

**Academic Regulations, Curriculum and Syllabi
2020**

**B. Tech.
Computer Science and Engineering**
(Duration of Study : 4 years)



Department of Computer Science and Engineering
GMR Institute of Technology
Rajam, Andhra Pradesh
(An Autonomous Institute Affiliated to JNTU Kakinada, AP)
NBA Accredited and NAAC Accredited



Academic Rules and Regulations

2020

Undergraduate Programs



GMR Institute of Technology
Rajam 532 127, Andhra Pradesh
(An Autonomous Institute, Affiliated to JNTUK, Kakinada, AP)
Accredited by NAAC & NBA

The Vision of GMRIT

- ❖ To be among the most preferred institutions for engineering and technological education in the country
- ❖ An institution that will bring out the best from its students, faculty and staff – to learn, to achieve, to compete and to grow – among the very best
- ❖ An institution where ethics, excellence and excitement will be the work religion, while research, innovation and impact, the work culture

The Mission of GMRIT

- ❖ To turnout disciplined and competent engineers with sound work and life ethics
- ❖ To implement outcome based education in an IT-enabled environment
- ❖ To encourage all-round rigor and instill a spirit of enquiry and critical thinking among students, faculty and staff
- ❖ To develop teaching, research and consulting environment in collaboration with industry and other institutions

Department Vision

To be a nationally most preferred department of learning for students and teachers alike, with dual commitment to research and serving students in an atmosphere of innovation and critical thinking.

Department Mission

1. To provide high-quality education in Computer Science Engineering to prepare the graduates for a rewarding career in Computer Science Engineering and related industries, in tune with evolving needs of the industry.
2. To prepare the students to become thinking professionals and good citizens who would apply their knowledge critically and innovatively to solve professional and social problems.

Program Educational Objectives

- PEO 1: To produce the competent software engineers as team players in industry and allied fields providing viable solutions.
- PEO 2: Adopt contemporary technologies for dynamic industry requirements with self-paced learning providing scope for advanced research.
- PEO 3: Nurture professionalism with soft skills, managerial & leadership skills and Ethical values

Program Outcomes

Engineering graduate will be able to

- PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [\(Engineering knowledge\)](#)
- PO 2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [\(Problem analysis\)](#)
- PO 3: 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. [\(Design/development of solutions\)](#)
- PO 4: 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. [\(Conduct investigations of complex problems\)](#)
- PO 5: 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. [\(Modern tool usage\)](#)
- PO 6: 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. [\(The engineer and society\)](#)
- PO 7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. [\(Environment and sustainability\)](#)
- PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [\(Ethics\)](#)
- PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [\(Individual and team work\)](#)
- PO 10: 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. [\(Communication\)](#)
- PO 11: 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. [\(Project management and finance\)](#)
- PO 12: 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. [\(Life-long learning\)](#)
- PSO1: Ability to apply the software engineering principles to meet automation of the process and service industries apart from the community utilities. [\(Program Specific\)](#)
- PSO2: Ability to design, develop and implement management systems, E-Commerce tools and Web Apps for product development. [\(Program Specific\)](#)

Department of Computer Science and Engineering

Minimum Credits to be earned: 160 (for Regular Students)

127 (for Lateral Entry Students)

First Semester							
No	Course Code	Course	POs	Contact Hours			
				L	T*	P	C
1	20HSX01	Communicative English	10,12	3	1	-	3
2	20MAX01	Engineering Mathematics I	1,12	3	1	-	3
3	20PYX01 20CYX01	Engineering Physics / Engineering Chemistry	1,12/ 1,12	3	1	-	3
4	20BEX01 20BEX02	Basics of Engineering / Problem Solving and Programming Skills	1,12/ 1,12	3	1	-	3
5	20BEX03 20HSX02	Problem Solving and Programming Skills Laboratory/ Communicative English Laboratory	4/ 10,12	-	-	3	1.5
6	20BEX04 20BEX05	Engineering Drawing / Engineering Workshop	1,5,10/ 1,9,10	-	-	3	1.5
7	20PYX02 20CYX02	Engineering Physics Laboratory / Engineering Chemistry Laboratory	4/ 4	-	-	3	1.5
Total				12	4	9	16.5
Second Semester							
1		Language Elective	10,12	3	1	-	3
2	20MAX02	Engineering Mathematics II	1,12	3	1	-	3
3	20PYX01 20CYX01	Engineering Physics / Engineering Chemistry	1,12/ 1,12	3	1	-	3
4	20BEX01 20BEX02	Basics of Engineering / Problem Solving and Programming Skills	1,12/ 1,12	3	1	-	3
5	20BEX03 20HSX02	Problem Solving and Programming Skills Laboratory/ Communicative English Laboratory	4/ 10,12	-	-	3	1.5
6	20BEX04 20BEX05	Engineering Drawing / Engineering Workshop	1,5,10/ 1,9,10	-	-	3	1.5
7	20PYX02 20CYX02	Engineering Physics Laboratory / Engineering Chemistry Laboratory	4/ 4	-	-	3	1.5
Total				12	4	9	16.5
Third Semester							
1	20MA304	Probability and Statistics using Python	1,4, 12	3	-	2	4
2	20HSX10	Engineering Economics and Project Management	11,12	3	1	-	3
3	20CS303	Data Structures	1,2,12	3	1	-	3
4	20CS304	Digital Logic Design	1, 4	3	-	2	4
5	20CS305	Discrete Mathematical Structures	1,12	3	1	-	3
6	20CS306	Object Oriented Programming with C++	1,2,12	3	-	-	3
7	20CS307	Data Structures Lab	4	-	-	3	1.5
8	20CS308	Object Oriented Programming Lab	4	-	-	3	1.5
9	20BEA01	Environmental Studies	1,6,7,12	-	-	-	-
10	20ESX01	Employability Skills I	1,2,5,8,10,12	1	1	1	-
11	20HSX11	CC & EC Activities I	6,7, 9,10	-	-	1	-
Total				19	5	12	23
Fourth Semester							
1	20IT304	Database Management Systems	1,2, 3,12, PSO2	3	1	-	3
2	20IT403	Operating Systems	1,2,7,12	3	1	-	3
3	20CS403	Computer Organization and Architecture	1,12	3	1	-	3
4	20CS404	Design and Analysis of Algorithms	2,3,4, PSO1	3	-	2	4
5	20CS405	Java in Web Technologies	2, 3, 5, 6	3	1	-	3
6	20IT308	Database Management Systems Lab	1,2,3,4, 5	-	-	3	1.5
7	20CS407	Java in Web Technologies Lab	2,3,4,5,8	-	-	3	1.5
8	20ESX01	Employability Skills I	1,2,5,8,10,12	1	1	1	3
9	20HSX11	CC & EC Activities I	6,7, 9,10	-	-	1	1
Total				16	5	10	23

Fifth Semester							
1	20ECE02	Microprocessors and Microcontroller Programming (Integrated)	1,2,3,4,5	3	-	2	4
2	20CS502	Artificial Intelligence and Machine Learning	1,2, PSO1	3	1	-	3
3	20CS503	Computer Networks (Integrated)	1,2,4,5	3	-	2	4
4	20CS504	Theory of Computation	1, 2	3	1	-	3
5		Elective I (Professional Elective)		3	1	-	3
6		Elective II (Open Elective I)		3	1	-	3
7	20CS507	Artificial Intelligence and Machine Learning Lab	4,5,8	-	-	3	1.5
8	20TPX01	Term Paper	1,4,10,12	-	-	3	1.5
9	20ESX02	Employability Skills II	1,2,5,8,10,12	1	1	1	-
10	20HSX12	CC & EC Activities II	6,7, 9,10	-	-	1	-
11	20SIX01	Summer Internship I	1,2,8,10,12	-	-	-	1.5
Total				19	5	12	24.5
Sixth Semester							
1	20CS601	Compiler Design	1, 2	3	1	-	3
2	20CS602	Internet of Things	3, 4, 7	3	1	-	3
3	20CS603	Software Engineering	4, 8,11,PSO1	3	1	-	3
4		Elective III (Professional Elective)		3	-	2	4
5		Elective IV (Open Elective II)		3	1	-	3
6	20CS606	Case Tools Lab	4, 5,11	-	-	3	1.5
7	20MPX01	Mini Project	ALL POs, PSOs	-	-	3	1.5
8	20ESX02	Employability Skills II	1,2,5,8,10,12	1	1	1	3
9	20HSX12	CC & EC Activities II	6,7, 9,10	-	-	1	1
10		Audit Course	-	-	-	-	-
Total				16	5	10	23
Seventh Semester							
1		Elective V (Professional Elective)		3	1	-	3
2		Elective VI (Professional Elective)		3	1	-	3
3		Elective VII (Open Elective III)		3	1	-	3
4	20SIX02	Summer Internship II	1,2,5,6,10,12	-	-	-	1.5
5	20PWX01	Project Work	All POs & PSOs	-	-	16	8
Total				9	3	16	18.5
Eighth Semester							
1		Elective VIII (Professional Elective)		-	-	-	3
2		Elective IX (Open Elective IV)		-	-	-	3
3	20FIX01	Full Semester Internship (FSI)	1,2,5,8,9,10,PSO1, PSO2	-	-	-	9
Total				6	2	-	15

List of Electives

Language Electives							
No.	Course Code	Course	POs	Contact Hours			
				L	T	P	C
1	20HSX03	Advanced Communicative English	10,12	3	1	-	3
2	20HSX04	Communicative German		3	1	-	3
3	20HSX05	Communicative French		3	1	-	3
4	20HSX06	Communicative Japanese		3	1	-	3
5	20HSX07	Communicative Spanish		3	1	-	3
6	20HSX08	Communicative Korean		3	1	-	3
7	20HSX09	Communicative Hindi		3	1	-	3

Elective I							
Career Path I, II, III							
1	20CSC11	Exploratory Data Analytics (AI&ML)	1,4	3	1	-	3
2	20CSC21	Web Programming Languages (Full Stack Developer)	1,2,7,12	3	1	-	3
3	20ITC31	Fundamentals of Security (Cyber Security)	1,2	3	1	-	3
Non-Career Path (Core Electives)							
4	20CS004	Principles of Programming Languages	1, 2, 3, 4	3	1	-	3
5	20CS005	Mobile Computing	3, 8	3	1	-	3
6	20CS006	Distributed Operating Systems	1,2	3	1	-	3
7		MOOCs/Honors		3	1	-	3
Elective II: Open Elective I							
1	20CE001	Disaster Management	2, 7	3	1	-	3
2	20EE001	Electrical Installation and Safety Measures	2,3,6,8	3	1	-	3
3	20ME001	Fundamentals of Optimization Techniques	1, 2	3	1	-	3
4	20EC001	Sensors for Engineering Applications	1	3	1	-	3
5	20CS001	Fundamentals of Artificial Intelligence (Except CSE & IT)	1, 2, 3	3	1	-	3
6	20CH001	Energy Conversion and Storage Devices	1.3, 6, 7	3	1	-	3
7	20IT001	Fundamentals of Multimedia	1, 5, 7	3	1	-	3
8	20BS001	Nano Materials and Technology	1, 12	3	1	-	3
Elective III							
Career Path I, II, III							
1	20CSC12	Deep Learning (AI&ML)	1,2,4, PS01	3	-	2	4
2	20CSC22	Web Application Developments Framework (Full Stack Developer)	1, 3,4	3	-	2	4
3	20ITC32	Cybernet Security (Cyber Security)	1,3,4, 5, PS01	3	-	2	4
Non-Career Path (Core Electives)							
4	20CS007	Cloud Computing Essentials	2,5,6,7,8	3	-	2	4
5	20CS008	Cryptography and Network Security	3, 6,8	3	-	2	4
Elective IV: Open Elective II							
1	20CE002	Air Pollution and Environmental Impact Assessment	6, 7,12	3	1	-	3
2	20EE002	Renewable Energy Sources	2, 7	3	1	-	3
3	20ME002	Principles of Entrepreneurship	1,11	3	1	-	3
4	20EC002	Electronics for Agriculture	1, 2	3	1	-	3
5	20CS002	Fundamentals of Machine Learning (Except CSE & IT)	2, 3	3	1	-	3
6	20CH002	Industrial Safety and Hazard Management	1,2,3,6,8	3	1	-	3
7	20IT002	Fundamentals of Cloud Computing	1,7	3	1	-	3
8	20BS002	Advanced Numerical Techniques	1, 2	3	1	-	3
9	20BS003	Functional Materials and Applications	1,4	3	1	-	3
Elective V							
Career Path I, II, III							
1	20CSC13	Natural Language Processing (AI&ML)	2,3,4	3	1	-	3
2	20CSC23	Web Application Databases (Full Stack Developer)	2,3	3	1	-	3
3	20ITC33	Cloud Security (Cyber Security)	2,3	3	1	-	3
Non-Career Path (Core Electives)							
4	20IT010	Social Network Analysis	2, 4, 5	3	1	-	3
5	20CS011	Optimization Techniques	2, 3, 5	3	1	-	3
6	20CS012	Wireless Adhoc Networks	2, 3	3	1	-	3
7		MOOCs/Honors		-	-	-	3
Elective VI							
1	20CS014	Green Computing	2,3,6,7	3	1	-	3
2	20CS015	Software Project Management	3,6	3	1	-	3
3	20CS016	Soft Computing	1,2,3,4	3	1	-	3

4		MOOCs/Honors		-	-	-	3
Elective VII: Open Elective III							
1	20CE003	Solid Waste Management	3,7,12	3	1	-	3
2	20EE003	Fundamentals of Electrical Vehicle Technology	2,3,12	3	1	-	3
3	20ME003	Industrial Engineering and Management	1,11	3	1	-	3
4	20EC003	Interfacing and Programming with Arduino	1,2	3	1	-	3
5	20CS003	Data Science for Engineering Applications	2,3,4	3	1	-	3
6	20CH003	Industrial Ecology for Sustainable Development	2,6,7	3	1	-	3
7	20IT003	Fundamentals of Mobile Computing	1,7	3	1	-	3
8	20BS004	Advanced Materials of Renewable Energy	1,7	3	1	-	3
9	20BS005	Applied Linear Algebra for Engineers	1,12	3	1	-	3

Elective VIII: Professional Elective							
1	20CS017	Fundamentals of Social Network Analysis	2, 4,5	-	-	-	3
2	20CS018	Information Retrieval Systems	1,2,3,4	-	-	-	3
3	20CS019	Fundamentals of DevOps	1,3, 5,8,10	-	-	-	3
4		MOOCs/Honors		-	-	-	3

Elective IX: Open Elective IV							
1	20CE019	Green Buildings	1,7,12	-	-	-	3
2	20EE017	Sustainable Energy	1,2,12	-	-	-	3
3	20ME018	Total Quality Management	1,11	-	-	-	3
4	20EC011	Communication Technologies	1,2	-	-	-	3
5	20CS020	Applications of Artificial Intelligence	2,3,6,7	-	-	-	3
6	20CH016	Green Technologies	1,6,7	-	-	-	3
7	20IT015	Human Computer Interaction	1,7	-	-	-	3
8	20BS006	Handling of Industrial Waste and Wastewater	1,7	-	-	-	3

