	Examine the laws of Boolean algebra and Simplify minterms and maxterms using K map and tabulation methods.	K4
CO2	Analyze combinational logic circuits like adders, subtractors, multiplexers and Demultiplexers	K3
CO3	Distinguish the operations of SR,JK,T and D flip-flops	K4
CO4	Criticize the different types of memories and their designs.	K5
CO5	Compile VHDL codes to design combinational and sequential circuits.	K6

BOOKS:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCE BOOKS:

- R1. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2ndedition, 2006.
- R2. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989.
- R3. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2ndedition2012.
- R4. Donald D. Givone, Digital Principles and Design, Tata McGraw–Hill Education, 2002.

WEBLINKS:

1. www.tutorialspoint.com/digital_electronics/index.asp
2. www.coertvonk.com/hw/logic/synchronous-sequential-logic-30712

PCC	OPERATING SYSTEMS	3	0	0	3
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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

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

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

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

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

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 Hours: 45

Text Books:

1. Silbers chatz, Galvin, and Gagne, “Operating System Concepts”, Sixth Edition, Wiley India Pvt Ltd, 2003
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004

Reference Books:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004
2. 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

ASSESSMENT METHODS:

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

PCC	DATA STRUCTURES AND ALGORITHMS	3	1	0	4
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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 12

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 algorithms, Asymptotic analysis for recurrence relation – Recursive Tree Method.

UNIT II Linear Data Structures 12

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, Applications -Polynomial Manipulation - Josephus problem(permutation)

UNIT III Sorting and Search Techniques 12

Searching - Linear Search and binary search, Applications - Finding square root of 'n'- Longest Common Prefix- Sorting – Insertion sort - Selection sort – Bubble sort – (Counting Sort) - Quick sort- Merge sort, Analysis, Applications - Finding the 'n' closest pair's

UNIT IV Non-linear Data Structures 12

Tree - Terminology, Binary Tree – Terminology and Properties, Tree Traversals, Expression Trees – 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- Single Source Shortest Path: Dijkstra's

Algorithm.

UNIT V Hashing, Heaps and Balanced Binary Search Trees

12

Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing, extendible hashing, Applications - Heaps - Heap sort, Applications -Priority Queue using Heaps - AVL trees – Terminology - basic operations (rotation, insertion and deletion) - Recent trends in algorithms and data structures

Total Hours: 60

Text Books:

1. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition,MIT Press, 2009.
2. Mark A. Weiss, Data Structures & Algorithm Analysis in C++, 3rd edition, 2008, PEARSON.

Reference Books:

1. Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Structures, The Basic Toolbox, Springer-Verlag Berlin Heidelberg, 2008.
2. Horowitz, Sahni, and S. Anderson-Freed, Fundamentals of Data Structures in C UNIVERSITIES PRESS, Second Edition,2008.

Web Links:

1. <https://nptel.ac.in/courses/106102064>
2. <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 apply a 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

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		
✓	✓				✓		
PCC	Foundations of Artificial Intelligence and Machine Learning			3	0	2	4

Course Objectives

- Identify and apply suitable intelligent agents for various AI applications
- Understand natural language processing.
- Learn and apply suitable algorithms to solve AI problems.
- Understand different learning-based applications
- Apply different pre-processing methods to prepare training data set for machine learning.
- Learn to design and implement supervised and unsupervised machine learning algorithm.

UNIT I Introduction to Artificial Intelligence 12

Artificial Intelligence: Introduction, History of AI, Applications of AI, Objectives of AI, Artificial Intelligence Programming, Criticism of AI, Future of AI, Applications of Artificial Intelligence in various Specialized Fields. Environment, Intelligent Agents: Table based Agent, Percept based Agent, goal-based Agent.

UNIT II State Space Search Algorithm 12

Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search: Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent. Optimal Search: A* algorithm, Iterative Deepening A*, Recursive Best First Search, Pruning the CLOSED and OPEN Lists

UNIT III Introduction to Machine learning 12

Classic and adaptive machines, Machine learning matters, beyond machine learning-deep learning and bio-inspired adaptive systems, Machine learning and big data. Important Elements of Machine Learning: Data formats, Learnability, Statistical learning approaches, Elements of information theory

UNIT IV Feature Selection

12

Scikit-learn Dataset, creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principal Component Analysis (PCA)-nonnegative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning

UNIT V Regression and Naïve Bayes and Support Vector Machine

12

Linear and bi-dimensional model, Linear and Logistic regression, Linear classification, Implementation and Optimizations, Stochastic gradient descent algorithms, Classification metric, ROC Curve, Bayes Theorem, Naïve Bayes' Classifiers, Naïve Bayes: Bernoulli, Multinomial, and Gaussian. Support Vector Machine (SVM)- Linear SVM, Scikit-learn implementation, Linear and Kernel-based classification, Controlled SVM, Support Vector Regression

Total Hours: 60

List of Experiments: 30 Hours

- Lab 1. Implement A* Search algorithm
- Lab 2. Implement AO* Search algorithm.
- Lab 3. Implement Candidate-Elimination algorithm
- Lab 4. Decision tree based ID3 algorithm
- Lab 5. Implement Backpropagation algorithm
- Lab 6. implement the naïve Bayesian classifier.
- Lab 7. EM algorithm to cluster a set of data stored in a .CSV file.
- Lab 8. Implement k-Nearest neighbor algorithm.
- Lab 9. Implement the non-parametric Locally Weighted Regression algorithm

Text Books:

- Artificial Intelligence and Machine Learning – Chandra S S V

Reference Books:

- Artificial Intelligence: An Essential Beginner's Guide to AI, Machine Learning, Robotics, The Internet of Things, Neural Networks, Deep Learning, Reinforcement Learning, and Our Future – Neil Wilkins
- Basics of Artificial Intelligence and Machine Learning – Dr Dheeraj Mehrotra
- Artificial Intelligence – A Modern Approach: Stuart Russell and Peter Norvig

Web Links:

1. <https://machinelearningmastery.com/types-of-learning-in-machine-learning/Online>
2. <https://www.coursera.org/learn/machinelearning>
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.	K 3
CO2:	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, feature selection techniques, artificial neural networks, and other machine learning models	K4
CO3:	To build various machine learning algorithms using Linear models	K5
CO4:	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning	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

ASSESSMENT METHODS:

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

PCC	OPERATING SYSTEMS LAB	0	0	2	1
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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)

Total Hours: 30**Text Books:**

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Sixth Edition, Wiley India Pvt Ltd, 2003
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004

Reference Books:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education, 2004
2. 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 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	PO8	PO9	PO10	PO11	PO12	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

ASSESSMENT METHODS:

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

PCC	DATA STRUCTURES AND ALGORITHM LAB	0	0	2	1
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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:
 - a. 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.

Total Hours: 30

Text Books:

1. T1: M. A. Weiss, "Data Structures and Algorithm Analysis in C", third Edition, Pearson Education, 2007
2. T2: A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.

Reference Books:

- 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

Course Outcome	Description	Knowledge Level
CO1	Gain skills to design and analyze simple linear and non linear data structures	K3
CO2	Examine insertion, deletion and modification in singly and doubly linked list.	K4
CO3	Construct Stack, Queue in array for which all insertions and deletions are made at both end using various operations	K4
CO4	Apply Insertion, find and deletion operations in Binary Search Tree and Hashing functions.	K4
CO5	Evaluate shortest path in an undirected graph using depth and breadth first algorithms	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	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

Assessment method

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

HSC	PERSONALITY DEVELOPMENT I	2	0	2	2
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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 Hours: 30

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.emeraldgroupublishing.com>.
2. Psychology of Self esteem – Nathaniel Branden, Nash (1st edition), Jossey – Bass
(32nd anniversary edition)

Weblinks:

<https://nptel.ac.in/courses/109104107>

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

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	-	-	2	-	3	-	2	3	2
CO2	2	2	2	2	2	-	-	2	-	2	-	2	3	3
CO3	3	2	2	2	2	-	-	-	-	3	-	2	2	2
CO4	2	2	3	3	2	-	-	2	-	3	-	2	3	2
CO5	2	3	2	3	3	-	-	3	-	3	-	3	1	3

ASSESSMENT METHODS:

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

MC	BASIC LIFE SKILS				2	0	0	2
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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 Physical Health

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 – Forgiveness Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual puritySocial Values: Non-violence– Service Patriotism – 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 Hours: 30

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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc19_hs32/preview

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	K2
CO2	Demonstrate foundational standing, sitting, balance postures with proper alignment and Maintain youthfulness through kaya kalpa practice.	K3
CO3	Explore relaxation techniques to observe thoughts and to manage emotions and stress, and reflect on those techniques which are most effective to them.	K3
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.	K5
CO5	Achieve a greater sense of awareness, wisdom, introspection, and a deeper sense of relaxation through meditation to keep up morality in life.	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	2	2	2	-	-	2	-	3	-	2	3	2
CO2	2	2	2	2	2	-	-	2	-	2	-	2	3	3
CO3	3	2	2	2	2	-	-	-	-	3	-	2	2	2
CO4	2	2	3	3	2	-	-	2	-	3	-	2	3	2
CO5	2	3	2	3	3	-	-	3	-	3	-	3	1	3

Assessment methods:

CAT 1	CAT 2	Model Exam	End Semester Exams	Assignments	Case Studies
			✓	✓	✓

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

BSC	Mathematics-IV (Random Process & Queuing Theory)	3	1	0	4
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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: Queuing 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): (k^k /FIFO) Model - Characteristics of parameters of models.

UNIT III: Queuing 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: Queuing 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:

1. Gross. D. and Harris C.M, “Fundamentals of Queueing Theory”, Wiley Student edition, 2004.
2. Sivaramakrishna Das. P and Vijayakumari. C, “Probability & Queueing Theory”, Pearson Education Asia, 6th Edition ,2013.
3. S.Palaniammal, “Probability & Queueing Theory”, Eastern Economy Edition, 2012.

REFERENCE BOOKS:

1. R1. A.O. Allen, “Probability, “Statistics and Queueing Theory with Computer Applications”, Elsevier, 2nd edition, 2005.
2. R2. G.Balaji, “Probability & Queueing Theory”, Balaji Publishers, 2018.
3. R3. T.Veerarajan , Probability Statistics and Random Process, McGraw 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=DbIXnXxUQc0>
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:	Analyze the 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:	Identify various 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

Assessment methods:

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

PCC	COMPUTER ORGANIZATION AND ARCHITECTURE	3	0	0	3
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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 Hours: 45

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 various models.	K5
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

ASSESSMENT METHODS:

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

PCC	DATABASE MANAGEMENT SYSTEMS	3	0	0	3
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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 Introduction 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 – Serializability- 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 queryprocessing-CASE STUDY- ORACLE

Total Hours: 45

Text Books:

1. Abraham Silberschatz, Henry F.korthS.Sudharshan, "Database system concepts" sixth edition,tata mcgraw hill 2010.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson / Addison wesley, fifth edition, 2009.

Reference Books:

1. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. S.K.Singh, "Database Systems Concepts, Design and Applications", Second Edition, Pearson Education, 2011.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs51/preview.
2. 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	0	0	0	0	0	0	0	0	3
CO2	3	2	2	3	3	0	0	0	0	0	0	0	0	3
CO3	3	2	3	3	3	0	0	0	0	0	0	0	0	3
CO4	2	2	2	3	3	0	0	0	0	0	0	0	0	3
CO5	0	2	3	3	3	0	0	0	0	0	0	0	0	3

ASSESSMENT METHODS:

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

PCC	COMPUTER NETWORKS	3	0	0	3
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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 learner 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 Hours :45

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	P10	P11	P12	PSO1	PSO2
CO1	2	1	1	1	1	-	1	2	-	2	-	1	-	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

ASSESSMENT METHODS:

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

PCC	PROGRAMMING FOR AI AND ML	3	0	2	4
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Learning Outcome:

- Learn Syntax and Semantics and create Functions in Python. Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python.
- Build Web Services and introduction to Network and Database Programming in Python.

COURSE OUTCOMES:

- Apply the concept of Decision-making statements, looping constructs, functions for solving basic programs
- Analyze the concepts of Lists, tuples, and error handling mechanisms
- Evaluate a program incorporating all the python language constructs

UNIT – I: Objects, Numbers and Sequences

12

Python Basics, **Objects**- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types

Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules

Sequences - Strings, Lists, and Tuples, Mapping and Set Types

UNIT – II: Files, Exceptions and Modules

12

FILES: File Objects, File Built-in Function [open ()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules

Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, *Creating Exceptions, Why Exceptions?

Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module

UNIT – III: Regular Expressions and Multithread Programming 12

Regular Expressions: Introduction, Special Symbols and Characters, Res, and Python

Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules

UNIT – IV: Data Analysis Packages 12

Data Analysis Packages, NumPy, SciPy, Matplotlib, Pandas, SIlkearn, Regression, Classification, Code a Linear Regression in Python with scikit-learn, Principal Component Analysis (PCA)

UNIT – V: Database Programming 12

Introduction, Python Database Application Programmer’s Interface (DB-API), Object Relational Managers (ORMs)

Total Hours: 60

List of Experiments: 30 Hours

Lab 1: Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a.CSV file

Lab 2: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Lab 3: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Lab 4: Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Lab 5: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Lab 6: Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Lab 7: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.

Lab 8: Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library classes/API in the program.

Lab 9: Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.

Lab 10: Implement the non-parametric Locally Weighted Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs.

Web Links:

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://www.coursera.org/learn/python-data-analysis#syllabus>

COURSE OUTCOMES

CO1	Apply the skills of data inspecting and cleansing.	K3
CO2	Determine the relationship between data dependencies using python	K3
CO3	Can handle data using primary tools used for data science in Python	K1
CO4	Represent the useful information using mathematical skills	K4
CO5	Can apply the knowledge for data describing and visualization using tools.	K2

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	3	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	2	3
CO5	2	2	3	3	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
✓	✓	✓	✓	✓	✓

PCC	DATABASE MANAGEMENT SYSTEMS LAB	0	0	2	1
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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

Total Hours: 30

TEXT BOOKS:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill, 3rd Edition
2. Database System Concepts, Silberschatz, Korth, McGraw Hill, V edition.

REFERENCES BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C.J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

Web Links:

1. <https://www.mongodb.com/>
2. <https://university.mongodb.com/>

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

ASSESSMENT METHODS:

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

PCC	COMPUTER NETWORKS LAB	0	0	2	1
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COURSE OBJECTIVE:

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

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 Hours: 30

Text Book:

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

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.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

	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	3	2	3	2
CO2	3	3	3	3	2	2	0	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	0	1	2	2	3	2	3	2
CO5	2	3	3	3	2	2	1	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
✓			✓	✓

HSC	PERSONALITY DEVELOPMENT II	2	0	0	2
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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 Hours: 30**TEXT BOOKS:**

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

REFERENCE BOOKS:

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

Weblinks:

https://onlinecourses.nptel.ac.in/noc19_hs32/preview

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

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	2	3	2
CO2	3	3	3	3	2	-	-	-	-	2	3	2	-	-
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO4	3	3	3	3	2	-	-	-	-	2	3	2	-	-
CO5	2	3	3	3	2	-	-	-	-	2	3	2	3	2

ASSESSMENT METHODS:

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

BSC	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	3
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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 Hours: 45

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, New Delhi, (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,

CO1	Understand the core concepts, methods of ecological and physical sciences, their application in environmental problem-solving.	K3
CO2	Apply system concepts and methodologies to analyze, understand the interactions between social and environmental processes.	K4
CO3	Apply the ethical, cross-cultural, and historical context of environmental issues and the link between human and natural systems.	K3
CO4	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	K4
CO5	Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.	K2

Mapping of Course Outcomes to Program Outcomes

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

MC	CONSTITUTION OF INDIA	2	0	0	0
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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 Hours: 30

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.

Weblinks:

https://onlinecourses.nptel.ac.in/noc20_lw03/preview

COURSE OUTCOMES

CO1	Elaborate the constitution of India and its salient features.	K2
CO2	Know the fundamental rights and duties	K3
CO3	Discuss the Parliamentary Form of Government in India.	K3
CO4	Recognize the Directive Principles of State Policy.	K2
CO5	Understand and abide the rules of the Indian constitution and to appreciate different culture among the people.	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	2	-	-	-	2	2
CO2	3	2	2	3	2	-	2	2	2	-	-	-	3	3
CO3	3	3	2	3	3	-	3	2	3	-	-	-	3	3
CO4	3	3	3	3	3	-	3	3	3	-	-	-	3	3
CO5	3	3	3	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
✓			✓	✓

PCC	JAVA AND WEB PROGRAMMING	3	0	0	3
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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

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

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

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

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

Rest API development with spring boot, Spring boot project with STS/MAVEN, Controller and Rest Controller annotations, Request Body, Response Body annotations, Error handling with spring boot

Total Hours: 45

Text Books:

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

Reference Books:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
2. 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	0	0	0	0	0	0	0	0	3
CO2	3	2	2	2	2	0	0	0	0	0	0	0	0	3
CO3	3	2	3	2	2	0	0	0	0	0	0	0	0	3
CO4	3	2	2	2	3	0	0	0	0	0	0	0	0	3
CO5	2	2	3	2	3	0	0	0	0	0	0	0	0	3

ASSESSMENT METHODS:

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

PCC	MOBILE APPLICATION DEVELOPMENT	3	0	0	3
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COURSE OBJECTIVE:

- Understand the basics of Android devices and Platform.
- Acquire knowledge on basic building blocks of Android programming required for App development.
- Understand persistence Data storage mechanism in Android
- Understand advanced application concepts like networking, Animations and Google Maps services etc.
- Develop and publish Android applications in to Android Market

Introduction: Introduction to mobile application development, trends, introduction to various platforms, introduction to smart phones , Android platform: Android platform features and architecture, versions, comparison added features in each versions. ART(Android Runtime),ADB(Android Debug Bridge). Development environment/IDE: Android studio and its working environment, gradle build system, emulator setup Application anatomy: Application framework basics: resources layout, values, asset XML representation and generated R.Javafile ,Android manifest file.

UNIT II Android UI Design 9

GUI for Android: Introduction to activities, activities life-cycle, Android v7 support library from API21 for lower version support Intent :intent object, intent filters ,adding categories, linking activities, user interface design components Views and View Groups: Basic views, picker views, adapter views, Menu, App Bar etc, basics of screen design; different layouts. App widgets. Lollipop Material design: new themes, new widgets, Card layouts. Recycler View . Fragments: Introduction to activities, activities life-cycle.

UNIT III Data Persistence 9

Different Data persistence schemes: Shared preferences, File Handling, Managing data using NOSQL database, Firebase, Content providers: user content provider, Android in build content providers.

UNIT IV Back Ground Running Process, Networking and Telephony Services 9

Services :introduction to services – local service, remote service and binding the service, the communication between service and activity, Intent Service. MultiThreading: Handlers ,AsyncTask Android network programming :URLConnection, Connecting to REST-based and SOAP based Web services Broad cast receivers: Local Broadcast Manager, Dynamic broadcast receiver, System Broadcast. PendingIntent.

UNIT V Advanced Applications 9

Location based services: Google maps V2 services using Google API, Animations and Graphics: Property Animation ,View Animations, Drawable Animations Media and Camera API: Working with video and audio inputs, camera API Sensor programming: Motion sensors, Position sensors, Environmental sensors .

Total Hours: 45

REFERENCE BOOKS:

1. Greg Milette,Adam Stroud,“PROFESSIONALAndroid™ Sensor Programming”, John Wiley and Sons, Inc2012,ISBN/978111265055,9781280678943,978111227459
2. Paul Deital,HarveyDeital, Alexander Wald, “Android 6 for Programmers ,App Driven approach”,2015, Prentice Hall ,ISBN: 9780134289366

Web links:

<http://developer.android.com/training/index.html>
https://www.tutorialspoint.com/android/android_overview.html
<https://www.geeksforgeeks.org/android-studio-tutorial/>
<https://www.tutlane.com/tutorial/android/android-hello-world-app-example>

COURSE OUTCOMES

Course Outcome	Description	Knowledge Level
CO1	To analyze the basic concepts of Mobile application Development and well versed in the Android platform	K4
CO2	To develop the GUI design of Android	K6
CO3	To build file Handling programs in mobile application	K3
CO4	To construct a mobile application and store data in database	K3
CO5	To build animation and utilize telephony services	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	3	3	2	1	1	1	-	-	-	1	1	3
CO2	3	2	2	2	2	-	-	1	1	1	1	1	1	3
CO3	3	-	-	-	2	-	-	-	2	2	2	2	-	3
CO4	3	2	2	2	3	-	-	-	-	-	1	1	1	3
CO5	2	2	3	2	3	-	-	-	-	1	1	1	1	3

ASSESSMENT METHODS:

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

PCC	DEEP LEARNING AND PREDICTIVE MODELLING	3	0	2	4
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Learning Outcomes:

- Understand the fundamentals of Deep Learning
- Familiarize with Neural Networks aspects
- Recognize the tangible applications of ML and Neural Networks.