Audit Course							
1	20AT001	Communication Etiquette in Workplaces		-	-	-	-
2	20AT002	Contemporary India: Economy, Policy and Society		-	-	-	-
3	20AT003	Design The Thinking		-	-	-	-
4	20AT004	Ethics and Integrity		-	-	-	-
5	20AT005	Indian Heritage and Culture		-	-	-	-
6	20AT006	Human Values and Professional Ethics		-	-	-	-
7	20AT007	Intellectual Property Rights and Patents		-	-	-	-
8	20AT008	Introduction to Journalism		-	-	-	-
9	20AT009	Mass Media Communication		-	-	-	-
10	20AT010	Science, Technology and Development		-	-	-	-
11	20AT011	Social Responsibility		-	-	-	-
12	20AT012	The Art of Photography and Film Making		-	-	-	-
13	20AT013	Gender Equality for Sustainability		-	-	-	-
14	20AT014	Women in Leadership		-	-	-	-
15	20AT015	Introduction to Research Methodology		-	-	-	-
16	20AT016	Climate Change and Circular Economy		-	-	-	-

B. Tech. (Honors)							
Domain I (Data Engineering)							
01	20CSH11	Advanced Data Structures	2,3,4	4	-	-	4
02	20CSH12	Advanced Databases	2,3,4	4	-	-	4
03	20CSH13	Programming, Data Structures and Algorithms Using Python	2,3,4,5	4	-	-	4
04	20CSH14	Bioinformatics	2,3	4	-	-	4
Domain II (Modern Software Engineering)							
01	20CSH21	DevOps	1,3,5,8,10	4	-	-	4
02	20CSH22	Design Patterns	2,3	4	-	-	4
03	20CSH23	Advanced Software Engineering	1,3,4, PSO1	4	-	-	4

04	20CSH24	Robotic Process Automation	3,5, 8, PSO2	4	-	-	4
Domain III (Security)							
01	20CSH31	Fundamentals of Systems Security	1,2	4	-	-	4
02	20CSH32	Python Programming for Security	2,3,4	4	-	-	4
03	20CSH33	Management of Information Security	3,6,7	4	-	-	4
04	20CSH34	Computer Forensics	2,3	4	-	-	4
Domain IV (User Interface Design)							
01	20CSH41	Computer Graphics	1,2,3,4	4	-	-	4
02	20CSH42	Multimedia Systems	3,4	4	-	-	4
03	20CSH43	Human Computer Interaction	2,3	4	-	-	4
04	20CSH44	Mobile Programming	3,4	4	-	-	4

B. Tech. (Minors)
Energy Science & Technology

01	20CHM11	Foundation of Energy Science and Technology	1,2,3,5,7,12	4	-	-	4
02	20CHM12	Energy Generation from Waste	1,2,3,4,5	4	-	-	4
03	20CHM13	Energy Storage Systems	1,2,3,6,7	4	-	-	4
04	20CHM14	Hydrogen Energy and Fuel Cells	1,2,3,7	4	-	-	4

Nano Science & Technology

01	20CHM21	Introduction and Characterization of Nano Materials	1,2,3,7	4	-	-	4
02	20CHM22	Carbon Nanostructures and Applications	1,3,4,5	4	-	-	4
03	20CHM23	Energy, Environment & Biomedical Nanotechnology	1,2,3,7	4	-	-	4
04	20CHM24	Industrial Applications of Nano Technology	2,3,5,,7	4	-	-	4

Environmental Engineering

01	20CEM11	Watershed Management	6,7	4	-	-	4
02	20CEM12	Industrial Pollution Control and Engineering	3,6,7,12	4	-	-	4
03	20CEM13	Solid and Hazardous Waste Management	1,3,6,7	4	-	-	4
04	20CEM14	Ecology and Environmental Assessment	1,3,6,7	4	-	-	4

Artificial Intelligence & Machine Learning

01	20CSM11	Fundamentals of AI & Machine Learning	1,12	4	-	-	4
02	20CSM12	Feature Engineering for Machine Learning	1,2,3	4	-	-	4
03	20CSM13	Exploratory Data Analytics	1,4	4	-	-	4
04	20CSM14	Foundations of Deep Learning	1,2, 4	4	-	-	4

Cyber Security

01	20CSM21	Fundamentals of Security	1,2	4	-	-	4
02	20CSM22	Management of Information Security	3,6,7	4	-	-	4
03	20CSM23	Cyber Security	1,3,4	4	-	-	4
04	20CSM24	Fundamentals of Cloud Security	2,3	4	-	-	4

Data Science & Analytics

01	20CSM31	Data Cleaning	2,3,4	4	-	-	4
02	20CSM32	Data Engineering	1,2,3,4	4	-	-	4
03	20CSM33	Text Analytics	1,2,4	4	-	-	4
04	20CSM34	Social Network and Semantic Analysis	2, 4	4	-	-	4

Computer Systems Programming

01	20CSM41	Programming Fundamentals	1,2,3	4	-	-	4
02	20CSM42	Data Structures & Algorithms	1,2,3,4	4	-	-	4
03	20CSM43	Fundamentals of Databases	1,4	4	-	-	4
04	20CSM44	Fundamentals of Computer Networks & Operating Systems	1,2,3	4	-	-	4

Digital IC Design

01	20ECM11	Fundamentals of VLSI Design	1,2,3	4	-	-	4
02	20ECM12	Digital Design using HDL	1,2,3	4	-	-	4
03	20ECM13	FPGA Technology	1,2	4	-	-	4
04	20ECM14	Analog and Mixed Signal Design	1,2	4	-	-	4

Industrial Automation

01	20ECM21	Microcontrollers and Interfacing	1,2,3	4	-	-	4
----	---------	----------------------------------	-------	---	---	---	---

02	20ECM22	Sensors and Data Acquisition System	1,2	4	-	-	4
03	20ECM23	Fundamentals of Labview	1,2	4	-	-	4
04	20ECM24	Medical Robotics	1,2,3	4	-	-	4
Communications and Networking							
01	20ECM31	Principles of Communications	1,2	4	-	-	4
02	20ECM32	Coding Theory and Practice	1,2	4	-	-	4
03	20ECM33	Ad-hoc and Wireless Sensor Networks	1,2,3	4	-	-	4
04	20ECM34	Fundamentals of Multimedia Networking	1,2,3	4	-	-	4
Avionics							
01	20ECM41	Principles of Aerodynamics	1,2	4	-	-	4
02	20ECM42	Aircraft Electrical Systems	1,2	4	-	-	4
03	20ECM43	Aircraft Instrument Systems	1,2	4	-	-	4
04	20ECM44	Aircraft Communication and Navigational Systems	1,2	4	-	-	4
Geographic Information System							
01	20ECM51	Sensors and Sensing Technology	1,2	4	-	-	4
02	20ECM52	Geographic Information Systems	1,2	4	-	-	4
03	20ECM53	Digital Image Processing	1,2	4	-	-	4
04	20ECM54	Lidar Systems	1,2	4	-	-	4
Electric Vehicles Technology							
01	20EEM11	Introduction to Electric Vehicles Technologies	2,3	4	-	-	4
02	20EEM12	Electrical Drives and Controllers for Electric Vehicles	2,3	4	-	-	4
03	20EEM13	Charging Technology in Electric Vehicles	2,3	4	-	-	4
04	20EEM14	Computer Vision in Electric Vehicles	2,3	4	-	-	4
Smart City Management							
01	20EEM21	Fundamentals of Smart City	2,3	4	-	-	4
02	20EEM22	Smart City Infrastructure	2,3	4	-	-	4
03	20EEM23	Computational Methods for Smart City Management	2,3	4	-	-	4
04	20EEM24	Communication Technologies and Mobility for Smart City	2,3	4	-	-	4
Industrial Applications and Control							
01	20EEM31	Modelling and Simulations of Industrial Applications	2,3	4	-	-	4
02	20EEM32	Industrial Sensors and Actuators	2,3	4	-	-	4
03	20EEM33	Programmable Logic Controllers	2,3	4	-	-	4
04	20EEM34	Control Design for Industrial Applications	2,3	4	-	-	4
Cloud Application Development							
01	20ITM11	Introduction to Cloud Computing	6, 7, 12	4	-	-	4
02	20ITM12	Introduction to Web Development with HTML, CSS, JavaScript	1, 2, 3, 9, 12	4	-	-	4
03	20ITM13	Developing Cloud Native Applications	5, 8, 10	4	-	-	4
04	20ITM14	Developing Cloud Apps with Node.js and React	5, 8, 10	4	-	-	4
Robotics and Automation							
01	20MEM11	Introduction to Robotics	1,2,3	4	-	-	4
02	20MEM12	Drives and Sensors	1,2,3,4	4	-	-	4
03	20MEM13	Control Systems for Robotics	1,2,3,4	4	-	-	4
04	20MEM14	Machine Learning for Robotics	2,5	4	-	-	4
Industrial Systems Engineering							
01	20MEM21	Industrial Management	1,10,11,12	4	-	-	4
02	20MEM22	Fundamentals of Operations Research	1,2,3,5	4	-	-	4
03	20MEM23	Enterprise Resource Planning	1,2,3,5,11,12	4	-	-	4
04	20MEM24	Production Planning and Control	1,2,3,5,11,12	4	-	-	4

1st Semester and 2nd Semester**20HSX01 Communicative English**
(Common to all B Tech Programmes)**3 0 0 3****Course Outcomes**

1. Develop effective listening skills for better comprehension of English spoken in different social and workplace contexts.
2. Compose speech clearly on a specific topic using appropriate language in informal discussions
3. Explain the implicit and explicit meanings of a text while reading
4. Summarize the texts of reading and listening based on comprehension
5. Construct sentences using proper grammatical sentence structures
6. Choose and use the appropriate vocabulary, phrases in different contexts

COs – POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions about main idea and supporting ideas.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question - wh-questions; word order in sentences.

Poem: Once upon a time by Gabriel Okara

15 Hours**Unit II**

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Short-story: Next Sunday by R.K. Narayan

15 Hours**Unit III**

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for reading comprehension

Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions; introducing the structure of essay writing.

Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes

Speech: The fringe benefits of failure (Harvard inaugural address) by J. K. Rowlings

15 Hours

Unit IV

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts -without the use of PPT slides.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms; Editing short texts identifying and correcting common errors in grammar and usage.

Essay: How to read a book? by Virginia Woolf

15 Hours

Total:60 Hours

Textbook (s)

1. English All Round: Communication Skills for Undergraduate learners, Vol.1, Published by Orient Black Swan, 2020

Reference (s)

1. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
4. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014
5. Dhanavel. S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, 2009.

Web resource(s)

Grammar/Listening/Writing

1. 1-language.com
2. www.5minuteenglish.com
3. www.englishpractice.com

Grammar/Vocabulary

4. English Language Learning online
5. www.bbc.co.uk/learningenglish
6. www.better-english.com
7. www.nonstopenglish.com
8. www.vocabulary.com

Reading

9. www.usingenglish.com
10. www.englishclub.com
11. www.english-online.at

Listening

12. learningenglish.voanews.com
13. www.englishmedialab.com

Speaking

14. www.talkenglish.com
15. BBC Learning English – Pronunciation tips
16. Merriam-Webster – Perfect pronunciation Exercises

All Skills

17. www.englishclub.com
18. www.world-english.org
19. learnenglish.britishcouncil.org

Online Dictionaries

20. Cambridge dictionary online
21. MacMillan dictionary
22. Oxford learner's dictionaries

20MAX01 Engineering Mathematics I
(Common to all B. Tech. Programmes)

3 1 0 3

Course Outcomes

1. Find the solution of system of linear equations, eigenvalues and eigen vectors
2. Identify the nature of the quadratic form using matrix theory
3. Classify and solve first and higher order ordinary differential equations with constant coefficients
4. Apply the knowledge of Mean value theorems, Maxima and Minima of functions of several variables
5. Analyze the characteristics to trace the curve
6. Adapt methods for measuring lengths, volumes, surface area of an object and also the procedure to transform change of variables and order of integration

COs - POs Mappings

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3- Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Matrices**

Rank-Echelon form, Normal form, Solution of Linear System of equations – Gauss Elimination Method and Gauss Jordan Method

Eigen values and Eigen vectors – Properties (without proofs), Cayley-Hamilton Theorem (without proof) - Inverse and powers of a matrix

Quadratic forms- Reduction of quadratic form to canonical form using orthogonal transformation – Rank, index and signature, Nature of Quadratic form

LU-Decomposition Method

11+4 Hours**Unit II****Differential Equations**

Differential equations of first order and first degree – exact and reducible to exact, Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories

Linear differential equations of higher order with constant coefficients with RHS term of the type

e^{ax} , $\sin bx$, $\cos bx$ polynomials in x , x^2 , x^3 , x^4

Problems related to LCR circuits

11+4 Hours**Unit III****Curve tracing and Functions of Several Variables**

Curve tracing-Cartesian, Polar and Parametric curves

Functions of several variables-Partial differentiation, Taylor's theorem (generalized Mean Value theorem-without proof), Jacobian, Functional dependence, Maxima and Minima of functions of two variables with and without constraints

Applications of Mean value theorems

11+4 Hours**Unit IV****Applications of Integration**

Lengths, Volumes and Surface areas of revolution in Cartesian and Polar Coordinates

Multiple integrals-Double integrals, Change of order of Integration, change of variables (Cartesian and Polar coordinates) and evaluation of triple integrals

Problems related to Centroid and Mass

12+3 Hours**Total:45+15 Hours****Textbook (s)**

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Ed., Khanna Publishers, New Delhi, 2012
2. E. Kreyszig, Advanced Engineering Mathematics, 9th Ed., Wiley, 2012

- R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, 4th Ed., Narosa Publishing House, New Delhi, 2014

Reference (s)

- B. V. Ramana, Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
- D. S. Chandrashekharaiyah, Engineering Mathematics, Volume 1, Prism Publishers, 2010
- T. K. V. Iyengar, B. Krishna Ghandhi, S. Ranganathan and M.V. S.S.N. Prasad, Engineering Mathematics, Volume-I, 12th Ed., S. Chand Publishers, 2014
- U. M. Swamy, P. VijayaLaxmi, K. L. Sai Prasad and M. Phani Krishna Kishore, A Text Book of Engineering Mathematics-I, Excel Books, New Delhi, 2010

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	20	20	-
Understand	50	50	-
Apply	30	30	60
Analyze	-	-	30
Evaluate	-	-	10
Create	-	-	-
Total (%)	100	100	100

SAMPLE QUESTION (s)

Remember

- State Cayley-Hamilton theorem.
- What is Bernoulli's equation?

Understand

- Represent $x^2 + 3x - 2$ in powers of $(x - 1)$ using Taylor's theorem.
- Show that $3x^4 + 4x^3 + 3x^2$ is solenoidal.

Apply

- Make use of the properties, to compute the sum and the product of the Eigen values of $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 5 & 1 \\ 0 & 0 & 2 \end{pmatrix}$.
- Solve $(x^3 - 3x^2 + 4) = x^2 + 6 + 80 \cos 2x$

Evaluate

- Determine the Eigen values and corresponding Eigen vectors of $A = \begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$
- Evaluate $\iiint_V \nabla \cdot \vec{P} \, dV$, where $\vec{P} = 4xz\vec{i} - 2y^2z\vec{j} + x^2z\vec{k}$ and V is bounded by $x^2 + y^2 = 4$, $z = 0$ and $z = 3$.