Course Outcomes:

- Implement deep learning models in Python using the PyTorch library and train them with real-world datasets.
- Design convolution networks for handwriting and object classification from images or video.
- Design recurrent neural networks with attention mechanisms for natural language classification, generation, and translation.
- Evaluate the performance of different deep learning models (e.g., with respect to the bias-variance trade-off, overfitting and underfitting, estimation of test error).
- Perform regularization, training optimization, and hyperparameter selection on deep models.

UNIT 1: The Fundamentals of Deep Learning 12

Differentiate Deep Learning from machine learning, Evolution of AI and ML: Historical Epochs, Deep Learning relevance. The matrix magic: Scalars->Vectors->Matrices->Tensors. Real-world data representation. Tensor operations and visualization, Visualizing Deep Learning, Elephant in the room.

Unit 2: Gradient Descent 12

Gradient Descent: Derivatives and tensors, Stochastic gradient descents, Backpropagation: our very own chain rule of differentiation! Layers: the atoms of DL, Models: the molecules of DL, Loss functions, Optimizers, Activation Functions: Application and types, Deep Learning in Action, Multiclass Classification and Regression. Overfitting and underfitting.

Unit 3: Convolutional Neural Networks and Recurrent Neural Networks 12

Convolution operation, Max pooling, Power of CNNs: abstraction across layers, reusing popular CNNs & fine-tuning. Recurrent Networks, LSTMs & GRU, Examples of simple RNNs, Complex recurrent neural networks: Overfitting in RNNs, Multi-layer RNNs, Multi-directional RNNs. Real- life examples: One-dimensional sequence processing, CNN+RNN.

Unit 4: Generative Deep Learning 12

Using LSTMs to synthesize text, Neural Style transfer and applications, Image synthesis with auto encoders, Generative Adversarial Networks, Generator, Discriminator, Generator vs Discriminator, Training GANs. MIMO Deep Learning models, Layers graphs: acyclic and directional, Bag of tricks: ensemble of models.

Unit 5: Tangential Topics of ML and Neural Networks 12

Information-Theoretic Machine Learning, Hebbian Learning, Competitive Learning, Boltzmann Learning, Radial Basis Function Networks. Introduction to Computer Vision.

Total Hours: 60

List of Experiments:

- Lab 1. Setting up the Spyder IDE Environment and Executing a Python Program
- Lab 2. Installing Keras, TensorFlow and Pytorch libraries and making use of them
- Lab 3. Artificial Neural Networks
- Lab 4. Convolutional Neural Networks
- Lab 5. Image Transformations
- Lab 6. Image Gradients and Edge Detection
- Lab 7. Image Contours
- Lab 8. Image Segmentation
- Lab 9. Harris Corner Detection
- Lab 10. Face Detection using Haar Cascades
- Lab 11: Introduction to CVIP Lab
- Lab 12: Image Geometry
- Lab 13: Binary Object Feature
- Lab 14: Edge Detection: Robert and Sobel
- Lab 15: Histogram Thresholding Segmentation

Web Links:

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://www.coursera.org/learn/python-data-analysis#syllabus>

COURSE OUTCOMES

Course Outcome	Description	Knowledge Level
CO1	Design a simple Neural Networks using Linear Perceptron	K5
CO2	Implement a Convolutional Neural Networks using TensorFlow	K6
CO3	Develop an application based on Recurrent Neural Network.	K3
CO4	Solve the Deep Reinforcement Learning problem.	K3
CO5	Build the Speech and Text applications based deep neural network	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	-	-	-	-	-	-	-	2	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	2	3
CO5	2	2	3	3	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
✓	✓	✓	✓	✓	✓

PCC	JAVA AND WEB PROGRAMMING LAB	0	0	2	1
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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 Hours: 30**Text /References**

- Java The Complete Reference , Herbert Schildt 7th Edition. Tata McGrawHill Edition
- Java 6 by Rogers Cadenhead, Laura Lemay, Pearson education
- Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition
- K. Arnold and J. Gosling, “The JAVA programming language”, Third edition,

Pearson Education, 2000

- Javascript A Beginners Guide, 3rd Edition – John Pollock - Tata McGraw-Hill Edition

Web Links:

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

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 Web Services for client server applications	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	-	-	-	-	-	-	0	2	3	3
CO3	2	2	2	2	-	-	-	-	-	-	0	2	2	2
CO4	2	2	3	3	-	-	-	-	-	-	0	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	0	3	1	3

ASSESSMENT METHODS:

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

PCC	MOBILE APPLICATION DEVELOPMENT LAB	0	0	2	1
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List of Experiments:

1. To implement mobile application life cycle methods.

2. To implement simple calculator application.
3. To implement simple SMS application.
4. To implement authentication verification application without and with database.
5. To implement navigation application with multiple pages / activities.
6. To implement student placement registration form with database.
7. To implement a simple notification application.
8. To implement simple intent with data passing application
9. To implement simple profile changer application through SMS.
10. To create mobile web browser application.
11. To create mobile e-mail application to sent a mail.
12. Mini project.

Total Hours: 30

Text Book/References:

1. Build Your Own Security Lab, Michael Gregg, Wiley India
2. Greg Milette, Adam Stroud, "PROFESSIONAL Android™ Sensor Programming", John Wiley and Sons Inc 2012, ISBN/978111265055, 9781280678943, 978111227459

Web links:

1. <http://developer.android.com/training/index.html>

COURSE OUTCOMES

CO1	Build a mobile application which implements the Lifecycle method	K1
CO2	Create a mobile application which stores the data in the database	K3
CO3	Design a mobile application which implements features like SMS and email	K4
CO4	Evaluate the application which navigates to different web pages	K1
CO5	Develop a notification application	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	3	3	3	2	3	2	1	2	3
CO2	3	2	3	2	2	3	2	1	3	2	3	2	3	2
CO3	3	3	2	2	2	0	2	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	2	3	3	3	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
✓			✓	✓

HSC	PERSONALITY DEVELOPMENT III	2	0	0	2
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COURSE OBJECTIVE:

- To enhance the communication, interpersonal, group skills.

UNIT I Verbal Aptitude 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 Hours: 30

TEXT/REFERENCE BOOKS:

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

2. Shejwalkar and Ghanekar, Principles and Practices of Management, Mc Graw Hill Latest.
3. Roberta Roesch, Time management for Busy people, Tata McGraw–Hill Edition

REFERENCE BOOKS:

1. D. P. Sabharwal, Personality Development Handbook, Fingerprint publishing, 2021
2. Dr V M Selvaraj, Personality Development, Bhavani Publications

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc22_hs08/preview

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

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	1	2	3
CO2	3	2	3	2	2	-	-	-	-	-	3	2	3	2
CO3	3	3	-	-	2	-	-	-	-	-	3	-	-	3
CO4	2	3	2	2	3	-	-	-	-	-	3	-	-	3
CO5	2	3	3	2	3	3	3	3	3	3	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
✓	✓	✓	✓	✓	

PCC	.NET PROGRAMMING	3	0	0	3
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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.

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 Hours: 45

TEXT BOOKS:

1. Balagurusamy. E, “Programming in C#”, Tata McGraw-Hill, 2004. (Unit I, II)
2. Liberty.J, “Programming C#”, 2nd Edition., O’Reilly, 2002. (Unit III, IV, V)
3. Bill Hamilton, Matthew MacDonald , “ ADO.NET in a Nutshell “ ,O’Reilly Media (Unit III)
4. Jesse Liberty, Dan Maharry, Dan Hurwitz . “Programming ASP.NET 3.5” 4th Edition , O’Reilly Media (Unit IV)

REFERENCES:

1. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw-Hill, 2004.
2. Robinson et al, “Professional C#”, 2nd ed., Wrox Press, 2002.
3. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.
4. ThamaraiSelvi, R. Murugesan, “A Textbook on C#”, Pearson Education
5. ADO.NET in a Nutshell By Bill Hamilton, Matthew MacDonald Publisher: O’Reilly Media.
6. Programming ASP.NET 3.5, 4th Edition By Jesse Liberty, Dan Maharry, Dan HurwitzPublisher: O’Reilly Media

Web Links:

1. <https://ict.iitk.ac.in/courses/introduction-to-c-sharp/>
2. <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	K1
CO2	Familiar about Object Oriented concepts in C# language	K5
CO3	Demonstrate how to retrieve data from database using ADO.NET programming	K3
CO4	Develop ASP.NET based web application using C#	K2
CO5	Develop desktop based, modern web based applications using Model View Controller	K2

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	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

ASSESSMENT METHODS:

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

PCC	COGNITIVE LEARNING				3	0	0	3
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Learning Outcome:

- Develop and understand the concept of Cognitive theory
- Develop knowledge-based problem-solving skills

COURSE OUTCOMES:

- Analyse different statuses of Cognitive Learning and able to identify different memory models.
- Compare different feature and network models and demonstrate different pattern recognition techniques.
- Comprehend the language by defining the errors and context and able to analyse the classification of problems.

Unit 1: Introduction to Cognitive Theory and human Brain 9

Cognitive Approach: Origin and Current status of Cognitive Psychology. Attention Processes: Selective Attention and its theories. Divided attention a resource allocation; Biological basis.

Unit 2: Perceptual Processes and Memory 9

Perceptual Processes, Pattern Recognition; Picture Perception. Memory: Models of Memory, Structural and Levels of processing models, Tulving's Episodic, Autobiographical and Procedural models; McClelland's PDP approach; Short Term

Memory, Mood & Memory; Autobiographical Memory; flash bulb memories; Memory for Action; Eye-witness Testimony; memory improvement.

Unit 3: General Knowledge 9

Semantic Memory: Nature, methodology, and structure; Feature comparison model and Network models; Concept Formation: Well Defined concepts -Features and Rules: Empirical determinants and selection Strategies; Ill-defined concepts (Natural Categories): Resemblance; Schemas in relation to memory selection, abstraction, interpretation, and integration.

Unit 4: Language Comprehension 9

Spoken language: Speech perception, Constituent structure, Transformational grammar; Factors affecting comprehension; Reading: Perceptual processes and theories of word recognition; Discovering Meaning; Interference in Reading; Meta cognition.: Language Production: Speaking: Selecting the context; Errors in Speaking; Gestures and Context.

Unit 5: Problem Solving, Creativity and Logical Reasoning: 9

Classification of problems; Newell and Simon's Theory; Problem-solving Approaches: Means-end, Heuristics, The Analogy approach, and other strategies; Class-room problem solving. Creativity: Nature and Measurement; Factors affecting Creativity.

Total Hours: 45

Text Books:

1. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, 1999.

References:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, <https://dippl.org/>.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, <https://probmods.org/>.

Web Links:

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://www.coursera.org/learn/python-data-analysis#syllabus>

COURSE OUTCOMES

CO1	Develop and understand the concept of Cognitive theory	K3
CO2	Develop knowledge-based problem-solving skills	K3
CO3	Analyse different statuses of Cognitive Learning and able to identify	K1

	different memory models.	
CO4	Compare different feature and network models and demonstrate different pattern recognition techniques.	K4
CO5	Comprehend the language by defining the errors and context and able to analyse the classification of problems	K2

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	3	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	2	3
CO5	2	2	3	3	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
✓	✓	✓	✓	✓	✓

PCC	. NET PROGRAMMING LABORATORY	0	0	2	1
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LIST OF EXPERIMENTS

- Implement C# program
 - Write a program in C# to count a total number of alphabets, digits and special characters in a string.
 - Write a program in C# to count a total number of duplicate elements in an array.
 - Design program to implement Stack in c#.
- Basic C# program
 - Calculate Hypotenuse of triangle using dynamic initialization of variables
 - To get input from the user and perform calculations
 - Calculate the quadrant for the coordinates using if..else...ladder
 - Check whether the alphabet is a vowel or not using switch..case...
 - To understand about for..each loop and strings
- Create a login page using controls.
- 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

Total Hours: 30

Text Books:

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

Reference Books:

1. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw-Hill, 2004.
2. Robinson et al, “Professional C#”, 2nd ed., Wrox Press, 2002.

Web Links:

1. <https://www.tutorialspoint.com/dot net/index.html>
2. <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	PSO2
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

ASSESSMENT METHODS:

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

PCC	COGNITIVE LEARNING LAB	0	0	2	1
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List of Experiments:

- Lab 1: Facial Recognition
- Lab 2: Image Recognition
- Lab 3: Speech Recognition
- Lab 4: Gesture Recognition
- Lab 5: Pattern Recognition
- Lab 6: Feature Comparison Models
- Lab 7: Lab Recognition
- Lab 8: Network Models

Total Hours: 30**Text Books:**

1. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, 1999

References:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, <https://dippl.org/>.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, <https://probmods.org/>.

Web Links:

1. <https://nptel.ac.in/courses/106/106/106106179/>
2. <https://www.codecademy.com/learn/learn-python>
3. <https://www.coursera.org/learn/python-data-analysis#syllabus>

COURSE OUTCOMES

CO1	Develop and understand the concept of Cognitive theory	K3
CO2	Develop knowledge-based problem-solving skills	K3
CO3	Analyze different statuses of Cognitive Learning and be able to identify different memory models.	K1
CO4	Compare different feature and network models and demonstrate different pattern recognition techniques.	K4
CO5	Comprehend the language by defining the errors and context and able to analyze the classification of problems	K2

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	3	2	-	-	-	-	-	-	-	2	3
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	3
CO4	3	3	2	3	2	-	-	-	-	-	-	-	2	3
CO5	2	2	3	3	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
✓	✓	✓	✓	✓	✓

HSC	PERSONALITY DEVELOPMENT IV	2	0	0	2
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COURSE OBJECTIVES:

- To enhance the soft skills and prepare them towards the skills needed for their career.

UNIT I **Soft Skills** **6**

Assertiveness – Meaning – Importance of assertiveness – Characteristics of Assertive communication – Merits – forms of assertion – Causes of misunderstanding

UNIT II **Communication Skills** **6**

Meaning – Elements of Communication – Functions of Communication – Principles of

Communication Formal and Informal Communication – Barriers in Communication – Characteristics of good – communication – Feedback – Communication systems.

UNIT III Presentation Skills 6

Meaning – Importance of Presentation – Concept of 5 W’s and one H – understanding the audience – Types of presentations – How to make effective presentation.

UNIT IV Presentation Skills II 6

Use of slide, PPT’s and visuals – Rules for slide presentation – precautions – seminars and conferences – Steps to eliminate Stage fear.

UNIT V Change Management 6

Definition – Necessity – Resistance towards Change – 10 Principles of Change Management – Leaders approach – Effective Change management.

Total Hours: 30

TEXT BOOKS:

1. LaClair, J. and Rao, R. Helping Employees Embrace Change, McKinsey Quarterly, 2002, Number 4.
2. Spencer Johnson, Who Moved My Cheese, Vermilion, First edition
2. Adair, John, Effective Communication, London: Pan Macmillan Ltd., 2003.

REFERENCE BOOKS:

1. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today, Tenth Edition. New Jersey: Prentice Hall, 2010.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc22_hs08/preview

COURSE OUTCOMES

CO1	Be assertive in their communication.	K3
CO2	Differentiate the principles of formal and informal communication.	K4
CO3	Make an effective presentation by understanding the audience.	K3
CO4	Practice the rules of presentation using slides, PPT’s and visuals.	K3
CO5	Discuss the principles of change management.	K2

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	3	2	2	-	-	2	-	2	2	-	2
CO2	2	3	2	2	2	2	-	-	2	-	2	2	-	3
CO3	3	2	3	2	2	1	-	-	2	-	2	2	-	1
CO4	2	2	3	3	2	2	-	-	2	-	2	2	-	2

CO5	3	3	3	3	2	3	-	-	2	-	2	3	-	3
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ASSESSMENT METHODS:

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

PCC	FULL STACK WEB DEVELOPMENT	3	0	0	3
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COURSE OBJECTIVES

To understand the various components of full stack development

- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Angular and Express in web applications
- To develop simple web applications with React

UNIT I Basics of Full Stack 9

Understanding the Basic Web Development Framework - User - Browser – Webserver – Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

UNIT III Mongo DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV Express and Angular 9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering

Total Hours: 45

Text Books:

1. T1: Brad Dayley, Brendan Dayley, Caleb Dayley, ‘Node.js, MongoDB and Angular Web Development’, Addison-Wesley, Second Edition, 2018
2. Vasanth Subramanian, ‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019.

Reference Books:

1. Chris Northwood, ‘The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer’, Apress; 1st edition, 2018
2. Kirupa Chinnathambi, ‘Learning React: A Hands-On Guide to Building Web Applications Using React and Redux’, Addison-Wesley Professional, 2nd edition, 2018
3. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
4. <https://www.coursera.org/specializations/full-stack-react>
5. <https://www.udemy.com/course/the-full-stack-web-development/>

Web Links:

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

COURSE OUTCOMES

CO1	Understand the various stacks available for web application development	K1
CO2	Use Node.js for application development	K5
CO3	Develop applications with MongoDB	K4
CO4	Use the features of Angular and Express	K6
CO5	Develop React applications	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

ASSESSMENT METHODS:

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

PCC	FULL STACK WEB DEVELOPMENT LAB	0	0	2	1
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Course Objectives

- To develop full stack applications with clear understanding of user interface, business logic and data storage.
- To design and develop user interface screens for a given scenario
- To develop the functionalities as web components as per the requirements
- To implement the database according to the functional requirements
- To integrate the user interface with the functionalities and data storage.

List of Experiments:

1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.
2. Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them
4. Create a food delivery website where users can order food from a particular restaurant listed in the website.
5. Develop a classifieds web application to buy and sell used products.
6. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.

7. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.
8. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.
9. Create your own web application
10. Mini Project

Total Hours: 30

Text Books:

1. Amos Q. Haviv, MEAN Web Development, 2nd Revised edition, Packt Publishing
2. Ethan Brown, Web Development with Node and Express, Oreilly

Reference Books:

Colin J Ihrig , Adam Bretz Full Stack JavaScript Development With MEAN, First Edition

Web Links:

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

COURSE OUTCOMES

CO1:	Design full stack applications with clear understanding of user interface, business logic and data storage	K3
CO2:	Design and develop user interface screens	K4
CO3:	Implement the functional requirements using appropriate tool	K4
CO4:	Design and develop database based on the requirements	K6
CO5:	Integrate all the necessary components of the application	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

ASSESSMENT METHODS:

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

LIST OF ALL PROFESSIONAL ELECTIVE COURSES

PEC	APPLIED CRYPTOGRAPHY	3	0	0	3
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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 Hours: 45

TEXT BOOK :

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

REFERENCE BOOKS :

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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc20_cs02/preview

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	0	1	2	0
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

ASSESSMENT METHODS:

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

PEC	BIG DATA PROGRAMMING	3	0	0	3
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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.