Analyze

- Examine the given differential equation for a circuit in which self-inductance and capacitance neutralize each other is $\frac{d^2i}{dt^2} + i = 0$ and find the current i as a function of t of given that i is the maximum current, and $i = 0$ when $t = 0$. **(For Open Book Examination and not for semester end examination)**
- Analyze the graph of $x^2(y - z) = y^2(z + x)$ by using the properties of curve tracing **(For Open Book Examination and not for semester end examination)**

20PYX01 Engineering Physics
(Common to all B. Tech. Programmes)

3 1 0 3

Course Outcomes

1. Interpret the concepts of mechanics to understand the conservative principles
2. Outline the principles of electrostatics, magnetostatics and able to explain electromagnetism
3. Illustrate the concepts of Interference, Diffraction, Polarization and their applications
4. Summarize the fundamental concepts of quantum theory and identify the applications of quantum theory in various contexts
5. Classify solids into conductors, insulators and semiconductors and understand conductivity in intrinsic and extrinsic semiconductors
6. Demonstrate the emission of laser light and their applications in various engineering fields. Interpret and classify optical fibers and their applications in modern communication systems.

COs - POs Mapping

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Mechanics, Electrostatics and Magnetostatics**

Scalar and Vector fields, – Gradient, divergence and curl – Gravitational potential energy – Work Energy theorem – Central forces – Conservative forces– Angular momentum - Kepler’s laws of planetary motion (qualitative)
Electric flux - Gauss’s law (electrostatics) – Applications of Gauss law: Coulomb’s law from Gauss law, Spherically distributed charge (Non conducting sphere) - Ampere’s law, application of Ampere’s law - Biot- Savart’s law, Applications of Biot-Savart’s law: B due to current carrying straight conductor and a circular loop
– Faraday’s law – Lenz’s law - Maxwell’s equations.

*Electric field due to infinite sheet of charge and infinite line of charge***13+4 Hours****Unit II****Wave Optics**

Principle of Superposition-Interference of light - Conditions for sustained Interference –Young’s double slit interference-Interference in thin films (reflected light) - Newton’s Rings, Determination of Wavelength, applications of Interference

Diffraction - Fraunhofer Diffraction at Single slit - Diffraction Grating – Grating Spectrum - Determination of Wavelength - applications of Diffraction.

Polarization - Types of polarization - Polarization by double refraction - Nicol’s Prism - Half wave and Quarter wave plates - applications of Polarization.

*Wedge shaped film - Polarioids - Rayleigh criterion in resolution***10+4 Hours****Unit III****Quantum theory and semiconductors**

Dual nature of matter - de-Broglie Hypothesis - Properties of matter waves – Uncertainty Principle - Physical significance of wave function - Schrödinger’s wave equation – Particle in infinite potential well (one dimensional box) - Free electron theory of metals, electrical conductivity - Fermi Dirac Distribution function (qualitative) - Kronig - Penney model (qualitative) - Classification of materials into conductors, semiconductors and insulators. Intrinsic semiconductors - Density of charge carriers (qualitative) - Fermi energy level – Electrical conductivity - Extrinsic semiconductors (P-type & N-type) - Density of charge carriers (qualitative) - Dependence of Fermi energy on carrier concentration and temperature - Hall effect - Applications of Hall effect - Drift and Diffusion currents

*Tunneling effect***13+4 Hours**

Unit IV**Lasers and Optical Fiber**

Characteristics of laser – Stimulated absorption – Spontaneous emission - Stimulated emission – Population inversion – Pumping mechanism – Active medium – Laser systems: Ruby laser, He-Ne laser, Semiconductor laser – Applications of Lasers

Introduction to Optical Fibers-Total Internal Reflection and Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile and modes – Applications of optical fibers - Block Diagram of Fiber optic Communication system

Fiber optic sensors - Holography.

9+3 Hours

Total:45+15 Hours

Textbook (s)

- Halliday, Resnick and Krane, Physics Part-II, Wiley India Pvt. Ltd, 2014
- D Kleppner and Robert Kolenkow, An Introduction to Mechanics –II, Cambridge University Press, 2015.
- David J Griffiths, Introduction to Electrodynamics, Printice Hall of India, 2012.
- R.K. Gour and S.L. Gupta, Engineering Physics, Dhanpathrai Publications, New Delhi, 2014
- S. O. Pillai, Solid State Physics, 6th Ed., Newage International Publishers, 2015
- A. S. Vasudeva, Modern Engineering Physics, S. Chand and Company, New Delhi, 2006

Reference (s)

- V. Rajendran, Engineering Physics, McGraw Hill Education (India) Private LTD, 2010
- M. Armugam, Engineering Physics, Anuradha Agencies, 2007
- P.K. Palanisamy, Engineering Physics – I, II, Scitech Publications (India) Pvt. Ltd, 2011.
- M.R. Srinivasan, Engineering Physics, New age International Publishers, 2nd Edition, 2014.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	40	40	-
Understand	40	40	-
Apply	20	20	80
Analyze	-	-	20
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

SAMPLE QUESTION (s)**Remember**

- Define Principle of Superposition.
- State Faraday's law of electromagnetic induction and Lenz's law.
- Recall vector and scalar fields.

Understand

- Explain the construction and working principle of Nicole's prism.
- Illustrate Ruby laser and explain its working principle with energy level diagram.
- Outline fermidirac distribution function.

Apply

- Demonstrate any four applications of lasers with reference to their characteristics. **(For Open Book Examination and not for semester end examination)**
- Apply Biot-Savart's law, and calculate the Magnetic field induction along the infinite length of a straight conductor at points close to the conductor. **(For Open Book Examination and not for semester end examination)**
- Calculate electric field intensity due to infinite line of charge by applying Gauss law. **(For Open Book Examination and not for semester end examination)**

Analyze

- Compare insulator, semiconductor and conductors based on energy bands**(For Open Book Examination and not for semester end examination)**
- Differentiate the types of optical fiber based on refractive index profiles. **(For Open Book Examination and not for semester end examination)**
- Justify the formation of newton rings based on interference of light. **(For Open Book Examination and not for semester end examination)**

20CYX01 Engineering Chemistry
(Common to all B.Tech. Programmes)

3 1 0 3

Course Outcomes

1. Illustrate the different types of polymers and their applications
2. Interpret the Nernst equation for electrode potential and construct various types of energy storage devices
3. Describe corrosion factors and implement prevention measures
4. Estimate the calorific value of a fuel and select a suitable fuel as an energy resource
5. Describe the important renewable energy sources and their usage
6. Explain bonding, colour and magnetic properties of molecules

COs - POs Mapping

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Polymer Chemistry**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples of polymer formation.

Plastics - Thermoplastics and Thermosettings; Compounding of plastics; Preparation, properties and engineering applications of - Teflon, Bakelite, polycarbonate; Fibre reinforced plastics (FRP), Elastomers: Processing of natural rubber, Vulcanization of rubber-Engineering applications of rubber

Conducting polymers: mechanism of conduction in polyacetylene and applications of conducting polymers, Bio-degradable polymers: Poly hydroxyalkanoates (PHA), Poly caprolactum (PCL)

Molecular imprinting polymers (MIP)

12+3 Hours**Unit II****Electrochemistry and Corrosion**

Concept of Electrode potential, electrochemical cell, Nernst equation, cell potential calculations

Primary cells - Fuel cells, hydrogen-oxygen fuel cells, working of the cells

Secondary cells - lead acid and lithium ion batteries- working of the batteries including cell reactions

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, environmental factors (pH, temperature, DO) affecting corrosion rate, protection methods - corrosion inhibitors with specific examples, cathodic and anodic protection.

Organic coatings

11+4 Hours**Unit III****Fuel Chemistry**

Fuels - Types of fuels, calorific value - HCV, LCV, numerical problems based on calorific value; Working and calorific value determination using Bomb calorimeter & Junkers Calorimeter, Characteristics of a good fuel, Analysis of coal - Proximate analysis & Ultimate analysis, refining of petroleum, liquid fuels, knocking and anti-knock agents, Octane and Cetane values, cracking of oils-Catalytic cracking, Synthetic petrol-polymerization, Fischer Tropsch & Bergius Process

Renewable Energy Resources: Energy scenario in India, Solar energy- Harnessing of solar energy in the form of Photo-voltaic cells, Bio-energy: Biodiesel

Rocket Fuels

11+4 Hours**Unit IV****Structure and Bonding Models**

Molecular orbital theory - bonding in homo- and heteronuclear diatomic molecules - energy level diagrams of O₂, N₂, NO and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order

Crystal field theory – salient features – energy level diagrams for transition metal ions – splitting in octahedral and tetrahedral environments, Magnetic properties and colour of complexes
Band theory of solids – band diagrams for conductors, semiconductors and insulators, role of doping on band structures.

Planck's quantum theory, Schrodinger equation (qualitative treatment only)

11+4 Hours
Total: 45+15 Hours

Textbook (s)

1. P. C. Jain and Monica Jain, Engineering Chemistry, 16th Ed., Dhanpat Rai Publishing Company, New Delhi, 2015
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference (s)

1. S. Chawla, A Textbook of Engineering Chemistry, 3rd Ed., Dhanpat Rai & Co (Pvt) Ltd, New Delhi, 2012
2. P. Murthy, C. V. Agarwal, A. Naidu, Textbook of Engineering Chemistry, B. S. Publications, Hyderabad, 2006
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand and Company Limited, New Delhi, 2094

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	20	20	-
Understand	60	60	-
Apply	20	20	60
Analyze	-	-	40
Evaluate	--	-	-
Create	--	-	-
Total (%)	100	100	100

SAMPLE QUESTION (s)

Remember

1. Define polymer. Which are the different types of polymerization?
2. Differentiate between polymer and plastic? List out the differences between thermoplastics and thermosetting plastics?
3. Define calorific value, HCV and LCV

Understand

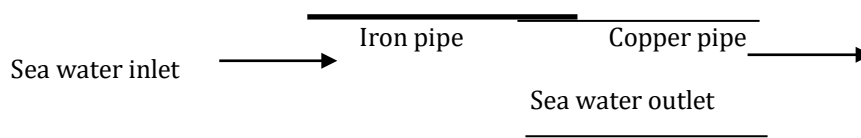
1. What is meant by vulcanization of rubber? Explain the advantages of vulcanization.
2. What is compounding of plastics? Explain the role of Fillers and Stabilizers with examples in compounding of plastics.
3. How a photo-voltaic cell is constructed and what is the working mechanism of it?

Apply

1. By which methods, the underground pipelines are protected from corrosion? Explain the involved mechanisms.
2. Illustrate the Molecular orbital diagram of NO molecule by applying the MOT.

Analyze

1. When a metal X (of reduction potential = 0.337V at 25⁰C) is connected to another metal Y (of reduction potential = -0.140V at 25⁰C) and this structure is exposed continuously to sea water, which type of corrosion would take place? Explain with suitable mechanism. **(For Open Book Examination and not for semester end examination)**
2. Which type of corrosion is involved in the following jointed pipeline and why? Explain the involved mechanism in detail **(For Open Book Examination and not for semester end examination)**



20BEX01 Basics of Engineering
(Common to all B. Tech. Programmes)

3 1 0 3

Course Outcomes

1. Understand the principles of surveying and building materials and components
2. Understand the working principle of steam, Gas, Diesel, Hydro-electric, Nuclear Power plants and IC Engines
3. Understand the working principle of vapour compression & vapour absorption refrigeration systems, Window and Split type AC systems
4. Illustrate the behavior of basic electric circuit elements for both DC and AC excitation
5. Outline the construction and working principle of DC machines with appropriate safety measures
6. Understand the operation of sensors for engineering applications.

COs - POs Mapping

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Surveying, building materials and components**

Surveying principles, measurements of distances and areas. Building Materials: Bricks, stones, sand, cement, steel and concrete. Substructure: safe bearing capacity, foundations and types. Superstructure: stone and brick masonry, beams, columns, lintels, roofs, floors, plastering.

Layout of building (Plan and Elevation)

12+3 Hours**Unit II****Power Plant, IC Engines, Refrigeration and Air Conditioning System**

Power plant - Classification, Working principle - steam, Gas, Diesel, Hydro-electric and Nuclear Power plants. IC Engines - Working principle of Petrol and Diesel Engines, Four stroke and two stroke cycles, Comparison. Refrigeration and Air Conditioning System - Simple and practical vapour absorption system, Window and Split type room Air conditioner.

Layout of typical domestic refrigerator

11+4 Hours**Unit III****Fundamentals of Electrical Engineering**

Voltage, Current, Ohm's law, Kirchhoff's laws, Faraday's Laws, Basic circuit elements-R, L and C-series and parallel circuits, mesh and nodal analysis, Generation of alternating current, basic definitions, RMS and average values of periodic waveforms-form factor and peak factor, Principle of operation and construction-DC machines, Electric shock and its prevention, Methods of earthing.

Indian electricity safety rules.

11+4 Hours**Unit IV****Sensors & Consumer Electronics**

Sensors and Applications: Resistive Sensors, Inductive Sensors, Capacitive Sensors, Optical Sensors, Electro Magnetic Sensors, Thermal Sensors. Electronic Appliances: Photo Copier, Digital Camera, Mobile Phone, Television, Washing Machine.

Ultrasonic sensors and applications

11+4 Hours**Total: 45+15Hours****Textbook(s):**

1. G. Shanmugam and M.S. Palanichamy, Basic Civil and Mechanical Engineering, 3rdEd., Tata. McGraw. Hill Publishing Co., New Delhi, 2000.
2. Ramamrutham S., Basic Civil Engineering, 3rd Ed., DhanpatRai Publishing Co. (P) Ltd. 2013.
3. Ganeshan.V, IC Engines, Tata McGraw-Hill Education Pvt. Ltd, 3rd Ed., 2013.

4. C.P.Arora, Refrigeration and Air Conditioning, Tata McGraw-Hill Publishing Company Limited, 3rdEd., 2009.
5. P.K.Nag, Power Plant Engineering, Tata McGraw Hill Publishing Company, India, 4th Ed., 2014.
6. R.K.Rajput, Power Plant Engineering, 5th Ed., Lakshmi Publications, 2016.
7. D. P. Kothari and I. J. Nagrath, Theory and Problems of Basic Electrical Engineering, 4th Ed., PHI Learning Private limited, 2013.
8. Ramana Pilla, M. Surya Kalavathi and G.T.Chandra Sekhar, Basics of Electrical Engineering, 1stEd., S. Chand & Company Ltd., 2018
9. D. Patranabhis, Sensors and transducers, 2ndEd., PHI publication, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	20	40	-
Understand	55	60	25
Apply	25	-	75
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

SAMPLE QUESTION (s)

Remember

1. Define Surveying.
2. Define Plane surveying.
3. Define Geodetic Surveying.
4. Define Bearing capacity, Ultimate bearing capacity, Gross safe bearing capacity and Net bearing capacity?
5. What are the different types of foundations and explain with neat sketches.
6. What is the standard Size of brick?
7. Why is gypsum needed in cement?
8. Define a cantilever beam.
9. What is D.P.C?
10. What is plastering?
11. Classify the power plant
12. Label the components of IC engine
13. State Faradays laws of Electro-magnetic Induction.
14. Define Kirchhoff's laws
15. List out five Indian electricity safety rules
16. Define RMS and average values, form factor and peak factor, of a periodic waveform
17. Define resolution of a sensor.
18. List any two applications of a electro magnetic sensor.
19. State the purpose of a sensor?
20. List any two applications of a capacitive sensor.
21. Define Slew rate of sensor.

Understand

(For Open Book Examination and not for semester end examination)

1. Explain Chain surveying with its accessories.
2. Explain different types of ranging methods.
3. Explain in detail about principle of Surveying
4. What are the factors effecting safe bearing capacity
5. What are the qualities of a good brick?
6. How are rocks classified? Briefly discuss the different classification of rocks.
7. What are the general principles of brick masonry?
8. Distinguish between short column and long column.
9. Differentiate between truss and a roof.
10. Compare the two stroke and four stroke engines.
11. Explain the working of split type air conditioner
12. Outline the expression for RMS and Average values of a sinusoidal voltage wave form

13. Outline the construction and working of DC generator.
14. Explain various methods of earthing.
15. Explain the preventive method of avoiding electric shock
16. Explain the principle behind the operation of thermal sensors.
17. Explain sensitivity and repeatability with reference to a sensor.
18. Explain the working principle of photo copier.
19. Explain the operating principle of a washing machine.
20. Discuss the evolution of mobile phone technology.

Apply

(For Open Book Examination and not for semester end examination)

1. The following perpendicular offsets were taken at 10 meters intervals from a survey line to an irregular boundary line: 3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20, 5.65
2. Calculate the area enclosed between the survey line, the irregular boundary line, and first and last offsets, by the application of a) average ordinate rule b) trapezoidal rule and c) Simpson's rule.
3. Demonstrate the working of engine adopted by APSRTC bus.
4. Power can be produced from the steam. Justify the statement.

20BEX02 Problem Solving and Programming Skills
(Common to all B. Tech. Programmes)

3 1 0 3

Course Outcomes

1. Explain and illustrate aspects of the problem-solving using algorithm, flowchart
2. Demonstrate conditional and iterative statements to write programs
3. Understand and apply the concepts of arrays and user defined functions
4. Describe and apply the concepts of pointers and structures
5. Understand and apply the file manipulation functions to handle data files
6. Solve problems of varying complexity by developing programs in C

COs - POs Mapping

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	2	1
6	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to Problem Solving and Fundamentals of C**

Problem solving basics: Introduction to computers, the problem-solving Aspect, Top-down Design, Algorithms, Flowcharts/Pseudo codes, Implementation of algorithms, Types of Programming Languages, Program development steps, The compilation process, Syntax and Semantic errors.

Fundamentals of C: C Fundamentals: C Character set, Token, Data types, variables, Declarations, Operators and Expressions: Different types of operators, expressions, Type Conversions, Precedence and Order of Evaluation, Data input and output statements.

Control Flow Statements: Branching: if, if-else, nested if, else-if ladder, Looping: while, do-while, for, Break, Continue, goto, Switch statement

Comma and size of operators, bitwise operators, escape sequences

15+4 Hours**Unit II****Arrays and Functions**

Arrays: definition, declaration, accessing elements, storing elements, 2-D arrays, Multidimensional arrays
Strings and string manipulations

Functions: Built-in functions, User-defined Functions: Function prototyping, Function Definition, Passing arguments to function, call by value, Recursion, Passing arrays to function, Storage classes, Scope and life time of variables.

Preprocessor commands, enumerations

11+4 Hours**Unit III****Pointers and Structures**

Pointers: Fundamentals, declarations, passing pointers as argument to function (Call by reference), arrays and pointers, Operations on pointers, dynamic memory management functions

Structures: Definition, declaration, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-referential Structures, typedef, Unions

Dangling pointers, variable length arguments

10+4 Hours**Unit IV****Data Files and Introduction to Data Structures**

File manipulation: Creation of Files, Opening and Closing a File, Processing a File, Unformatted Files

Introduction to Data Structures: Definitions, Classification of data structures: Linear, Non-Linear, Operations on Linked lists, Stack, Queue.

Command line arguments, Macros, error handling functions.

9+3 Hours**Total:45+15 Hours**

Textbook (s)

1. Byron Gottfried, Programming with C, 3rd Ed., Tata McGraw Hill, 2017.
2. R. G. Dromey, How to solve it by Computer, Pearson Education India, 2008

Reference (s)

1. Y. Kanetkar, Let us C, 8th Ed., BPB Publication, 2004
2. ISRD Group, "Programming and Problem Solving Using C", Tata McGraw Hill, 2008.
3. F. E. V. Prasad, C Programming: A Problem-Solving Approach, Giliberg, Cengage, 2010
4. A. S. Tenenbaum, Y. Langsam and M. J. Augenstein, Data Structures using C, Pearson Education, 2009
5. Ellis Horowitz, Anderson-Freed, S Sahni, Fundamentals of Data Structures in C, 2nd Ed., Universities Press, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	25	20	-
Understand	35	40	30
Apply	40	40	40
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

SAMPLE QUESTION (s)**Remember**

1. Define Algorithm
2. List any four types of operators of C – Language
3. What is dangling pointer?

Understand

1. What is Structured programming?
2. Differentiate linear and nonlinear data structures
3. List any four string handling functions

Apply

1. Write a program for matrix multiplication using arrays
2. Solve Towers of Hanoi problem using recursion
3. Identify the suitable file mode for adding new data in to the existing file

Analyze

1. Compare structure and union
2. Differentiate logical and relational operators
3. Distinguish between Recursive and non-recursive functions

20BEX03 Problem Solving and Programming Skills Laboratory
(Common to all B. Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Implement, execute the programs in C language for solving a problem
2. Exercise conditional and iterative statements to Write C programs
3. Implement programs to develop applications using functions
4. Apply Arrays and structures to solve real world problems
5. Make use of pointers to design applications with efficient use of memory
6. Solve problems using files concept

COs - POs Mapping

COs	PO4
1	3
2	3
3	3
4	3
5	3
6	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Draw the Flow charts using Raptor tool (Minimum 2)
2. Mr. John takes a loan to buy a truck at the rate of some interest. Help John to calculate the simple interest to be paid for the loan amount for a time.

For example:

Given P=15000 amount at the rate of 5% interest annually (T=12 months).find SI?

Functional Description:

Complete the task using C editor and the output of the program is to display a float value.

Constraints:

- $P > 10,000$
- $T > 0$
- $2 \leq R \leq 5$

Sample Test case:

15000

11

3

4950.00

The first integer indicates Principal amount

Second integer indicates Time

Third integer indicates Rate of interest

Forth value indicates the interest to be paid by John.

3. A person brought a new house and want to paint his house. He is having following details: Length, Height, Breadth and cost for square feet to paint a single wall. Help him out to calculate the cost for painting work.

For example:

Given L=5, B=3, H=10, C=1000 and find total cost of house for painting

Functional Description:

Complete the task using C editor and the output of the program is to display a value.

Constraints:

- $0 < L < 100$
- $0 < B < 100$
- $1 \leq H \leq 10$
- $C > 100$

Sample Test case:

5
3
10
1000
150000

The first integer indicates Length
Second integer indicates Breadth
Third integer indicates Height
Fourth integer indicates Cost
Fifth value indicates total cost.

4. Government wants implement new pension scheme to people of the country based on the following criteria

Age	Amount to be paid monthly	Pension after 60 Years
Below 18	---	Not Eligible
18-22	210	5000
23-27	310	5000
28-35	410	5000
35-45	510	5000

Help the citizens to know how much amount need to be paid based on age criteria

Functional Description:

Complete the task using C editor and the output of the program is to display a value.

Sample Test case:

20
210
5000

The first integer indicates Age
Second integer indicates amount to be paid
Third integer indicates pension amount

5. There are n students attempted a competitive exam. The college wants to allocate the section to a student based on their rank. Use an appropriate logic to order the students according to their rank.

Functional Description:

Complete the task using C editor by reading set of integer values into 1-D array and display them in sorted order.

Constraints:

- $n > 4$
- All values should be in integer

Sample Test case:

5
3
2
1
4
10
1 2 3 4 10

6. Consider a country with n states. Read capital income from n states and find the highest , lowest capital income

Functional Description:

Complete the task using C editor by reading set of integer values into 1-D array and display highest and lowest values.

Constraints:

- $n \geq 2$
- All values should be in integer

Sample Test case:

5
3
2
1
4

10
1 10

7. 2 colleges with 3 teams each participating in a technical quiz. Each team should consists of students from IT, ECE, CSE. Find the total number of students participated from each branch in both colleges.

Functional Description:

Complete the task using C editor by reading set of integer values into 2-D array and display the output.

Constraints:

- All values should be in integer

Sample Test case:

College1			College2		
2	3	4	1	2	5
3	4	5	5	6	3
4	2	1	6	2	4

21 20 22

8. Divya is teaching her student Amit about palindromes. A palindrome is a word, phrase, number, or other sequence of characters which reads the same backward or forward.

For example

The string "MALAYALAM" is a palindrome. Help Divya to check whether Amit identified palindromes correctly or not.

Functional Description:

Complete the task using C editor and the output of the program is to display a value.

9. A box contains 'n' distinct color balls. A person has to take 'r' balls at a time. Find the arrangements and selections of balls.

Functional Description:

Complete the task using C editor and the output of the program is to display the output.

Constraints:

- $n > 0$
- $r \geq 0$

Sample Test case:

5
3
10
60

The first integer indicates n

Second integer indicates r

Third integer indicates number of arrangements

Forth value indicates number of arrangements

10. a. Bob wants to store some information regarding his research work later he wants to see whenever necessary. Suggest him how efficiently he can do this work.
b. An Organization has several branches, which maintain information regarding company one Of Sub branches wants some information from main branch. Help them in effective way

Functional Description:

Complete the task using C editor and the output of the program is to display its content.

11. Determine all positive integer values that evenly divide into a number, its factors. Return the pth element of your list, sorted ascending. If there is no pth element, return 0.

For example, given the number $n = 20$, its factors are $\{1, 2, 4, 5, 10, 20\}$. Using 1-based indexing if $p = 3$, return 4. If $p > 6$, return 0.

Function Description

Complete the function pth Factor in the editor below. The function should return a long integer value of the pth integer factor of n.

pth Factor has the following parameter(s):

n: an integer

p: an integer

Constraints

- $1 \leq n \leq 1015$

- $1 \leq p \leq 109$

Input Format for Custom Testing

Input from stdin will be processed as follows and passed to the function.

The first line contains an integer n , the number to factor.

The second line contains an integer p , the 1-based index of the factor to return.

Sample Case 0

Sample Input 0

10

3

Sample Output 0

5

Explanation 0

Factoring $n = 10$ we get $\{1, 2, 5, 10\}$. We then return the $p = 3$ rd factor as our answer.

Sample Case 1

Sample Input 1

10

5

Sample Output 1

0

Explanation 1

Factoring $n = 10$ we get $\{1, 2, 5, 10\}$. There are only 4 factors and $p = 5$.

We return 0 as our answer.

Sample Case 2

Sample Input 2

1

1

Sample Output 2

1

Explanation 2

Factoring $n = 1$ we get $\{1\}$. We then return the $p = 1$ st factor as our answer.

12. Alex wants to paint a picture. In one stroke, Alex can only paint the same colored cells, which are joined via some edge. Given the painting, determine the minimum number of strokes to completely paint the picture. Take for example, the canvas with height given by $h = 3$ and width given by $w = 5$ is to be painted with picture `picture = ["aabba", "aabba", "aaaca"]`, the diagram below shows the 4 strokes needed to paint the canvas.

Strokes

Canvas 1 2 3 4

aabb~~aa~~ bb a

aabb~~aa~~ bb a

aaaca~~aaa~~ c a

Function Description

Complete the function `strokesRequired` in the editor below. The function must return an integer, the minimum number of strokes required to paint the canvas.

`StrokesRequired` has the following parameter(s):

`picture[picture[0],...picture[h-1]]`: an array of strings where each string represents one row of the picture to be painted

Constraints

- $1 \leq h \leq 105$
- $1 \leq w \leq 105$
- $1 \leq h*w \leq 105$
- $\text{len}(\text{picture}[i]) = w$ (where $0 \leq i < h$)
- $\text{picture}[i][j] \in \{'a', 'b', 'c'\}$ (where $0 \leq i < h$ and $0 \leq j < w$)

Input Format For Custom Testing

The first line contains an integer, h , that denotes the height of the picture and the number of elements in `picture`.

Each line i of the h subsequent lines (where $0 \leq i < h$) contains a string that describes `picture[i]`.

Sample Case 0

Sample Input For Custom Testing

3

aaaba

ababa

aaaca

Sample Output

5

Explanation

The 'a's can be painted in 2 strokes, 'b's in 2 strokes and 'c' in 1 stroke, for a total of 5.

Strokes

Canvas 1 2 3 4 5

aaaba aaa b a

ababa a a b b a

aaaca aaa c a

Sample Case 1

Sample Input For Custom Testing

4

bbba

abba

acaa

aaac

Sample Output

4

Explanation

The 'a's can be painted in 1 stroke, the 'b's in 1 stroke and each 'c' requires 1 stroke.

Strokes

Canvas 1 2 3 4

bbbabb a

abba bb a a

acaa a aa c

aaacaaa c

13. We define the following:

A binary string is a string consisting only of 0's and/or 1's. For example, 01011, 1111, and 00 are all binary strings.

The prefix of a string is any substring of the string that includes the beginning of the string. For example, the prefixes of 11010 are 1, 11, 110, 1101, and 11010.

We consider a non-empty binary string to be magical if the following two conditions are true:

The number of 0's is equal to the number of 1's.

For every prefix of the binary string, the number of 1's should not be less than the number of 0's.

For example, 11010 is not magical because it doesn't have an equal number of 0's and 1's, but 110100 is magical because it satisfies both of the above conditions.

A magical string can contain multiple magical substrings. If two consecutive substrings are magical, then we can swap the substrings as long as the resulting string is still a magical string. Given a magical binary string, binString, perform zero or more swap operations on its consecutive magical substrings such that the resulting string is as lexicographically large as possible. Two substrings are considered to be consecutive if the last character of the first substring occurs exactly one index before the first character of the second substring.

For example, if we look at the magical binary string binString = 1010111000, we see two magical binary substrings, 1010 and 111000 among others. If we swap these two substrings we get a larger value: 1110001010. This is the largest possible magical substring that can be formed.

Function Description

Complete the function largestMagical in the editor below. The function must return a string denoting the lexicographically largest possible magical string that can be formed by performing zero or more swap operations on consecutive magical substrings of binString.

largestMagical has the following parameter(s):

binString: a string

Constraints

Each character of binString \in {01}.

$1 \leq |\text{binString}| \leq 50$

binString is a magical string.

Input Format For Custom Testing

The only line of input contains the string binString.

Sample Case 0

Sample Input 0

11011000

Sample Output 0

11100100

Explanation 0

Given the magical string binString = 11011000, we can choose two consecutive magical substrings, 10 and 1100, to swap such that the resultant string, str = 11100100, is the lexicographically largest magical string possible.

Sample Case 1

Sample Input 1

1100

Sample Output 1

1100

Explanation 1

The only magical substring of binString is 1100. So none of the operations can be applied on the string.

Sample Case 2

Sample Input For Custom Testing

1101001100

Sample Output

1101001100

Explanation

The only consecutive magical substrings of binString are 110100 and 1100. Note that 100 is not a magical substring because it contains more zeroes than ones. If we were to swap them, it would result in a lexicographically smaller string. Thus, binString is already the lexicographically largest magical string that can be formed.