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:

1. Prajapati, Big Data Analytics with R and Hadoop, 2014
2. Stephan Kudyba, Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications, March 12, 2014 .
3. 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
4. Jason Rutherglen, Dean Wampler and Edward Capriolo, Programming Hive, O'REILLY, 2012

Reference Books:

1. Michael Berthold, David J. Hand, —Intelligent Data Analysisll, Springer, 2007.
2. Tom White — Hadoop: The Definitive Guidel Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk De Roos, Tom Deutsch, George Lapis, Paul Zikopoulos, —Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Datal, McGraw Hill Publishing, 2012
4. Anand Rajaraman and Jeffrey David Ullman, —Mining of Massive Datasets, Cambridge University Press, 2012.
5. Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, JohnWiley& sons, 2012.
6. Glenn J. Myatt, —Making Sense of Data, John Wiley & Sons, 2007
7. Dr. Mark Gardener, Beginning R: The Statistical Programming Language (Wrox), 2013
8. PeteWarden, —Big Data Glossary, O'Reilly, 2011.
9. Jiawei Han, MichelineKamber —Data Mining Concepts and Techniques, Second Edition, Elsevier, Reprinted 2008.
10. Da Ruan,Guoqing Chen, Etienne E.Kerre, GeertWets, Intelligent Data Mining, Springer,2007
11. 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.
12. 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
13. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011

Weblinks:

1. <https://nptel.ac.in/courses/106104189>

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
✓	✓		✓	✓	

PEC	CLOUD COMPUTING	3	0	0	3
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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:

1. 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.
2. T2: Rajkumar Buyya, Christian Vecchiola. S.Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, 2013.

Reference Books:

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O’Reilly.
3. Ronald L. Krutz, Russell Dean Vines, “Cloud Security – A comprehensive Guide to Secure Cloud Computing”, Wiley – India, 2010.
4. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs20/preview.
2. <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 applications.	K5
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	-	3	-	-	-	-	-	-	-	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	-	-	3
CO3	3	2	3	3	3	-	-	-	-	-	-	-	-	3
CO4	2	2	2	3	-	-	-	-	-	-	-	-	-	3
CO5	-	2	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
✓	✓		✓		

PEC	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3
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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

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

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

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**

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**

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 Hours: 45**Text Books:**

1. T1 William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003.
2. T2 Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2013

Reference Books:

1. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
2. 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	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

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 FORENSICS	3	0	0	3
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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 hours

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 Guillosoy, —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:

1. <https://nptel.ac.in/courses/106106129>
2. <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

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

PCC	DATA WAREHOUSING AND DATA MINING	3	0	0	3
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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, and implication.
- 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 Transformation Tools, 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 for Applications – Cognos Impromptu Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet -Data Cube Technology, From Data warehousing to Data Mining.

UNIT III Data Mining 9

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data 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 Based Association Mining – Classification and Prediction – Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification By Back propagation – 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 hours

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”, Second Edition, Elsevier, 2007.(III to 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 and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition, 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 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

ASSESSMENT METHODS:

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

PEC	E - COMMERCE			3	0	0	3
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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 Hours: 45

Text Books:

1. T1 Ravi Kalakota, Andrew B. Whinston “ Frontiers of Electronic Commerce”,Pearson Education, 2008
2. T2 Gary PSchneider “Electronic commerce”, Thomson learning & James TPeny Cambridge USA, 2001
3. T3 Manlyn Greenstein and Miklos “Electronic commerce” McGraw-Hill, 2002.

Reference Books:

1. R1 Efrain Turvan J. Lee, David Kug and Chung, "Electronic Commerce" Pearson Education Asia 2001.
2. R2 Brenda Kienew Ecommerce Business Prentice Hall, 2001.

Weblinks:

https://archive.nptel.ac.in/content/storage2/courses/106108103/pdf/Worked_Examples/WKm13.pdf

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	0	0	0	0	0	0	0	0	3
CO2	3	2	2	2	2	0	0	0	0	0	0	0	0	3
CO3	3	3	3	2	2	0	0	0	0	0	0	0	0	3
CO4	2	3	2	2	3	0	0	0	0	0	0	0	0	3
CO5	3	2	3	2	3	0	0	0	0	0	0	0	0	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		ETHICAL HACKING	3	0	0	3
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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

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, Hactivism - 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

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

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

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

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 Hours: 45

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, James E. “Corley, Hands-On Ethical Hacking and Network Defense”, Second Edition, CENGAGE Learning, 2010.

REFERENCE BOOKS:

1. Steven DeFino, Barry Kaufman, Nick Valenteen, “Official Certified Ethical Hacker Review Guide”, CENGAGE Learning, 2009-11-01.
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Basics Series – Elsevier, August 4, 2011.
3. Whitaker & Newman, “ Penetration Testing and Network Defense” , Cisco Press, Indianapolis, IN, 2006

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

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

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

PEC	INFORMATION RETRIEVAL	3	0	0	3
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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: Characterizing 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.

XML Retrieval – Multimedia IR – Parallel and Distributed IR – Digital Libraries – Social Media Retrieval – Content-based Image Retrieval – Online Public Access Catalogs (OPACs).

Total Hours: 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.

Weblinks:

1. <https://nptel.ac.in/courses/106101007>

COURSE OUTCOMES

After the completion of this course, students will be able to:

CO1:	Describe various IR modeling techniques	K3
CO2:	Identify and design the various components of an Information Retrieval system	K3
CO3:	Apply machine learning techniques to text classification and clustering for efficient Information Retrieval	K3
CO4:	Describe various IR applications	K2
CO5:	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
CO1	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO2	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO3	3	2	2	-	1	-	-	1	1	1	-	1	2	3
CO4	2	1	1	-	1	-	-	1	1	1	-	1	1	2
CO5	3	2	2	-	1	-	-	1	1	1	-	1	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	OBJECT ORIENTED ANALYSIS AND DESIGN	3	0	0	3
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Course Objective:

1. To understand the system modelling and design based on requirements, converting design to code.
2. To use various UML design diagrams and to apply the appropriate design patterns.
3. To learn the basic Object oriented analysis and design skills through an elaborate case study.
4. 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 diagram UML 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 for identifying 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 Hours: 45

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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc19_cs48/preview

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 the test Cases, test Plan and Myer's Debugging Principles	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	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
			✓	✓

PEC	SOFT COMPUTING	3	0	0	3
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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; Unsupervised 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 Hours: 45

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, Eiji Mizutani, “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.

Weblinks:

1. <https://archive.nptel.ac.in/courses/106/105/106105173/>

COURSE OUTCOMES

Upon completion of this course, the students should be able to:

CO1:	Understand various soft computing techniques	K2
CO2:	Design and develop different neural network algorithms	K3
CO3:	Analyse and apply fuzzy logic and fuzzy inference system	K3
CO4:	Solve problems using Genetic Algorithms	K3
CO5:	Apply various soft computing techniques for complex problems	K3

CO PO MAPPING

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

ASSESSMENT METHODS

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

PEC	SOFTWARE ENGINEERING	3	0	0	3
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Course Objective:

1. To understand the phases in a software project
2. To understand the fundamental concepts of requirements engineering and Analysis Modeling.
3. To understand the various software design methodologies
4. 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 Hours: 45

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 Private Limited, 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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview

COURSE OUTCOME

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

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

ASSESSMENT METHODS:

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

PEC	SOFTWARE PROJECT MANAGEMENT	3	0	0	3
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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 Hours: 45**TEXT BOOK:**

1. Bob Hughes, Mikecoterrell, “Software Project Management”, Third Edition, Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Ramesh, Gopaldaswamy, "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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

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	0	0	0	1	0	0	0	2	3
CO2	3	2	2	3	3	0	0	0	1	0	0	0	2	3
CO3	3	3	3	3	3	0	0	0	1	0	0	0	2	3
CO4	3	3	2	3	3	0	0	0	1	0	0	0	2	3
CO5	2	2	3	3	3	0	0	0	1	0	0	0	2	3
	2.8	2.6	2.6	3	3	0	0	0	1	0	0	0	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	SOFTWARE QUALITY ASSURANCE	3	0	0	3
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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.

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.

Weblinks:

1. <https://nptel.ac.in/courses/106101163>

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

ASSESSMENT METHODS:

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

PEC	SOFTWARE TESTING	3	0	0	3
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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.

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 Hours: 45

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,

Weblinks:

- 1.<https://nptel.ac.in/courses/106101163>

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

ASSESSMENT METHODS:

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

PEC	SYSTEM SOFTWARE				3	0	0	3
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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 - Machine-independent 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:**

1. Leland L. Beck, “System Software – An Introduction to Systems Programming”, 3rd Edition, Pearson education Asia, 2006.
2. John R. Levine, “Linkers & Loaders”, Morgan Kauffman, 2003.

REFERENCE BOOKS:

1. John J. Donovan “Systems Programming”, Tata McGraw-Hill Edition, 2000.
2. D. M. Dhamdhare, “Systems Programming and Operating Systems”, Second Revised Edition, Tata McGraw Hill, 2000.
3. John R. Levine, Linkers & Loaders – Harcourt India Pvt. Ltd., Morgan Kaufmann Publishers, 2000.
4. Srimanta Pal, “ Systems Programming “ , Oxford University Press, 2011.

Weblinks:

1.<https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs05/>

COURSE OUTCOMES

After completion of course, students would be able to:

CO1	Demonstrate the machine architecture of SIC and SIC/XE.	K4
CO2	Identify the different assembler modes and features.	K6
CO3	Analyse different loaders with various linkage methods.	K4
CO4	Identify the functionalities of macro processing and analyse the virtual machine implementation.	K6
CO5	Apply the basic concepts of data base management systems with programming coding standards.	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	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

ASSESSMENT METHODS:

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

PEC	USER INTERFACE DESIGN	3	0	0	3
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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 Hours: 45

TEXT BOOKS:

1. T1: Wilbent. O. Galitz ,“The Essential Guide To User Interface Design”, John Wiley& Sons, 2007.
2. 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:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. <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.	K4
CO2	Discuss User Interface Design Process, Obstacles and Usability	K6
CO3	Compare Window Characteristics, Presentation Styles, Organizations and Operations	K4
CO4	Discuss International Consideration and Accessibility of multimedia	K6
CO5	Analyze the concept of Visualization and Hypermedia	K5

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	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

ASSESSMENT METHODS:

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

PEC	VIRTUAL REALITY	3	0	0	3
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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 Modeling

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 Hours: 45**TEXT BOOK :**

1. T1: John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.

REFERENCE BOOKS:

1. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
2. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.
3. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

Web Links:

1. <https://nptel.ac.in/courses/106106138>
2. www.vresources.org
3. www.vrac.iastate.edu
4. 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	K4
CO2	Explain Geometric Modelling Know ,Geometric Transformations and Generic VR system	K6
CO3	Appraise the details of Physical Simulation in Virtual Environment	K4
CO4	Explain Integrated VR systems, VR Software and VRML	K6
CO5	Develop a Virtual Reality Applications with different modes of interaction	K5

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	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

ASSESSMENT METHODS:

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

PEC	AGILE METHODOLOGIES	3	0	0	3
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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

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

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

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

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**

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:**

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

REFERENCE BOOKS:

1. Craig Larman, “Agile and Iterative Development: A Manager’s Guide”, Addison-Wesley, 2004.
2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction, and Management”, Butterworth-Heinemann, 2007.