14. Write recursive functions for the following
- i) To find the factorial of the given positive integer
 - ii) To generate first n terms of Fibonacci series
 - iii) To compute the sum of first n integers
 - iv) To find the GCD of given 2 numbers

List of Augmented Experiments¹

1. Employee's Management System
2. Library management system
3. Automation of department store
4. Personal Dairy Management
5. Telecom Billing Management
6. Bank Management System
7. Contacts Management

Reading Material (s)

1. C Programming Lab manual–Department of CSE-GMRIT Rajam, 2020

¹Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20HSX02 Communicative English laboratory
(Common to all B Tech Programmes)

0 0 3 1.5

Course Outcomes

1. Make use of the acquired knowledge of English sound system
2. Improve articulation of sounds using the patterns of accent, rhythm and intonation
3. Develop the skills of communication in formal and informal situations
4. Choose and play different roles and practice interpersonal communication
5. Organize ideas in a structured manner in public speaking activities
6. Demonstrate the necessary verbal and non-verbal communication in technical presentations

COs - POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

Module-1: Letters and Sounds of English	(2) sessions
Letters and sounds, Speech Organs	
Module -2: Interaction-1:	(1) session
Greeting and taking leave, introducing oneself to others.	
Module -3: The Sounds of English:	(1) session
Consonants, consonant clusters and Vowels	
Module -4: Pronouncing Words:	(1) session
Silent letters, Plural markers and past tense markers	
Module -5: Interaction-2:	(1) session
Making request and response to them ask for and give/refuse permission, Ask for and give directions, thank and respond	
Module -6: Stress and Intonation	(1) session
Module -7: Interaction-3:	(1) session
Invite, accept, and declining invitations, Make complaints and respond to them, Express sympathy	
Module -8: Presentation Skills:	(2) sessions
Oral and PPT Presentations	
Module -9: Interaction-4:	(1) session
Apologize and respond, advice and suggest, Telephone Skills	
Module -10: Group Discussions	(1) session

List of Augmented Experiments¹

1. Common Errors in English
2. Listening Skills
3. Writing Skills
4. Reading Skills
5. Public Speaking
6. Interview Skills
7. Business Communication
8. Functional English
9. Preparation for GRE/TOEFL
10. Preparation for IELTS/CAT/GMAT

Reading Material (s)

1. K. Nirupa Rani, Jayashree Mohanraj and B. Indira, Strengthen Your Steps, Maruthi publications, 2012

2. K. Nirupa Rani, Jayashree Mohan Raj, B. Indira, (Ed) Speak Well (C.D) Orient Black Swan Pvt Ltd, Hyderabad, 2012
3. D. Jones, English Pronouncing Dictionary (Software)CUP, Ver.1.0, 2003
4. J. Sethi, S. Kamlesh, D. V. Jindal. *A Practical Course in English Pronunciation*, Prentice-Hall of India, New Delhi, 2007
5. T. Balasubramanian, *A Textbook of English Phonetics for Indian students*, McMillan, 2081
6. K. Mohan and M. Raman, *Effective English Communication*, 1st Ed., Tata McGraw Hills, 2000
7. R. K. Bansal and J. B. Harrison, *Spoken English*, 3rd Ed., Orient Black Swan, Hyderabad, 2083

¹Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20BEX04 Engineering Drawing
(Common to all B. Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Understand Principles of engineering drawing
2. Construct Conic sections using general methods and other methods
3. Construct Orthographic projections of Points, Lines and Planes
4. Construct Orthographic projections of Solids using basic drafting software
5. Construct Isometric projections using basic drafting software
6. Construct Orthographic projections from given isometric projections of an object and vice versa

COs – POs Mapping

COs	PO1	PO5	PO10
1	3	-	2
2	3	-	2
3	3	-	2
4	3	3	2
5	3	3	2
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

List of Experiments**Unit I****Conic Sections-Introduction to Orthographic Projections**

Construction of conics using general method and other special methods

Orthographic Projections of Points, Straight Lines parallel to both planes, parallel to one plane and inclined to other plane

9 Hours**Unit II****Orthographic Projections of Straight Lines and Planes**Projections of Straight Lines inclined to both planes; Projections of Planes; Regular Planes Perpendicular Parallel to one Reference Plane and inclined to other Reference Plane; inclined to both the Reference Planes
*Practice the following topics by using any one 2D drafting software***9 Hours****Unit III****Projections of Solids & Isometric Projections**

Projections of Prisms, Cylinders, Pyramids and Cones with the axis inclined to one Principal Plane and Parallel to the other, Projections of Prisms, Cylinders, Pyramids and Cones inclined to both the Principal Planes Introduction to Isometric Projections, Isometric axes, angles, Isometric views, Construction of Isometric views of Simple planes and Solids in various positions

15 Hours**Unit IV****Conversion of Engineering Views**

Conversion of Orthographic Views of Simple Solid objects into Isometric View, Conversion of Isometric View of Simple Solid objects into Orthographic Views

9 Hours**Total: 42 Hours****List of Drawing Sheets**

1. Conics by General Method
2. Conics by using Special Methods
3. Projections of Points and Straight lines in Simple Positions
4. Projections of Lines inclined to both planes
5. Projections of Planes in Simple positions
6. Projections of Planes inclined to both planes
7. Projections of Solids
8. Projections of Solids inclined to both planes
9. Isometric Projections
10. Conversion of Orthographic views into Isometric views
11. Conversion of Isometric views into Orthographic views

List of Augmented Experiments³

1. Draw the Knuckle Pin and fork end of the knuckle joint
2. Draw the Socket and spigot cotter joint
3. Draw the Tommy bar and body of the Screw jack
4. Draw the Cup and Big and Small screws of screw jack
5. Draw the Connecting rod of IC Engine using CAD
6. Draw the Pipe spool with flanges and a valve
7. Draw a sample pipe line construction design in oil and gas industries using CAD
8. Draw the Pipe truss design using AutoCAD
9. Draw a 3-D bolt and nut with Threads using CAD
10. Draw a 3-D Cross head pattern using CAD
11. Draw the sample Bridge using CAD
12. Draw the pipe vice using CAD
13. Draw the Ni-Cd Battery zapper circuit diagram using CAD
14. Draw the circuit diagram of battery charger with automatic cutoff using CAD
15. Draw the satellite dish and Antenna using CAD

Reading Material (s)

Textbook (s)

1. N.D. Bhatt, V. M. Panchal, Pramod R. Ingle, Engineering drawing, Charotar Publications, 54th Edition, 2014
2. D. M. Kulkarni, A.P. Rastogi, Ashoke K. Sarkar, Engineering Graphics with Auto CAD, Prentice Hall of India, 2nd Edition, 2010

Reference (s)

1. K. C. John, Engineering Graphics for Degree, PHI Publications, 2nd Edition, 2009
2. M. B. Shah and B. C. Rana, Engineering Drawing, Pearson Publishers, 2nd Edition, 2009
3. D. A. Jolhe, Engineering Drawing, Tata McGraw-Hill Education, 1st Edition, 2008

³Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20BEX05 Engineering Workshop
(Common to all B. Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Make use of basic hand tools of carpentry, fitting, tin smithy and house wiring
2. Develop simple wooden components cross lap, T-Lap, Dovetail and Mortise and Tennon joints
3. Develop simple house hold items Square Box without lid ,Taper Tray, Open Scoop and Funnel
4. Develop Square, V, Half Round and Dovetail Fits using mild steel
5. Understand simple house wiring circuits
6. Create a model using the basic principles of all workshop trades

COs - POs Mapping

COs	PO1	PO9	PO10
1	3	2	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	2
6	3	3	2

3-strongly linked | 2-moderately linked | 1-weakly linked

List of experiments**Trades**

Carpentry :
 1. Cross Lap joint
 2. T-Lap joint
 3. Dovetail Joint
 4. Mortise and Tennon Joint

Fitting :
 1. Square Fit
 2. V- Fit
 3. Half Round Fit
 4. Dovetail Fit

Tin Smithy :
 1. Square Box without lid
 2. Taper Tray
 3. Open Scoop
 4. Funnel

House wiring :
 1. Parallel/Series connection of three bulbs
 2. Florescent Lamp Wiring
 3. Stair Case Wiring
 4. Godown Wiring

Total: 45 Hours**List of Augmented Experiments¹**

1. Prepare Tee-bridle joint
2. Prepare Corner dovetail joint
3. Make Corner bridge joint
4. Make Dovetail lap joint
5. Prepare 90⁰ round elbow pipe
6. Prepare Ellipse using GI sheet
7. Make cylindrical pipe
8. Make Round T-pipe
9. Prepare hexagonal fitting
10. Prepare diagonal dovetail fitting
11. Prepare universal fitting
12. Make square fitting
13. Set the general house wriing
14. Set the dim & bright lighting

15. Set the test lamping

Reading Material (s)

1. Engineering workshop Lab manual, Department of Mechanical Engineering, GMRIT Rajam.

⁴Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20PYX02 Engineering Physics Lab
(Common to all B.Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Infer the knowledge from the scientific methods and learn the process of measuring different physical parameters
2. Develop the laboratory skills in handling of electrical and Optical instruments
3. Demonstrate the interference and diffraction phenomena of light
4. Inspect and experience physical principles of Magnetic fields and optical fiber communications
5. Apply the principles of physics and measure the solid state properties of materials
6. Design and analyze experiment based on physics concepts

COs - POs Mapping

COs	PO4
1	3
2	3
3	3
4	3
5	3
6	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Variation of magnetic field along the axis of current-carrying circular coil-Stewart and Gee's Method
2. Determination of wavelengths of spectral line of mercury spectrum using diffraction grating
3. Determination of radius of curvature of convex lens by forming Newton's rings
4. LCR circuit- Study of parallel and series Resonance
5. Measurement of thickness of a thin paper using wedge method
6. Fiber optics-Numerical aperture of a given fiber and study of bendig losses
7. Meldie's Experiment-Transverse and longitudinal modes
8. Determination of wave length of Laser by diffraction grating
9. Determination of Hall Coefficient and charge carrier density of semi-conductor
10. Determination of Band gap of a semiconductor

List of Augmented Experiments⁵

1. To study the magnetization (M) of a ferromagnetic material in the presence of a magnetic field B and to plot the hysteresis curve (M vs. B)
2. Study the Thermoemf of the thermo couple
3. LCR Series and Parallel-Design of circuit for various resonance frequencies
4. Determination of characteristics of Laser beam
5. Determination of Horizontal component of earth's magnetic field
6. Study of double refraction in calcite crystals
7. Dispersive power of various liquids using spectrometer
8. Photo cell-Characteristics and determination of Planks constant
9. Michelson's interferometer.

Reading Material (s)

1. Physics Lab manual-Department of Physics, BS & H, GMRIIT, Rajam, 2020
2. S. Balasubramanian, M.N. Srinivasan " A Text book of Practical Physics"- S Chand Publishers, 2017
3. Y. Aparna and K. Venkateswararao, Engineering Physics-I and II, VGS Techno series, 2010
4. S. Panigrahi and B. Mallick, Engineering Practical Physics, Cengage leaning, Delhi, 2015
5. <http://www.amrita.vlab.co.in> Virtual Labs, Amrita University.
6. <http://www./iitk.vlab.co.in>

⁵Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20CYX02 Engineering Chemistry Lab
(Common to all B. Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Utilize different Analytical tools and execute experiments involving estimation of raw materials, finished products and environmental samples etc.
2. Utilize modern instruments like ion analyzer, UV Vis spectrophotometer for characterization of materials used in industry & environment
3. Determine the amount of fluoride present in water for its quality in drinking purpose
4. Estimate the acid number of oil and assess its suitability as a lubricant.
5. Prepare a cross-linked & thermosetting polymer - Bakelite
6. Identify the adulteration of food items such as milk, honey, tea, coffee

COs - POs Mapping

COs	PO4
1	3
2	3
3	3
4	3
5	3
6	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Introduction to Quantitative Analysis - Demonstration
2. Determination of Acid number of a lubricating oil [titration of weak acid vs. strong base]
3. Estimation of Strength of an acid in Pb-Acid battery by pH metry
4. Conductometry - Determination of cell constant and conductance of solutions
5. Potentiometry - Determination of redox potentials and emfs using Weston cell
6. Preparation of a polymer - Bakelite
7. Determination of molecular weight of a polymer using viscometer
8. Verify Lambert-Beer's law - λ calculation or conc. estimation
9. Assessment of quality of water – Fluoride content
10. Detection of adulteration of food in Honey/Milk/Tea
11. Making and using a blue printing paper
12. Measurement of 10Dq by spectrophotometric method
13. Determination of corrosion of metal in the presence/absence of inhibitor

List of Augmented Experiments⁶

1. Assessment of ground water quality of your village/Mandal (by taking min. 6 locations and determining min. 4 parameters – Fluoride, Chloride, Hardness, TDS etc.
2. Preparation of desired quality of Viscosity Index lubricating oil
3. Studies on the effect of various factors on corrosion
4. Making a battery of required potential
5. Energy scenario in India- Various sources, % consumption, solutions to meet future demand etc.

Reading Material (s)

1. K. Gouru Naidu, Engineering Chemistry Lab Manual, 1st Ed.,2014
2. G. Svehla, Vogel's Qualitative Inorganic Analysis, 7th Ed., Pearson Education, New Delhi,2003

⁶Students shall opt any one of the Augmented Experiments in addition to the regular experiments

20HSX03 Advanced Communicative English
(Language Elective for all B Tech Programmes)

3 0 0 3

Course Outcomes

1. Summarize the information while listening to English spoken in different social and workplace contexts
2. Play different roles in Group Discussions and make formal structured presentations on academic topics using PPT slides
3. Organize information from reading texts after selecting relevant and useful points
4. Paraphrase academic texts, prepare CV and make presentations and project reports
5. Apply the knowledge of grammar in both spoken and written communication with accuracy
6. Develop vocabulary to enhance communicative ability

COs - POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Listening: Listening for presentation strategies and answering questions on the speaker, audience, and key points.

Speaking: Formal presentations using PPT slides without graphic elements and with graphic elements.

Reading: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style.

Writing: Paraphrasing; using quotations in writing; using academic style - avoiding colloquial words and phrases. Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences for presenting views, opinions and position.

Grammar and Vocabulary: Formal/academic words and phrases; Phrasal prepositions; phrasal verbs
Novel: Time Machine by H G wells

15 Hours**Unit II**

Listening: Following an argument/ logical flow of thought; answering questions on key concepts after listening to extended passages of spoken academic discourse.

Speaking: Group discussion on general topics; agreeing and disagreeing, using claims

Reading: Understand formal and informal styles; recognize the difference between facts and opinions.

Writing: Formal letter writing and e-mail writing (enquiry, complaints, seeking permission, seeking internship); structure, conventions and etiquette.

Grammar and Vocabulary: Language for different functions such as stating a point, expressing opinion, agreeing/disagreeing, adding information to what someone has stated, and asking for clarification.

Drama: Hayavadanaby Girlish karnad

15 Hours**Unit III**

Listening: Identifying views and opinions expressed by different speakers while listening to discussions.

Speaking: Group discussion; reaching consensus in group work (academic context).

Reading: Identifying claims, evidences, views, opinions and stance/ position.

Writing: Applying for internship/ job - Writing one's CV/Resume and cover letter.

Grammar and Vocabulary: Active and passive voice – use of passive verbs in academic writing.
Autobiography: Wings of Fire by Abdul Kalam

15 Hours**Unit IV**

Listening: Understanding inferences; processing of information using specific context clues and processing of explicit and implicit information inferable from the text or from previous /back ground knowledge.

Speaking: Formal team presentations on academic/ general topics using PPT slides.

Reading: Reading for inferential comprehension.

Writing: Structure and contents of a Project Report; identifying sections in project reports; understanding the purpose of each section; significance of references.

Grammar and Vocabulary: Reinforcing learning; editing short texts; correcting common errors in grammar and usage.

Travelogue: Butter Chicken in Ludhiyana by Pankaj Mishra

15 Hours

Total: 60 Hours

Textbook (s)

1. English All Round: Communication Skills for Undergraduate Learners, vol.2, Published by Orient Black Swan, 2020.

Reference (s)

1. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
4. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014
5. Dhanavel, S.P. *English And Communication Skills For Students Of Science And Engineering*. Orient Blackswan, 2009.