Web Links:

1. <https://www.guru99.com/scrum-testing-beginner-guide.html>
2. <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

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

ASSESSMENT METHODS:

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

PEC	INFORMATION SECURITY	3	0	0	3
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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 Hours: 45**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:

1. <http://web.cse.ohio-state.edu/~champion.17/4471/>
2. <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 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	3	3	3	-	-	-	-	-	2	2	3	2
CO2	3	3	3	3	3	-	-	-	-	-	2	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	2	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3	2
CO5	2	3	3	3	3	-	-	-	-	-	2	2	3	2

ASSESSMENT METHODS:

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

PEC	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

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 Data Planes

UNIT II Open Flow & SDN Controllers 9

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

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

UNIT IV SDN Programming**9**

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**

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:

1. https://opennetworking.org/wp-N_ARCH_1.0_06062014.pdfOnline
2. <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	2
CO2	3	2	2	2	2	-	-	-	1	1	-	-	2	2
CO3	2	2	2	2	3	-	-	-	1	1	-	-	2	2
CO4	2	2	2	2	2	-	-	-	1	1	-	-	2	2
CO5	2	2	3	2	3	-	-	-	1	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
✓			✓		

PEC	BLOCK CHAIN TECHNOLOGIES	3	0	0	3
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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

Basics of blockchain-Public Ledgers-Block Chain as Public Ledgers-Types of Block chains- Pillars of Block chain-Government Initiatives of BlockChain-Bitcoin-SmartContracts

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

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	3	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
✓			✓		

PEC	NATURAL LANGUAGE PROCESSING	3	0	0	3
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COURSE OBJECTIVES

- To learn the fundamentals of natural processing
- To understand the way to measure one or more qualities of an algorithm or a system
- To gain knowledge of the linguistics concerned with the interactions between computers and human.

UNIT 1 Overview and Language Modelling

9

Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

UNIT 2 Word Level Analysis 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT 3 Syntactic Analysis 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT 4 Information Retrieval And Lexical Resources 9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.

UNIT 5 Discourse Analysis And Lexical Resources 9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brills Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Total Hours: 45

TEXT / REFERENCE BOOKS

1. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
2. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
3. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc19_cs56/preview

COURSE OUTCOMES

CO1	Understand NLP problems and survey the literature about that problem	K5
CO2	Understand language modeling	K4
CO3	Describe automated natural language generation and machine translation	K5
CO4	Learn the natural language generation.	K3
CO5	Analyse the logic and semantics of world knowledge	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	2	2	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	2	-	-	-	-	-	-	1	3	2
CO3	2	3	1	2	2	-	-	-	-	-	-	2	-	-
CO4	2	3	-	-	-	2	3	2	2	3	3	2	3	3
CO5	2	3	3	3	3	1	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
✓			✓		

PEC	APPLICATIONS OF AI	3	0	0	3
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COURSE OBJECTIVES

- To give deep knowledge of AI and how AI can be applied in various fields to make the life easy

UNIT I

9

Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.

UNIT II

9

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 **9**

Robotic Processes Automation for supply chain management.

UNIT IV **9**

AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology & Security using AI.

UNIT V **9**

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:

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.
2. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published July 2018.
3. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, published March 2017.
4. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

Reference Books:

1. Somogyi, Zoltán. The Application of Artificial Intelligence: Step-by-Step Guide from Beginner to Expert. Switzerland, Springer International Publishing, 2022.
2. Artificial Intelligence Applications in Information and Communication Technologies. Germany, Springer International Publishing, 2015.

Web Links:

https://opennetworking.org/wp-N_ARCH_1.0_06062014.pdfOnline

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

ASSESSMENT METHODS:

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

PEC	ARTIFICIAL INTELLIGENCE FOR CYBER SECURITY	3	0	0	3
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COURSE OBJECTIVES

- To learn the need of AI for Cyber Security
- To learn the detection of DDOS using AI techniques
- To learn the intrusion detection using Neural Networks
- To learn the various applications of AI to detect cyber attacks

UNIT I Fundamentals of AI and DDOS

9

Introduction – Problems that AI Solves – Why AI in Cyber security – Current Cyber Security Solutions -Structured data, Unstructured data – Supervised learning – Unsupervised learning –Reinforcement learning – classification problem - clustering problems – SVM – ANNs. Time series – Types of Time series – Time Series analysis in Cyber Security – Detecting DDOS with Time Series – Predicting DDOS attacks – Ensemble Techniques for Cyber security – Types of Ensemble – Types of Ensemble

Algorithms – Bagging, Boosting, Stacking, Bayesian Model - Ensemble Method to detect Cyber attack.

UNIT II Detection of malicious web pages, URLs 9

URL Blacklisting – Drive by download URL- Command and Control URLs – Phishing URLs – Using Heuristics to detect Malicious Pages – Data for the analysis – Feature Extraction – Lexical Features – Web Content based Features – Host based features – site Popularity features.

UNIT III CAPTCHA and Event Detection 9

Using AI to crack CAPTCHA – Types of CAPTCHA – ReCAPTCHA – Breaking a CAPTCHA – Solving CAPTCHA with neural network - Machine Learning in Scan Detection - Machine-Learning- Applications in Scan Detection - Context based Malicious event detection – Adware – Bots –Bugs – Ransomware – Rootkit – Spyware – Trojan horses – Viruses – Worms – Malicious Injections in Wireless networks-Context based Malicious event detection – Adware – Bots –Bugs – Ransomware – Rootkit – Spyware – Trojan horses – Viruses – Worms – Malicious Injections in Wireless networks

UNIT IV AI and IDS 9

Architecture of IDS based on Neural networks – Intelligent flow based IDS - Multi-Agent IDS – AI based Ensemble IDS – Machine Learning in Hybrid Intrusion Detection Systems - Machine- Learning Applications in Hybrid Intrusion Detection: Anomaly - Misuse Sequence Detection System - Parallel Detection System.

UNIT V AI and Mail Server 9

Types of Mail Server – Data Collection from mail server – Naive Bayes theorem to detect spam –Laplace smoothing – Featurization Techniques to convert text based emails to numeric values – Logistic regression to spam filters - Anomaly detection techniques for SMTP and HTTP.

Total Hours: 45

Text Books:

1. Hands-On Machine Learning for Cyber Security: Safeguard your system by making your machine intelligence using the python ecosystem, Soma Harder, Sinan Ozdemir, Packt Publishing Ltd, 2018.
2. The state of the Art in Intrusion Detection System, AI-Sakib Khan Pathan, CRC Press, Taylor &
3. Francis Group, 2014.
4. Data Mining and Machine Learning in Cyber Security, Sumeet Dua and Xian Du, CRC Press, 2011.

Reference Books:

1. Cyber security for Dummies, Brian Underdahl, Wiley, 2011.
2. Cryptography and Network security, Behrouz A. Forouzan, Debdeep Mukhopadhyay, Mcgraw Hill Education, 2nd Edition, 2011

Web Links:

https://opennetworking.org/wp-N_ARCH_1.0_06062014.pdfOnline

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

ASSESSMENT METHODS:

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

PEC	ARTIFICIAL INTELLIGENCE IN BLOCK CHAIN	3	0	0	3
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COURSE OBJECTIVES

The objective of this course is to:

- To introduce the concept and the basics of blockchain technologies,
- To provide knowledge on various applications of blockchain technologies
- To comfortably discuss and describe the history, technology, and applications of blockchain

UNIT I Introduction to Blockchain and its applications 9

Blockchain Introduction, history of blockchain, other technologies spawned from blockchain, mechanism behind blockchain, limitations and challenges of blockchain, Demystifying the blockchain, uses of blockchain, new components of blockchain, challenges in the use of blockchain technology, applications of blockchain technology.

UNIT II Blockchain Consensus 9

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate

UNIT III Blockchain and cryptocurrency 9

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

UNIT IV AI in Blockchain and Blockchain implementation 9

The Blockchain as a Path to Artificial Intelligence, data collection, cleaning, and processing in AI modelling, Smart Contract Advocates on Behalf of Digital Intelligence, Hyperledger, Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation

UNIT V Ethereum 9

Directed Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

TOTAL :45 hours

Text Books:

1. Blockchain for Beginners: The Complete Step by Step Guide to Understanding Blockchain Technology, Mark Watney, 2017
2. Blockchain: Step-By- Step Guide to Understanding and Implementing Blockchain Technology, Paul Laurence, 2018

Reference Books:

1. Ganesh Prasad Kumble , —Hands-On Artificial Intelligence for Blockchain: Converging Blockchain and AI to build smart applications for new economies| 2020
2. Kiran Garimella, Peter Fingar, Vint Cerf, —AI + Blockchain| 2018
3. Stein Smith, Sean , Blockchain, Artificial Intelligence and Financial Services
4. Implications and Applications for Finance and Accounting Professionals, Springer, 2020

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

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

ASSESSMENT METHODS:

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

PEC	TEXT AND SPEECH ANALYSIS	3	0	0	3
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COURSE OBJECTIVES

- Understand natural language processing basics

- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

UNIT I Natural Language Basics 9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.

UNIT II Text Classification 9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models.

UNIT III Question Answering and Dialogue Systems 9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -- evaluating dialogue systems.

UNIT IV Text-To-Speech Synthesis 9

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems.

UNIT V Automatic Speech Recognition 9

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

Total hours :45

Text Books:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

Reference Books:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.