Web resource(s)

Grammar/Listening/Writing

1. 1-language.com
2. www.5minuteenglish.com
3. www.englishpractice.com

Grammar/Vocabulary

4. English Language Learning online
5. www.bbc.co.uk/learningenglish
6. www.better-english.com
7. www.nonstopenglish.com
8. www.vocabulary.com

Reading

9. www.usingenglish.com
10. www.englishclub.com
11. www.english-online.at

Listening

12. learningenglish.voanews.com
13. www.englishmedialab.com

Speaking

14. www.talkenglish.com
15. BBC Learning English – Pronunciation tips
16. Merriam-Webster – Perfect pronunciation Exercises

All Skills

17. www.englishclub.com
18. www.world-english.org
19. learnenglish.britishcouncil.org

Online Dictionaries

20. Cambridge dictionary online
21. MacMillan dictionary
22. Oxford learner's dictionaries

20MAX02 Engineering Mathematics II
(Common to all B. Tech. Programmes)

3 1 0 3

Course Outcomes

1. Solve problems related to engineering applications using integral transform techniques
2. Make use of Laplace transforms in solving the differential equations with the initial and boundary conditions
3. Utilize basic knowledge of conservative field, potential function and work done and also identify the relationships between line, surface and volume integrals in engineering problems
4. Find the Fourier series of periodic functions and expand a function in sine and cosine series
5. Solve problems related to basic linear and non-linear partial differential equations
6. Formulate and solve some of the physical problems of engineering using partial differential equations

COs – POs Mappings

COs	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Laplace Transforms**

Laplace transforms of standard functions, Shifting Theorems, Transforms of derivatives and integrals (Properties-without proofs), Unit step function, Dirac delta function, evaluation of definite integrals Inverse Laplace transforms, Convolution theorem (without proof), Application of Laplace transforms to ordinary differential equations with constant coefficients

*Laplace transforms of Periodic functions***11+4 Hours****Unit II****Vector Calculus**

Vector Differentiation-Gradient, Divergence, Curl and Vector Identities (without proofs)
Vector Integration - Line integral, work done, Scalar Potential function, surface and volume integrals, Vector integral theorems- Green's, Stokes and Gauss Divergence Theorems (Theorems without proof) and related problems

*Proofs of Vector Identities***11+4 Hours****Unit III****Fourier Series and Transformations**

Fourier series- even and odd functions, Half-range sine and cosine series, Fourier integral theorem (without proof)

Fourier transforms – sine and cosine transforms, properties (without proofs), inverse Fourier transforms.

*Fourier Transform of convolution products***11+4 Hours****Unit IV****Partial Differential Equations and Applications**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equations and non-linear equations (four standard types)
Method of Separation of Variables, Applications to wave equation, one dimensional heat conduction equation and two-dimensional Laplace equation (Cartesian form)

*Charpit's method***12+3 Hours****Total:45+15 Hours****Textbook (s)**

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, New Delhi, 2012
2. S. R. K. Iyengar, R. K. Jain, Advanced Engineering Mathematics, Narosa Publishing House, 4th Edition, New Delhi, 2014

3. B. V. Ramana , Engineering Mathematics, Tata McGraw Hill, New Delhi, 4th Edition,2009

Reference book (s)

1. T. K. V. Iyengaret.al, Engineering Mathematics, 12th Edition, Volume -II, S. Chand Publishers, 2014
2. U. M. Swamy et .al, A Text Book of Engineering Mathematics – I, Excel Books, New Delhi, 2010
3. D.S. Chandrashekharaiiah, Engineering Mathematics, Vol- 1, Prism Publishers, 2010
4. Erwin Kreyszig Advanced Engineering Mathematics, Wiley Student Edition,9th Edition, 2012

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examinations (%)
Remember	20	20	-
Understand	50	50	-
Apply	30	30	60
Analyze	-	-	30
Evaluate	-	-	10
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define unit step function.
2. Solve the PDE. $\sqrt{x} + \sqrt{y} = z$.

Understand

1. Interpret Laplace transform technique $x^{11} - 3x^1 + 2x = x^{30}$ given $(0) = 1$ $x^1(0) = 0$.
Show that the vector $(x^2 - y^2) - (x^2 - y^2)z - (x^2 - y^2)z$ is Irrotational.

Apply

1. Verify Gauss divergence theorem $\nabla \cdot (x^3 - y^2) - 2xz - y$ taken over the surface of the cube formed by the planes $x = 0, y = 0, z = 0$ and coordinate planes.
2. A tightly stretched string with fixed end points $x = 0, x = \pi$ is initially in a position given by $y = \frac{1}{2} \sin^3 \frac{x}{2}$. If it is released from rest from this position, find the displacement $y(x, t)$.

Evaluate

1. Using Laplace transform to evaluate $\int_0^\infty \frac{\cos 2t - \cos 3t}{t} dt$
2. Evaluate $f(x) = x^2$ as a fourier series in $-\pi < x < \pi$.

Analyze

1. Examine whether $F = (x^2yz^2 + y^3) + (2xyz^2 - 4) + (3xz^2 + 2)$ is a conservative vector field ? If so find the scalar potential?
2. Distinguish Gradient, Divergence and Curl by using their physical interpretation.

20HSX04 Communicative German
(Language Elective for all B Tech Programmes)

3 0 0 3

Course Outcomes

1. Demonstrate an awareness of the relevance of foreign languages and understanding of the foreign culture
2. Show a basic level of proficiency necessary in an environment where German is used professions and careers exclusively
3. Make use of German language in description, narration, asking/answering questions and short statements for the variety of topics and situations
4. Build familiar vocabulary, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs
5. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations
6. Write sentences and short paragraphs in German language

COs – POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-1

Grammar:

- 1) Nouns 2) Indefinite articles 3) Definite articles 4) Prepositions 5) Negation 6) Interrogatives 7) Conjugation of verbs in present perfect 8) Conjugation of verbs in present tense

15 Hours

Unit-2

Vocabulary:

- 1) Alphabet 2) Transport 3) Hobby 4) Birthday 5) Colors 6) Numbers 0 to 100 (Ordinal, cardinal) 7) Parts of the face and body 8) Clothes 9) Fruits and vegetables 10) Time, Days, Months, Seasons

15 Hours

Unit-3

Communicative skills:

- 1) How to greet 2) Locating objects and places 3) How to ask and answer questions 4) How to introduce oneself 5) How to talk about the weather 6) How to talk over the telephone

Grammar:

- 1) Personal Pronoun 2) Imperative mood 3) Nominative and Accusative cases 4) Dative case 5) Adjectives 6) Separable and Inseparable verbs 7) Modal verbs 8) Conjunctions 9) Plurals

15 hours

Unit-4

Civilization:

- 1) Greetings 2) Etiquettes 3) Facts about Germany 4) German customs and traditions 5) Food culture in Germany

Vocabulary:

- 1) Food and Drinking 2) Family and Friends 3) Names of Country, its Citizens & Language 4) Vacation 5) Home 6) Furniture 7) Office 8) Directions 9) Shopping 10) Contacts 11) Daily routine 12) Games/Sports 13) Medical Equipment

15 hours

Total: 60 hours

Recommended study material:

1. Netzwerk A1 Kursbuch by Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber
2. Netzwerk A1 Arbeitsbuch by Stefanie Dengler, T Mayr-Sieber, Paul Rusch

20HSX05 Communicative French
(Language Elective for all B Tech Programmes)

3 0 0 3

Course Outcomes

1. Demonstrate an awareness of the relevance of foreign languages and understanding of the foreign culture
2. Show a basic level of proficiency necessary in an environment where French is used professions and careers exclusively
3. Make use of French language in description, narration, asking/answering questions and short statements for the variety of topics and situations
4. Build familiar, everyday expressions and very simple sentences, which relate to the satisfying of concrete needs
5. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations
6. Write sentences and short paragraphs in French language

COs - POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-1

Grammar: 1) Nouns 2) Indefinite articles 3) Definite articles 4) Prepositions 5) Negation 6) Interrogatives 7) Irregular verbs (Present tense): être 8) Regular verbs (Present tense): -er 9) Expressions: c'est, cesont, il y a. 10) Imperative mood

15 Hours

Unit-2

Vocabulary: 1) Alphabet 2) Geography of France 3) Days 4) Months 5) Colours 6) Numbers 0 to 100 (Ordinal, cardinal) 7) Parts of the face and body

15 Hours

Unit-3

Communicative skills: 1) How to greet 2) Locating objects and places 3) How to ask and answer questions 4) How to introduce oneself 5) How to talk about the weather 6) How to talk over the telephone
Grammar: 1) Contracted Articles 2) Irregular verbs (present tense): avoir, aller, faire, venir, écrire, lire, recevoir. 3) Adjectives 4) Verbs: -ir (present tense) 5) Tense: futurproche 6) Impersonal verbs: pleuvoir ;neiger. 7) Possessive adjectives

15 hours

Unit-4

Civilization: 1) Greetings 2) Etiquettes 3) Facts about France 4) French customs and traditions 5) Food culture
Vocabulary: 1) Clothes 2) Fruits and vegetables 3) Festivals

15 hours
Total: 60 hours

Recommended study material

1. **Sans frontieres 1** by Michèle Verdelhan-Bourgad

20HSX09 Communicative Hindi
(Language Elective for all B Tech Programmes)

3 0 0 3

Course Outcomes

1. Build confidence to speak Hindi language and demonstrate an awareness and relevance of Hindi language
2. Show a basic level of proficiency in speaking in meaningful conversations in careers
3. Make use of good vocabulary in description, narration, asking/answering questions and short statements for the variety of topics and situations
4. Practice familiar, everyday expressions and sentence structures, which relate to the satisfying of concrete needs
5. Comprehend the language and grasp the main idea and some supporting details in short conversations.
6. Write simple sentences and short paragraphs in Hindi language

COs - POs Mapping

Cos	PO10	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3-strongly linked | 2-moderately linked | 1-weakly linked

Unit I**Writing:** Introduction to Alphabet (phonology) –classification; Mathra**Vocabulary:** Useful words- home, animals, birds, vegetables, flowers, fruits, relationships, days, months**Grammar** Noun, Pronoun, verb, adjective, adverb, post position, conjunction, interjection.**15hours****Unit II****Vocabulary:** Antonyms, synonyms, gender, vachan, suffix, prefix**Speaking:** Simple sentences, comparative sentences, Sentence structures, use of want, not, don't, must, so-that, aa-ee-ye**Grammar:** Tense, Usage of lag-sak-chuck-Degrees of comparison**15hours****Unit III****Writing:** Official, Formal and informal letters**Speaking:** Self- introduction, Conversations (at bank, post office, etc.)**Grammar and Vocabulary:** Translations - words; sentences, paragraphs.**15hours****Unit IV****Writing:** Short notes/stories, Essay writing**Speaking:** Short talk and Conversations in travel, market etc**Vocabulary:** Names of numerals, business vocabulary, time and scales of measurement etc.**15hours****Total: 60 hours****Recommended Study material:**

1. Meenu Katuria. Saral Hindi Vyakarantatha Rachana. Kumar publications Delhi.
2. N. Rajesh Rakhade & G. Kanaka Durga. Hindi Speaking course, Mudra Books. 2014

3rd Semester**20MA304 - Probability and Statistics using Python****3 0 2 4****Course Outcomes:**

1. List the basic data structures of Python and visualize data using various libraries of Python.
2. Illustrate basic probability axioms and apply Bayes' theorem related to engineering problems.
3. Differentiate between various distributions of random variables on given data.
4. Choose appropriate curve fitting and correlation methods for a given data
5. Examine given dataset based on descriptive statistics.
6. Compare the null or alternative hypotheses using the suitable test statistic.

CO-PO Mapping

CO	PO1	PO4	PO12
1	3	1	2
2	3	2	2
3	1	3	1
4	3	2	1
5	3	2	1
6	2	3	1

3- Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+8 Hours**

Fundamental of Python Programming: Variables, expressions, and statements, Conditional execution, Functions, Iteration; Python Data Structures: Strings, Files, Lists, Dictionaries, Tuples.

Data Interpretation and Visualization using Python packages: Pandas, NumPy, SciPy, Sklearn and Matplotlib.

Objects & Classes

Practical Components

1. Lab Activity: Python Installation and Lab Setup
2. Lab Activity: Basic Experiments on Fundamentals of Python
3. Lab Activity: Experiments on Exploratory Data Analysis using NumPy, Pandas and Matplotlib packages

Unit II**11+8 Hours**

Introduction to Probability: Definition, Events and their probabilities, Rules of Probability; Conditional Probability, Bayes Theorem,

Random Variables: Discrete and Continuous; Expectation and Variance, Probability Density, Distribution of a Random Variables: Discrete and Continuous Distributions- Bernoulli distribution, Binomial Distribution, Poison Distribution and Normal Distribution; Central Limit Theorem.

Gaussian and chaotic random distributions

Practical Components

1. Lab Activity: Simulation of random experiment (e.g. rolling an n-face dice) and plot the empirical probability of each event, alongside the theoretical probability.
2. Lab Activity: Python script to find conditional probability of a given event.
There are two urns α and β . Urn α contains R_A red balls and W_A white balls whereas urn β contains R_B red balls and W_B white balls. One of the urns is picked at random and then one ball is picked at random from this urn. Write a function **conditional probability** that calculates the conditional probability that the randomly chosen ball belonged to urn A given that it is white.
Assume that $(R_A/W_A) \neq (R_B/W_B)$.

Unit III**11+6 Hours**

Introduction Statistics: Introduction to Statistics, Population and sample, parameters and statistics, Simple Descriptive Statistics and Graphical Statistics.

Statistical Inference: Parameter Estimation, Confidence Intervals, Unknown Standard Deviation.

Hypothesis Testing: Hypothesis and alternative, Type I and Type II errors, Maximum error, one tail and two-tail tests, level of significance, Hypothesis testing concerning one mean and proportions, two means –Proportions and their differences using Z-test, Student's t-test, F-test, Chi-square test.

ANOVA for one way and two way classified data

Practical Components

1. Lab Activity: Python Modules for Descriptive Statistics

- Write a python program to perform z-test, t- test for testing the Null hypothesis for single mean and difference of means at alpha level of significance and also explore problems in F-test.
- Write a python program to perform chi square for determine whether there is a significant association between the two variables

Unit IV

11+8 Hours

Curve Fitting and Correlation: Introduction-fitting a straight line-second degree curve-exponential curve-power curve by method of least square.

Simple Correlation and Regression-Rank Correlation-Multiple Regression-Subject Category

Causation, Correlation vs covariance,

Practical Components

- Lab Activity: Develop a curve to fit some real world observations
- Lab Activity: Explore problems in Correlation and Regression

Total: 45+30 Hours

Text Books:

- Probability & Statistics by T.K.V.Iyengar & B.Krishna Gandhi & Others, S.Chand (2016) 6th edition.
- E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye, (2012), Probability and Statistics for Engineers and Scientists,9th Edition, Pearson Education, ISBN: 978-8-131-71552-9.
- Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O’Reilly Media, Inc.

Reference Books:

- Michael Baron, Probability and Statistics For Computer Scientists, 2nd Edition, CRC Press
- Sheldon M. Ross, (2011), Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation, ISBN: 978-8-190-93568-5.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	40	30	--
Understand	50	40	--
Apply	10	30	--
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)

Remember

- Define variable in python.
- List any two differences between built-in and user defined functions.
- List any two python packages used mathematics.

Understand

- Explain use of probability and statistics in real world.
- Illustrate about random variables in python.

Apply

- Find different real time applications which use Markov process
- Implement a queuing theory to handle multiple processes.

19HSX10 Engineering Economics and Project Management**3 1 0 3****Course Outcome(s)**

1. Illustrate the basic principles of engineering economics.
2. Demonstrate Cost-Volume-Profit (CVP) analysis in business decision making.
3. Implement the simple financial statements for measuring financial performance of a firm.
4. Evaluate investment proposals through various capital budgeting methods.
5. State key issues of organization, management and administration.
6. Determine the accurate project cost estimates and plan future activities.

COs – POs Mapping

CO _s	PO ₁₀	PO ₁₁	PO ₁₂
1	1	1	2
2	3	2	1
3	3	3	2
4	2	2	1
5	1	2	1
6	2	3	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit-I**Introduction to Engineering Economics - Demand Forecasting & Cost Analysis**

Concept of Engineering Economics – Types of efficiency – Managerial Economics Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis: Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis.

Factors affecting the elasticity of demand – Supply and law of Supply

10 + 3 Hours**Unit-II****Market Structures - Financial Statements & Ratio Analysis**

Different type of Markets Structures – Features – Price Out-put determination under Perfect Competition and Monopoly

Financial Statements & Ratio Analysis: Introduction to Financial Accounting – Double entry system – Journal – Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

Price output determination under Monopolistic markets, Accounting concepts and conventions

13 + 4 Hours**Unit-III****Investment Decisions and Fundamentals of Management**

Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting

Introduction to Management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process – Inventory Control, Objectives, Functions – Analysis of Inventory – EOQ.

Maslow & Douglas McGregor theories of Management, ABC Analysis

10 + 4 Hours**Unit-IV****Project Management**

Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks – Time-Cost Relationship (Crashing) – Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Sources of Long-term and Short-term Project Finance

12 + 4 Hours**Total: 45+15 Hours****Textbook (s)**

1. Pravin Kumar, Fundamentals of Engineering Economics, Wiley India Pvt. Ltd. New Delhi, 2015
2. Rajeev M Gupta, Project Management, 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014
3. Panneer Selvam. R, Engineering economics, 2nd Ed., Prentice Hall of India, New Delhi, 2013

Reference (s)

1. R.B.Khanna, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2011

2. R. Panneer Selvam & P.Senthil Kumar, Project Management, PHI Learning Pvt. Ltd. New Delhi, 2010
3. A. Aryasri, Management Science, 4th Ed., Tata McGraw Hill, 2014
4. A. Aryasri, Managerial Economics and Financial Analysis, 4th Ed., Tata McGraw Hill, 2014
5. Koontz & Weihrich, Essentials of Management, 6th Ed., TMH, 2010
6. Chuck Williams and Mukherjee, Principle of Management 7th Ed., Cengage Learning, 2013

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination ¹ (%)
Remember	25	25	--
Understand	35	35	--
Apply	40	40	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define Managerial Economics. Explain its nature and scope.
2. Define Production Function? List the various types of production functions.
3. Define the meaning of productivity? Explain how productivity can be enhanced in the Indian industries.
4. Define management and its functions.
5. List out short-term source of finance and explain briefly.
6. Why is it essential to define project life cycle and divide it into various phases?

Understand

1. Summarize engineering economics with suitable examples.
2. Explain different elements of costs used in cost analysis.
3. Illustrate the effect of price on demand and supply with the help of a diagram.
4. Explain the features of Perfect Competition.
5. Describe the Top level Upper Middle level of management and its functions.
6. Explain Price-Output determination under Perfect Competition under Market period.

Apply

1. Consider the following data of company for the year 2015
 Sales = Rs.2,40,000/-
 Fixed cost = Rs.50,000/-
 Variable cost = Rs.75,000/-
 Find out the followings
 a) Profit b) BEP c) Margin of safety
2. The following trial balance of Mr. Ramesh, prepare trading, profit & loss A/c for the year ended 31.12.2018 and balance sheet as on that date.

Particulars	Debit (Rs.)	Credit (Rs.)
Capital		1,00,000
Drawing	18,000	
Furniture	32,500	
Machinery	15,000	
Bills payable		15,000
Interest paid	900	
Sales		1,00,000
Purchases	75,000	
Opening stock	25,000	
Advertisement	15,000	
Wages	2,000	
Insurance	1,000	
Commission received		4,500
Sundry debtors	28,100	
Cash in hand	20,000	
Sundry creditors		10,000
Interest received		3,000
Total	2,32,500	2,32,500

¹Open Book Examination should contain only questions related to Higher Order Thinking (HOT) Skills

Adjustments:

Closing Stock Rs.60,000 b) Outstanding wages Rs.500

3. From the following balances as on the date March 31st, 2014.

Particulars	Amount (Rs.)	Particulars	Amount (Rs.)
10% Debentures	3,00,000	Cash in hand	30,000
6% Long term Loans	50,000	Debtors	15,000
Share capital	2,50,000	Opening stock	50,000
Creditors	1,00,000	Closing stock	40,000
Bill payable	45,000	Gross Profit	20,000
Sales	100000	Building	700000

Calculate: Current Ratio, Debt-equity ratio, Quick ratio, Inventory turnover ratio, Debtors turnover ratio

4. A company requires 40,000 kg of raw materials. The company incurs a handling cost of Rs.360/- plus freight of Rs.390 per order. The incremental carrying cost of inventory of raw material is Rs. 15 per kg. Calculate: a) EOQ b) Number of orders per annum c) How frequently should orders be placed
5. The following table gives the activities in a construction project and other related information:

Activity	Immediate Predecessors	t ₀	t _m	t _p
A	-	1	9	11
B	-	5	6	7
C	A	5	7	9
D	A,B	4	7	10
E	C,D	1	4	7
F	C,D	7	9	11

- a) Draw PERT diagram
 b) Calculate total project duration
 c) Mark the critical path
 d) Find out the S.D and Variance of each activity
6. ABC Ltd., a US based organization, is engaged in manufacturing television screens. It is planning to establish a subsidiary organization in India to manufacture picture tubes. Cost studies produced the following estimates for the Indian subsidiary based on the estimated annual sales of picture tube (Rs.400000/-):

Particulars	Total Annual Cost (Rs.)	Percent of total annual cost that is variable
Materials	1936000	100%
Labour	900000	70%
Overhead	800000	64%
Administration	300000	30%

The Indian production would be sold by manufacturer's representatives who would receive a commission of 8% of the sales. No portion of the parent organizations' expenses is to be allocated to the Indian subsidiary.

Questions:

1. Compute the sale price per picture tube to enable management to realize an estimated 10% profit on sale proceeds in India.
2. Is it feasible for ABC Ltd., to invest in the Indian market by studying the preceding calculation?

(For Open Book Examination and not for semester end examination)

Analyze:

1. From the following cases analysis the situation of price elasticity of product.

Case 1:

Price of product (Rs.) Quantity of Demand (Units)

100 1000

90 1500

Case 2:

Price of product (Rs.) Quantity of Demand (Units)

100 1000

70 1100

2. Analyze the attributes to be consider for selection project.
3. Differentiate between Perfect Competition & Monopoly Competition.

4. Compare significances and limitation of liquidity and solvency ratios.
5. You are given the following information about two companies in the year 2020.

Particular	Company - A	Company - B
Sales	Rs. 50,00,000	Rs. 50,00,000
Fixed Expenses	Rs. 12,00,000	Rs. 17,00,000
Variable Expenses	Rs. 35,00,000	Rs. 30,00,000

A friend seeks your advices as to which company's shares be should purchase. Assuming the capital invested is equal for the two companies, state the advice that you will give.

6. A private school is considering the purchase a school bus to transport students to school. The initial cost of the bus is Rs.600,000. The life of bus is estimated to be five years, after the life time the vehicles would have to be scrapped with no salvage value. The school's management team has derived the following estimates for annual revenues and cost for the next five years.

year	Annual Revenue	Diver Cost	Repairs & maintenance	Other costs	Annual depreciation
1	330000	33,000	8,000	130000	120000
2	330000	35,000	13,000	135000	120000
3	350000	36,000	15,000	140000	120000
4	380000	38,000	16,000	136000	120000
5	400000	40,000	18,000	142000	120000

The buses would be purchased at the beginning of the project (i.e., in Year 0) and all revenues and expenditures shown in the table above would be incurred at the end of each relevant year. A business consultant has advised management that they should use a cost of capital of 10% to evaluate this project.

Questions:

1. Attributes to be involved to estimate the net cash flow for each year in this project.
2. Justify the steps involved in the calculation process of net present cash flows above the project investment. **(For Open Book Examination and not for semester end examination)**

20CS303 Data Structures**3 1 0 3****Course Outcomes**

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

1. Describe the operations and implementation of List ADT (Understand)
2. Comprehend the operations and implementation of Stack and Queue (Understand)
3. Illustrate the applications of linear data structures (Apply)
4. Describe the operations and implementation of hash table (Understand)
5. Comprehend the operations and implementation of tree data structure (Understand)
6. Illustrate the variations of tree data structure (Understand)

CO-PO Mapping

CO	PO1	PO2	PO12
1	3	2	1
2	3	2	1
3	2	3	1
4	2	3	1
5	3	2	1
6	2	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Linear Data Structures – List****10 + 3 Hours**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists- Circularly linked lists- Doubly-linked lists – Applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal) - Searching - Linear Search – Binary Search

Doubly linked Circular list

Unit II**Linear Data Structures – Stack and Queue****12 + 4 Hours**

Stack ADT – Array implementation – Linked list implementation – Applications of Stack – infix to postfix conversion, evaluation of postfix expression – Queue ADT – Array implementation – Linked list implementation – Application of Queue – Ticket counter

Circular Queue

Unit III**Sorting, Hashing Techniques and Trees****11 + 4 Hours**

Sorting – Bubble Sort – Selection Sort – Insertion Sort – Shell Sort – Radix Sort – Quick Sort – Merge Sort - Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing
Trees: Introduction, Terminology, Binary Trees, Representation of Binary Trees using arrays and linked lists, Binary tree traversals

Extendible Hashing

Unit IV**Variations on Trees and Graphs****12 + 4 Hours**

Binary Search Trees: definition, basic operations of BST (Searching, Insertion and deletion) - Introduction to AVL trees: Balancing AVL tree by rotations after insertions and deletions of a data node Multi-way search trees: Introduction to m-way search trees, B-trees, B+ Trees;
Heaps: Binary heaps, definition of a Max-heap, Min-heap, Creating Max-Heap, Applications: Heap sort
Graphs: Terminology, Representation, Traversals: Depth First Search and Breadth First Search

Priority queue operations: insertions and extract-max

Total: 45+15 Hours

Textbook (s)

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2002
2. Michael Main, Walter Savitch, Data Structures and other objects using C++, 4th Edition, Addison Wesley, 2018

Reference (s)

1. S. Tanenbaum, Y. Langsam and M.J. Augenstein,, Data Structures using C and C++, 2nd Edition, Pearson Education, 2015
2. R. F. Gilberg, B. A. Forouzan, Data Structures A Pseudocode Approach with C, 2nd Edition, CENGAGE Learning, 2005

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination ³ (%)
Remember	20	20	--
Understand	60	60	--
Apply	20	20	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What are abstract data types?
2. List any 2 disadvantages of array
3. Define linked list
4. Define data structure
5. List any 2 applications of queue

Understand

1. Compare linked list with array
2. Explain Bubble Sort Process with an example
3. Demonstrate with neat diagram and algorithm to insert a node before the given key
4. Explain Deletion process using an example binary search tree
5. Explain why the selection sort is more efficient than the bubble sort
6. Explain with suitable example of LL rotation after inserting a new node into an AVL tree
7. Demonstrate the application of singly linked lists for the addition of the polynomials P1 and P2

Apply

1. Develop an algorithm to concatenate two single linked lists
2. Construct a priority queue and implement all basic operations to demonstrate priority queue
3. Build a recursive procedure to count the number of nodes in a binary tree

Sample Questions for Open Book Examination**Apply**

1. Select appropriate data structure to simulate the operations of a Music Player – Songs in music player are linked to previous and next song. you can play songs either from starting or ending of the list.

³Open book Examination should contain only questions related to Higher Order Thinking (HOT) Skills

2. A bracket is considered to be any one of the following characters: (,), {, }, [, or]. Two brackets are considered to be a matched pair if the an opening bracket (i.e., (, [, or {) occurs to the left of a closing bracket (i.e.,),], or }) of the exact same type. There are three types of matched pairs of brackets: [], {},and (). A matching pair of brackets is not balanced if the set of brackets it encloses are not matched. For example, {[()]} is not balanced because the contents in between { and } are not balanced. The pair of square brackets encloses a single, unbalanced opening bracket, (, and the pair of parentheses encloses a single, unbalanced closing square bracket,]. By this logic, we say a sequence of brackets is balanced if the following conditions are met: It contains no unmatched brackets. The subset of brackets enclosed within the confines of a matched pair of brackets is also a matched pair of brackets. Given n strings of brackets, determine whether each sequence of brackets is balanced. If a string is balanced, return YES. Otherwise, return NO.
3. You are given a stack of **N** integers such that the first element represents the top of the stack and the last element represents the bottom of the stack. You need to pop at least one element from the stack. At any one moment, you can convert stack into a queue. The bottom of the stack represents the front of the queue. You cannot convert the queue back into a stack. Your task is to remove exactly **K** elements such that the sum of the **K** removed elements is maximized.
4. Vikas is given a bag which consists of numbers (integers) blocks, Vikas has to organize the numbers again in the same order as he has inserted it into the bag, i.e. the first number inserted into the bag by Vikas should be picked up first followed by other numbers in series. Help Vikas to complete this work in $O(n)$ time complexity with the condition to use one extra bag to complete the work (assume that the bags are compact and is in the form of a stack structure and has the same width as that of the number blocks and is large enough to fill the bag to the top and the number taken from bag is in reverse order).

20CS304 Digital Logic Design**3 0 2 4****Course Outcomes**

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

1. Understand different number systems, its conversions and binary arithmetic. (Understand)
2. Classify logic circuits using basic Logic gates and simplify logic expressions using theorems, K-map. (Understand)
3. Design and implement logical devices using combinational circuits. (Apply)
4. Demonstrate and compare the construction of programmable logic devices and different types of ROM (Understand)
5. Understand and Analyze Sequential circuits like latches and flip-flops. (Understand)
6. Analyze and Design sequential circuits like Registers and Counters. (Analyze)

CO-PO Mapping

CO	PO1	PO4
1	3	2
2	3	2
3	3	3
4	3	2
5	3	3
6	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**10+6 Hours****Number systems and Boolean algebra**

Review of Number Systems, Conversion of Numbers from One Radix to Another Radix, Complements, Representation of Negative Numbers, Binary Arithmetic, Binary Codes, Error detecting & correcting codes, Basic Theorems and Properties of Boolean Algebra, Digital Logic Gates, Universal Gates.

IC specifications and pin diagram of gates

Practical Components

1. Realization of Logic gates and verification of Truth tables
2. Realization of basic gates using Universal gates

Unit II**12+8 Hours****Boolean Function Minimization**

Minimization of Switching Functions using K-Map up to 4-variables, Prime implicants, don't care combinations, Minimal SOP and POS forms

Combinational Arithmetic Logic Circuits-1

Adders, Subtractors, Binary Multiplier-*parity bit Generator*, Ripple carry adder, Multiplexer, De-Multiplexer, Encoder, Priority encoder, Decoder, MUX Realization of switching functions.