4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

COURSE OUTCOMES

CO1:	Explain existing and emerging deep learning architectures for text and speech processing	K5
CO2:	Apply deep learning techniques for NLP tasks, language modelling and machine translation	K3
CO3:	Explain coreference and coherence for text processing	K5
CO4:	Build question-answering systems, chatbots and dialogue systems	K4
CO5:	Apply deep learning models for building speech recognition and text-to-speech systems	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	3	3	3	-	-	-	1	2	1	2	1	1
CO2	3	1	2	2	3	-	-	-	2	2	1	3	2	2
CO3	2	2	1	2	1	-	-	-	3	3	1	2	3	3
CO4	2	1	1	2	2	-	-	-	2	1	2	2	3	1
CO5	1	3	2	2	1	-	-	-	3	2	1	1	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	KNOWLEDGE ENGINEERING	3	0	0	3
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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 – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

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 On answering And Dialogue Systems 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 Reasoning 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.

Total hours :45

Text Books:

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. R1: Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. R2: Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. R3: John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. R4: King , Knowledge Management and Organizational Learning , Springer, 2009.
5. R5: Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

COURSE OUTCOMES

CO1:	Understand the basics of Knowledge Engineering.	K1
CO2:	Apply methodologies and modelling for Agent Design and Development	K3
CO3:	Design and develop ontologies.	K5
CO4:	BuiApply reasoning with ontologies and rules	K3
CO5:	Understand learning and rule learning	K1

Mapping of Course Outcomes to Program Outcomes

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

- Formulate and solve linear programming problems (LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.

- Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGraw Hill, 2017.
- Jit. S. Chandran, Mahendran P. Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
- Ravindran A., Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

COURSE OUTCOMES

CO1:	Formulate and solve linear programming problems (LPP)	K1
CO2:	Evaluate Integer Programming Problems, Transportation and Assignment Problems	K3
CO3:	Obtain a solution to network problems using CPM and PERT techniques	K5
CO4:	Able to optimize the function subject to the constraints.	K3
CO5:	Identify and solve problems under Markovian queuing models	K1

Mapping of Course Outcomes to Program Outcomes

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

- Study the morality and ethics in AI
- Learn about Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

UNIT I Introduction 9

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II Ethical Initiatives in AI 9

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization

UNIT III AI Standards and Regulation 9

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV Roboethics: Social and Ethical Implication of Robotics 9

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy

UNIT V AI and Ethics-Challenges and Opportunities 9

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI...

Total hours :45

Text Books:

1. T1: y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,”The ethics of artificial intelligence: Issues and initiatives”, EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. T2:. Patrick Lin, Keith Abney, George A Bekey,” Robot Ethics: The Ethical and Social Implications of Robotics”, The MIT Press- January 2014.

REFERENCE BOOKS:

1. R1: Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017

- R2: Mark Coeckelbergh, "AI Ethics", The MIT Press Essential Knowledge series, April 2020

WEB LINKS:

- https://sci-hub.mkxa.top/10.1007/978-3-540-30301-5_65
- <https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/>
- <https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/>
- <https://sci-hub.mkxa.top/10.1159/000492428>

COURSE OUTCOMES

CO1:	Learn about morality and ethics in AI	K1
CO2:	Acquire the knowledge of real time application ethics, issues and its challenges	K3
CO3:	Understand the ethical harms and ethical initiatives in AI	K1
CO4:	Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	K1
CO5:	Understand the concepts of Roboethics and Morality with professional responsibilities	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	2	2	2	-	-	-	1	2	1	2	1	1
CO2	3	2	3	2	2	-	-	-	2	1	2	1	3	3
CO3	2	1	3	2	2	-	-	-	3	2	2	2	3	2
CO4	2	1	3	1	1	-	-	-	2	2	2	2	2	1
CO5	2	2	2	1	1	-	-	-	2	1	1	1	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
✓	✓		✓		✓

PROFESSIONAL ELECTIVE COURSE (BLENDED)

PEC	DATA EXPLORATION AND VISUALIZATION	3	0	2	4
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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 12

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 12

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 12

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 12

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 12

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 : 60 hours

Text Books:

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.

2. Visualizing Data: Exploring and Explaining Data with the processing Environment, O'Reilly Publications, 2007
3. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reilly Publications, 2019

Reference Books:

1. Xiang Zhou, Sean, Yong Rui, Huang, Thomas S., Exploration of Visual Data, Springer Publications, 2003
2. Eric Pimple, Data Visualization and Exploration with R, Geo Spatial Training service, 2017

Web Links:

1. https://onlinecourses.nptel.ac.in/noc22_mg09/preview
2. 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	0	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

ASSESSMENT METHODS:

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

PEC	BIG DATA ANALYTICS	3	0	2	4
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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

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 Map reduce Programming 12

Map Reduce working principle, Map Reduce types and formats, MapReduce features, Combiner optimization, Map side join, Reduce Side Join, Secondary sorting, Pipelining MapReduce jobs.

UNIT III R Programming 12

History and overview of R , Install and configuration of R programming environment , Basic language elements and data structures, Data input/output, Data storage formats , Subsetting objects.

UNIT IV Visualization Using R 12

Vectorization, Control structures, Functions, Scoping Rules, Loop functions, R Graphs and visualization using lattice, ggplot2

UNIT V Spark Framework and Data Analysis Models 12

Overview of Spark – Hadoop vs Spark – Cluster Design – Cluster Management – 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.

Total Hours: 60

Text Book(s)

1. Garrett Golemund, “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:

1. <https://nptel.ac.in/courses/106104189>
2. <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	-	1	2	2	2	2	3	2
CO2	3	3	3	3	2	2	-	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	-	1	2	2	2	2	3	2
CO5	2	3	3	3	2	2	1	1	2	2	2	2	3	2

ASSESSMENT METHODS:

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

PEC	Python for Data Science	3	0	2	4
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COURSE OBJECTIVES:

- To understand the basic concepts of Python
- To apply the knowledge to use advanced features of python
- To execute statistical analysis of data with NumPy and Pandas .
- To build data visualization in real-world scenarios.

UNIT I Python Basics 12

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 - Fruitful functions

UNIT II Python: Advanced Features 12

Handling text files - Reading and Writing files- format operator-command line arguments - Exception Handling -- Modules -Strings and Regular Expressions.

UNIT III Numpy in Python 12

Introduction to Numpy-Data Types-NumPy array in Python-NumPy Narray- Array indexing- NumPy String Functions-Numpy ufunc-Statistical Functions **Case Study**

UNIT IV Pandas in Python 12

Pandas Introduction-Pandas Data Structures- -Series-DataFrame- Accessing and Changing values of DataFrames- Pandas Data Operations-Indexing-Cleaning data- Pandas plotting -Case study

UNIT V Matplotlib: Visualization Python 12

Introduction to Matplotlib-pyplot-plot types-Matplotlib Plotting-Subplot- Matplotlib Three Dimensional Plotting-**Case study**

TOTAL HOURS : 60

Text Books:

1. Mark Lutz, “Learning Python”, O Reily, 4thEdition, 2009, ISBN: 978-0-596 15806-4,5th edition, 2013
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Parts of chapters 2–4 for Units IV and V)
4. Fabio Nelli, “Python Data Analytics: With Pandas, NumPy, and Matplotlib”, Apress,2018.

REFERENCE BOOKS

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2. Magnus Lie Hetland , “Beginning Python: From Novice to Professional”, 3rd Edition, 2013

Weblink

Numpy, Matplotlib and Pandas :

https://python-course.eu/books/bernd_klein_python_data_analysis_a4.pdf

https://python-course.eu/python_and_machine_learning.pdf

CO1:	Understand the basic concepts of Python	K1
CO2:	Apply the knowledge to use advanced features of python	K3
CO3:	Demonstrate the skills with statistical analysis of data using NumPy	K4
CO4:	Ability to analyse the data operations using Pandas	K3
CO5:	Build visualizations of many different kinds of datasets using MATPLOTLIB	K5

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	P O4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	-	-	-	-	-	-	2	3	-
CO2	3	2	3	2	2	-	-	-	-	-	-	2	3	3
CO3	3	1	3	2	2	-	-	-	-	-	-	2	3	2
CO4	3	2	3	3	2	-	-	-	-	-	-	2	3	2
CO5	1	2	1	2	2	-	-	-	-	-	-	2	3	3

ASSESSMENT METHODS:

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

PEC	NOSQL DATABASE	3	0	2	4
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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

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

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

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**

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**

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:**

1. Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, An introduction to Information Retrieval, Cambridge University Press
2. Daniel Abadi, Peter Boncz and Stavros Harizopoulos, The Design and Implementation of Modern Column-Oriented Database Systems, Now Publishers.

REFERENCE BOOKS:

Guy Harrison, Next Generation Database: NoSQL and big data, Apress

Web Links:

1. <https://www.mongodb.com/>
2. <https://university.mongodb.com/>
3. <https://www.ibm.com/cloud/learn/nosql-databases>
4. <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	0	0	0	0	0	0	0	3	3
CO2	2	2	2	3	3	0	0	0	0	0	0	0	3	3
CO3	2	3	3	3	3	0	0	0	0	0	0	0	3	3
CO4	2	3	2	3	3	0	0	0	0	0	0	0	3	3
CO5	1	2	3	3	3	0	0	0	0	0	0	0	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
✓	✓		✓	✓	✓

PEC	GAME PROGRAMMING	3	0	2	4

COURSE OBJECTIVES

1. To provide an in-depth introduction to technologies and techniques currently used in the game industry
2. To understand game design and development
3. To understand the processes, mechanics, issues in game design, and game engine development
4. To understand modeling, techniques, handling situations, and logic
5. 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

12

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

12

CO1:	Understand the basics of Game Programming and Game Engine Architecture.	K2
CO2:	Develop 2D and 3D Images using Mathematical coordinates	K4
CO3:	Apply various Lighting and Texturing Effects in game environment.	K3
CO4:	Extend the Game Programming using Artificial Intelligence.	K2
CO5:	Solve search problems for Game move prediction and optimization using AI.	K6

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	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

ASSESSMENT METHODS:

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

PEC	ROBOTICS AND ITS APPLICATION	3	0	2	4
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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

12

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 12

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 12**

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 12**

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 12

Application of Machine learning – AI – Expert systems – Tele-robotics and Virtual reality – Micro & Nanorobots – Unmanned vehicles – Cognitive robotics – Evolutionary robotics – Humanoids.

Total Hours : 60

COURSE OUTCOMES

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.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc22_me39/preview

COURSE OUTCOMES

CO1	Understand the concepts of industrial robots	K2
CO2	Examine different sensors and actuators for applications like maze solving and self driving cars	K2
CO3	Design a 2R robot & an end-effector and solve the kinematics and dynamics of motion for robots	K3
CO4	Understand the navigation and path planning techniques for robot motion planning	K2
CO5	Understand the impact and progress of AI in the field of robotics	K2

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	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	3	-	3	3	-
CO5	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
✓	✓		✓	✓	✓

UNIT V Virtual Reality Applications:**12**

Engineering, architecture, education, medicine, entertainment, science, training.

TOTAL : -- 60 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 Kujiff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA

WEB LINKS:

1. <https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality>
2. <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
			✓		

PEC	EMBEDDED SYSTEMS FOR INTERNET OF THINGS	3	0	2	4
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COURSE OBJECTIVES

1. Comprehend the basic concepts, architecture and design components of embedded systems and IoT devices
2. Synthesize design platforms used for an embedded system to incorporate IoT applications.
3. Apply the concepts of embedded system design and IoT to resolve real time issues and develop new cloud based or web based IoT applications.

UNIT I Basics of IoT 12

Purpose and requirement specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.

UNIT II Design of Embedded Systems 12

Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.

UNIT III Inputs and Outputs 12

Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).

UNIT IV IoT Enabling Technologies**12**

Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx, GE Predix, Xively, macchina.io, Carriots, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces.

UNIT V Web of Things and Cloud of Things**12**

Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers, Cloud Offerings and IoT Case Studies: Introduction to Cloud Storage Models, Communication API, Logical design using Python.

Total hours: 60**Text Book(s)**

1. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
2. Klaus Elk, “Embedded Software for the IoT”.

REFERENCE BOOK(S)

1. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed”.
2. Elizabeth Gootman et. al, “Designing Connected Products”, Shroff Publisher/O’Reilly Publisher.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O’Reilly (SPD), 2014,

TEXT BOOK(S)

1. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
2. Klaus Elk, “Embedded Software for the IoT”.

REFERENCE BOOK(S)

1. Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed”.
2. Elizabeth Gootman et. al, “Designing Connected Products”, Shroff Publisher/O’Reilly Publisher.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O’Reilly (SPD), 2014, ISBN: 9789350239759

Weblinks:

1. <https://nptel.ac.in/courses/128108016>

COURSE OUTCOMES

CO1:	Demonstrate the embedded system concepts and architecture of embedded systems	K3
CO2:	Identify different software techniques for microcontroller-based embedded systems	K3
CO3:	Analyze different hardware input and output methods in embedded systems	K5
CO4:	Identify various techniques and methods used in IoT	K3
CO5:	Develop novel IoT applications in web/cloud based to solve real-time issues	K4

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	2	3	3	2	0	2	2	2	0	0
CO2	2	3	2	2	3	3	3	1	2	3	2	2	2	2
CO3	2	3	3	3	3	2	2	3	2	3	3	3	2	3
CO4	2	3	3	2	3	3	3	2	1	3	3	3	2	3
CO5	3	3	3	3	3	2	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
			✓	✓

OPEN ELECTIVE COURSES

OEC	INTERNET OF THINGS	3	0	0	3
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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

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

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

Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors -Introduction to Arduino, Pi, Spark, Intel Galileo

UNIT IV IOT Technical Standards and Protocols 9

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

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:

1. ArshdeepBahga, Vijay Madiseti, “Internet of Things, A Hands -on Approach”, 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7
2. Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”,1st Edition2015,ISBN: 978-81-265-5686-1
3. 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

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

OEC	ARTIFICIAL INTELLIGENCE	3	0	0	3
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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

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

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

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

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 Overfitting, 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

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:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, 3rd Edition, Pearson Education/ Prentice Hall of India 2010
2. Poole, D. and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press
3. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd, 2003.

REFERENCE BOOKS:

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, 2nd Edition, Tata McGraw-Hill, 2003.
2. 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>

COURSE OUTCOMES:

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:	Determine an efficient strategy for various applications of AI	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	2	2	2	2	-	-	-	-	2	3	2
CO2	2	2	2	2	2	2	2	-	-	-	-	2	3	3

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

ASSESSMENT METHODS:

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

OECC	INTRODUCTION TO DATA ANALYTICS	3	0	0	3
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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

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

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

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

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

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:

1.Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publication, 2015

REFERENCE BOOKS:

1. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, John Wiley & Sons, Inc., 2013.
2. Tom White, “Hadoop: The Definitive Guide”, O’Reilly Publications, 2011.
3. Kyle Banker, “Mongo DB in Action”, Manning Publications Company, 2012.
4. Russell Bradberry, Eric Blow, “Practical Cassandra A developers Approach“, Pearson Education, 2014

Weblinks:

1.https://onlinecourses.nptel.ac.in/noc20_cs01/preview

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

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	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	-	3	3	-	-	3	3	2	3	2
CO5	2	3	2	3	-	3	2	-	-	3	2	3	1	3

ASSESSMENT METHODS:

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

OEK	UI AND UX DESIGN				3	0	0	3
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COURSE OBJECTIVES

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I Foundations of Design 9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II Foundations of UI Design 9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III Foundations of UX Design 9

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV Wireframing, Prototyping And Testing

9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V Research, Designing, Ideating, & Information Architecture 9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Total hours : 45

TEXT BOOKS:

- 1.T1: Joel Marsh, “UX for Beginners”, O’Reilly , 2022
- 2.T2: Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021

REFERENCE BOOKS:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’Reilly 2020
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, Third Edition, 2015

WEBLINKS:

1. <https://www.nngroup.com/articles/>
2. <https://www.interaction-design.org/literature>

COURSE OUTCOMES

CO1:	Build UI for user Applications	K6
CO2:	Evaluate UX design of any product or application	K5
CO3:	Demonstrate UX Skills in product development	K4
CO4:	Implement Sketching principles	K5
CO5:	Create Wireframe and Prototype	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	1	1	3	1			-	3	3	2	2	3	1
CO2	2	3	1	3	2			-	2	2	2	2	3	2
CO3	1	3	3	2	2			-	3	2	2	2	2	3
CO4	1	2	3	3	1			-	2	3	3	2	3	3
CO5	1	2	3	2	1			-	1	2	2	3	1	3

ASSESSMENT METHODS:

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

OEC	DEVOPS				3	0	0	3
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COURSE OBJECTIVES

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I Introduction to Devops 9

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II Compile and Build using Maven & Gradle 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT III Continuous Integration Using Jenkins

9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV Configuration Management Using Ansible

9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V Building Devops Pipelines Using Azure

9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

Total hours : 45

TEXT BOOKS:

1. T1: Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. T2: Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

REFERENCE BOOKS:

1. R1: Hands-On Azure Devops: Cid Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. R2. by Mitesh Soni 3. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. R3: David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. R4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.

Weblinks:

1. <https://www.jenkins.io/user-handbook.pdf>
2. <https://maven.apache.org/guides/getting-started/>

COURSE OUTCOMES

CO1:	Understand different actions performed through Version control tools like Git.	K1
CO2:	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.	K5
CO3:	Ability to Perform Automated Continuous Deployment	K4
CO4:	Ability to do configuration management using Ansible	K5
CO5:	Understand to leverage Cloud-based DevOps tools using Azure DevOps	K1

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	2	3			-					2	2
CO2	3	3	3	2	3			-					2	2
CO3	3	3	3	2	3			-					2	2
CO4	3	3	3	2	3			-					2	2
CO5	3	3	3	2	3			-					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
✓	✓		✓	✓	

OEC	MULTIMEDIA AND ANIMATION	3	0	0	3
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COURSE OBJECTIVES

- To grasp the fundamental knowledge of Multimedia elements and systems
- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I Introduction to Multimedia 9

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning

UNIT II Multimedia File Formats and Standards 9

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III Multimedia Authoring 9

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV Animation 9

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V Multimedia Applications 9

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries

Total hours : 45

TEXT BOOKS:

T1: Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, “Fundamentals of Multimedia”, Third Edition, Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCE BOOKS:

1. R1 John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation, CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, “Multimedia Computing”, Cambridge University Press, 2018.

3. Prabhat K. Andleigh, Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rd Edition, 2012.

WEBLINKS:

1. <https://itsfoss.com/>
2. <https://www.ucl.ac.uk/slade/know/3396>
3. <https://handbrake.fr/>
4. <https://opensource.com/article/18/2/open-source-audio-visual-production-tools>
5. <https://camstudio.org/>
6. <https://developer.android.com/training/animation/overview>
7. <https://developer.android.com/training/animation/overview>

(UNIT-IV) COURSE OUTCOMES

CO1:	Understand the basic concepts of AR and VR	K1
CO2:	Understand the tools and technologies related to AR/VR	K5
CO3:	Know the working principle of AR/VR related Sensor devices	K4
CO4:	Design of various models using modeling techniques	K5
CO5:	Develop AR/VR applications in different domains	K1

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	3	2	3			-	2	2	3	3	2	2
CO2	3	2	3	2	3			-	3	2	2	3	2	2
CO3	3	3	2	2	3			-	3	2	2	3	2	2
CO4	3	3	3	2	3			-	3	2	3	3	2	2
CO5	3	3	3	2	3			-	2	2	3	3	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
✓	✓		✓	✓	

REFERENCE BOOKS:

1. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
2. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creative and Technical Guide", Digital Video and Audio, McGraw – Hill 2003

WEBLINKS:

CO1:	Compare the strengths and limitations of Nonlinear editing	K3
CO2:	Identify the infrastructure and significance of storytelling	K5
CO3:	Apply suitable methods for recording to CDs and VCDs.	K3
CO4:	Address the core issues of advanced editing and training techniques.	K4
CO5:	Design and develop projects using AVID XPRESS DV 4	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	2	3	2	3			-	2	2	3	3	2	2
CO2	3	2	3	2	3			-	3	2	2	3	2	2
CO3	3	3	2	2	3			-	3	2	2	3	2	2
CO4	3	3	3	2	3			-	3	2	3	3	2	2
CO5	3	3	3	2	3			-	2	2	3	3	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
✓	✓		✓	✓	