Code Converters, Magnitude Comparator

Practical Components

1. Implementation of Half Adder and Full Adder
2. Implementation and verification of Decoder and Encoder
3. Implementation and verification of MUX and DE-MUX

Unit III**12+6 Hours****Programmable Logic Devices and Sequential Logic Circuits-1**

Basic PLD's-ROM-PROM-PLA-PAL - Realization of Switching functions using PLD's Classification of Sequential Circuits (Synchronous and Asynchronous): Latches and Basic Flip-Flops-Truth Tables and Excitation Tables

Conversion of flip-flops

Practical Components

1. Realization of Flip-Flops using ICs

Unit IV**11+10 Hours****Sequential Logic Circuits - II**

Design of Registers - Buffer Register - Control Buffer Registers - Bidirectional Shift Registers - Universal Shift Register - Design of Synchronous Counters – Ripple counter, Up-down Counters, Design of Asynchronous Counters-Variable Modulus Counters (Mod-2,4,6,10 & 16), Ring Counter, Johnson Counter, Sequence generator.

Sequence detector

Practical Components

- 1.Verification of functioning of Basic Shift Register
- 2.Implementation of Synchronous Counter
- 3.Implementation of Asynchronous Counter

Total: 45+30 Hours**Textbook (s)**

1. Digital Design 6th Edition by M Morris Mano, PEARSON INDIA,2018.
2. Charles H. Roth, Fundamentals of Logic Design,3rd Edition, Thomson Publications,2014
3. John F. Wakerly, Digital Design Principles & Practices, 4th Edition, PHI/ Pearson Education Asia,2008

Reference (s)

1. ZviKohavi, Switching & Finite Automata theory, 2nd Edition, TMH,2008
2. R P Jain,Modern Digital Electronics, 3rd Edition, TMH,2003
3. A. Anand Kumar, Switching Theory and Logic Design, 3rd Edition, PHP,2016.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test ⁴ (%)
Remember	20	10	--
Understand	50	40	--
Apply	30	30	--
Analyze	--	20	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)**Remember**

1. Retrieve the decimal value of the fractional binary number 0.1011
2. List any two postulates of Boolean algebra
3. List the four uses of Multiplexer.
4. Define Flip flop and Latch
5. Define Synchronous sequential circuit

Understand

1. Explain working functionality of Programmable Logic Devices (PLD).
2. Represent the following Boolean expression to SOP and POS form: $A+BC'+ABD'+ABCD$
3. Represent the Boolean function $T=F(w, x, y, z) = \sum m(0,1,2,4,5,7,8,9,12,13)$ by using 8 to 1mux.
4. Illustrate a half adder using NAND – NAND
5. Represent a T flip flop using JK flip flop.
6. Differentiate between Bi-directional and Universal Shift Registers.

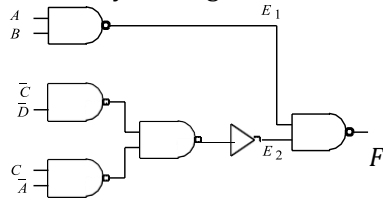
⁴Assignment test should contain only questions related to Higher Order Thinking (HOT) Skills

Apply

1. Find a circuit that has no static hazards and implements the Boolean function $F(A,B,C,D) = \Sigma (0,2,6,7,8,,10,12) ..$
2. Construct a four input NAND gate using gates with 2 inputs. Write down the truth table. Do the same for a 4 input NOR gate.
3. Implement MOD-6 and Johnson Counter.
4. Construct a combinational circuit to convert BCD to EX-3 code.
5. Implement a combinational logic circuit, which can compare two bits binary numbers.

Analyse

1. Analyze the following in two ways to get sums of product and product of sums equations. Then show how you can get one from the other using DeMorgan's Theorem



2. Why the input variables to a PAL are buffered
3. Why the fixed format is not used and floating format is used
4. What happens when an electric signal is grounded?
5. Design a Sequence detector to detect 10111001

20CS305 Discrete Mathematical Structures**3 1 0 3****Course Outcomes**

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

1. Construct and Verify the Correctness of Statements using Propositional and Predicate Logic. (Apply)
2. Illustrate the Operations on Discrete Structures such as Relations and Functions (Understand)
3. Demonstrate the Lattices and Algebraic Structures for the Modeling of Objects (Understand)
4. Utilize the Counting Techniques to Solve Combinatorics Problems (Apply)
5. Make use of the Binomial and multinomial Theorems to Solve Problems involving Recurrence Relations and Generating Functions (Apply)
6. Demonstrate Graphs and Trees as Tools to Visualize and Simplify Situations (Understand)

CO-PO Mapping

CO	PO1	PO12
1	3	1
2	3	1
3	3	1
4	3	1
5	3	1
6	3	1

3- Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Statement Logic and Predicate Logic****11+3 Hours**

Statements and Notations - Connectives - Well-formed Formulas - Truth Tables - Tautology - Equivalence Implication - Normal Forms - Rules of Inference for Statement Logic - Proof Techniques - Proof by Contradiction - Method of Induction.

Predicative Logic - Quantifiers - Universal Quantifiers - Free & Bound Variables - Rules of Inference for Predicate Logic

Program Correctness - Design of Logic Circuits

Unit II**Binary Relations, Functions and Algebraic Structures****11+4 Hours**

Binary Relations - Properties and Operations - Relational Graphs - Relation Matrices - Equivalence Relations - Compatibility Relations - Partial Ordering Relations - Hasse Diagram

Lattices - Properties and Types

Functions - Types of functions - Inverse Function - Composition of Functions

Algebraic Structures - Properties - Semi Groups - Monoids - Groups - Abelian Groups - Subgroups

Relations in Databases - Rings - Fields

Unit III**Combinatorics, Generating Functions and Recurrence Relations****12+4 Hours**

Basics of Counting - Cardinality - Sum and Product Rules - Permutations and Combinations with Repetitions

Binomial Coefficients - Binomial and Multinomial Theorems - The Principle of Inclusion and Exclusion - Pigeonhole Principle.

Generating Functions - Function of Sequences - Calculating Coefficient of Generating Functions - Recurrence Relations - Solving Recurrence Relation by Substitution.

Algorithm Analysis - Time and Space Complexity - Combinatorics for Bioinformatics

Unit IV**Basics of Graph Theory****11+4 Hours**

Representation of Graphs - Degree of a Graph - Handshaking Property - Complete Graphs - Regular Graphs - Bipartite Graphs - Walk - Path - Circuit - Cycle - Planar Graphs - Euler's Formula - Isomorphism - Euler Circuit and Hamilton Cycle - Chromatic Number - Trees and its Properties - Binary Trees and its Types.

Operations on Graphs, Four Color Problem, Applications of Graphs and Trees, Ternary Tree

Total: 45 + 15 Hours

Textbook (s)

1. Kenneth H. Rosen, Discrete Mathematics and Applications, 7th Edition, Tata McGraw Hill, 2015.
2. J. L. Mott, A. Kandel & T. P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, Prentice Hall India, 2nd Edition, 2010.

Reference (s)

1. Tremblay J.P. and P. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2007.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, A Computer Oriented Approach, 3rd Edition, Tata McGraw Hill, 2008.
3. D. S. Chandrasekharaiah, Mathematical Foundation to Computer Science, Prism Books Pvt. Ltd, Hyderabad, 4th Edition, 2012.
4. Ralph P. Grimaldi, B. V. Ramana, –Discrete and Combinatorial Mathematics - An Applied Introduction||, Pearson Education, India, 5th Edition, 2011.
5. Seymour Lipschutz and Marc Lipson, Discrete Mathematics, Revised 3rd Edition, Schaum's Outline Series, Tata McGrawHill, New Delhi, 2009.

Web References:

1. <http://www.web.stanford.edu/class/cs103x>
2. http://www.cs.odu.edu/~cs381/cs381content/web_course.html
3. <http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book>
4. <http://www.saylor.org/course/cs202/>
5. <http://www.nptel.ac.in/courses/106106094/>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination ⁵ (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	60
Analyze	--	--	30
Evaluate	--	--	10
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define converse, contra positive and inverse of an implication
2. List out the different Principal normal forms with example
3. State the property of first theory of digraph theory by taking a suitable example
4. Define monoid and Abelian group with a suitable example
5. Define Pigeonhole Principle and the generalization of the Pigeonhole Principle

Understand

1. Explain the Planarity of the Kuratowski's two planar graphs
2. Explain the General Principle of Inclusion-Exclusion for n-sets
3. Draw the Hasse diagram of the following relation R is a relation defined as the divisors of 60 and denoted by D₆₀.
4. Compare between Eulerian graph and Hamiltonian graph

⁵Open Book Examination should contain only questions related to Higher Order Thinking (HOT) Skills

Apply

1. Show that the identity. $C(n, r - 1) + C(n, r) = C(n + 1, r)$
2. Show that the complete graphs K_2, K_3, K_4 are planar
3. Let G be the set of all non-zero real numbers with a binary operation $*$, defined as $a*b = a^2b^2$. Show that $\langle G, * \rangle$ is an abelian group.
4. Find the coefficient of x^9y^3 in the expansion of $(2x^{-3}y)^{12}$

Analyze

1. Differentiate between Permutation and Combination and find the relation between them.
2. Compare the Equivalence Relation, Compatible relation and Partial Order Relation.
3. Justify, whether the following argument is valid or not.

$p \Rightarrow q$

$r \Rightarrow s \wedge p$

$\vee r$

$q \vee s$

4. Identify the combinations in set of electives of 7 subjects that has no repetitions for a group of 10 members having 5 students in each group.

20CS306 Object Oriented Programming with C++**3 0 0 3****Course Outcomes**

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

1. Describe the basics of Object-Oriented concept (Understand)
2. Comprehend the basics of overloading, type conversion and its implementation (Understand)
3. Illustrate the importance and applications of inheritance (Apply).
4. Describe Virtual Function, runtime Polymorphism and Templates (Understand).
5. Illustrate exception handling (Understand).
6. Describe Standard Template Library (Understand).

CO-PO Mapping

CO	PO1	PO2	PO12
1	3	2	1
2	3	2	1
3	1	1	2
4	3	1	2
5	3	1	2
6	2	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**Introduction to OOPs****11 + 3 Hours**

The Object-Oriented Technology Disadvantage of Conventional Programming- Key Concepts of Object-Oriented Programming Advantage of OOP- Object Oriented Language. **Classes and Objects:** Classes in C++- Declaring Objects- Access Specifiers and their Scope- Defining Member Function- Nested class, **Constructors and Destructor:** Introduction- Constructors and Destructor- Characteristics of Constructor and Destructor. Constructor with arguments & constructor overloading.

*Copy constructor, inline functions, friend function and friend class.***Unit II****Compile time polymorphism and Type Conversion & Inheritance****13 + 4 Hours**

Overloading-Operator Overloading: **Overloading** Unary Operator- Operator Return Type- Overloading Assignment Operator (=)- Rules for Overloading Operators, Overloading Member Function, Inheritance, Reusability- Types of Inheritance- Virtual Base Classes- Object as a Class Member- Abstract Classes- Advantages of Inheritance-Disadvantages of Inheritance. **Pointers:** Pointer, Features of Pointers- Pointer Declaration- Pointer to Class- Pointer Object- The this Pointer- Pointer to Derived Classes and Base Class.

*Interfaces, pure virtual function and Aggregation in C++.***Unit III****Virtual Functions and runtime polymorphism****11 + 4 Hours**

Binding runtime Polymorphisms and Virtual Functions, Introduction- Binding in C++- Virtual Functions- Rules for Virtual Function- Virtual Destructor. **Generic Programming with Templates:** Generic Programming with Templates, Need for Templates- Definition of class Templates Normal Function Templates- Bubble Sort Using Function Templates- Difference Between Templates and Macros

*Over Loading of Template Function.***Unit IV****Exception Handling****10 + 4 Hours**

Exception Handling- Principles of Exception Handling- The Keywords try throw and catch- Multiple Catch Statements –Specifying Exceptions. **Overview of Standard Template Library:** Overview of Standard Template Library- STL Programming Model- Containers- Sequence Containers- Associative Containers- Algorithms- Iterators- Vectors- Lists- Maps

User-defined exceptions and Namespaces.

Total: 45+15 Hours

Textbook (s)

1. Ashok N. Kamthane Object-Oriented Programming with ANSI and Turbo C++, 2nd Edition, Pearson, 2006.
2. Herbert Schildt, The Complete Reference C++, 5th Edition, TMH, 2012
3. Gary Bronson, A First Look of C++, 4th Edition CENAGE Learning, 2012
4. E Balaguruswamy Object-Oriented Programming with C++, Mc Graw Hill, 6th Edition 2013.

Reference (s)

1. Joyce Farrell, Object Oriented Programming using C++, 3rd Edition Cengage Publications, 2006
2. DS Malik, C++ Programming: from problem analysis to program design, 7th Edition, Cengage, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination ⁶ (%)
Remember	40	30	--
Understand	50	40	--
Apply	10	30	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTIONS

Remember

1. Define class
2. Define inline function

Understand

1. Illustrate use of virtual functions
2. Explain operator overloading

Apply

1. Make use of STL to implement 1X20 vector.
2. Make use of exception handling concept to define a user defined exception.

⁶Open book Examination should contain only questions related to Higher Order Thinking (HOT) Skills

20CS307 Data Structures Lab**0 0 3 1.5****Course Outcomes**

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

1. Implement stack and queue data structures using array and linked list
2. Demonstrate the applications of stack and queue data structures
3. Implement sorting and searching algorithms and to compare their efficiency
4. Implement binary tree, binary search tree and tree traversals
5. Solve graph problems using appropriate data structure
6. Implement hashing techniques for real world applications (telephone directory, dictionary)

CO-PO Mapping

CO	PO4
1	3
2	3
3	2
4	2
5	3
6	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Implementation of list using array
2. Implementation of singly linked list
3. Implementation of doubly linked list
4. Implementation of Stack using array and linked list
5. Stack applications: Infix to postfix conversion
6. Implementation of sorting and searching algorithms: Bubble sort, Insertion sort, Selection sort, Merge sort, Quick sort, linear and binary search
7. Implementation of BST
8. Implementation of tree traversal algorithms
9. Implementation of Shortest path algorithms
10. Implementation of Graph Traversals using stack and queue
11. Implement open hashing
12. Implementation of closed hashing

Indicative list of applications-based experiments

1. Given an expression **exp** of length **n** consisting of some brackets. The task is to print the bracket numbers when the expression is being parsed.
Input:
 The first line contains an integer **T**, the number of test cases. For each test case, there is a string **exp** containing the expression.
Output:
 For each test case, the output is the bracket numbers of the expression.
2. Given an unsorted array **arr[]** of size **N**, rotate it by **D** elements (clockwise).
Input:
 The first line of the input contains **T** denoting the number of test cases. First line of each test case contains two space separated elements, **N** denoting the size of the array and an integer **D** denoting the number size of the rotation. Subsequent line will be the **N** space separated array elements.
Output:
 For each test case, in a new line, output the rotated array.
Example:
Input:
 2
 5 2
 1 2 3 4 5

20CS308 Object Oriented Programming Lab

0 0 3 1.5

Course Outcomes

- At the end of the course, students will be able to.
1. Demonstrate basic building blocks of C++.
 2. Demonstrate class and object concepts to represent real time entity as object.
 3. Apply Inheritance concept to reuse existing code.
 4. Make use of polymorphism to design operators and functions to exhibit different behavior.
 5. Utilize Template concept to create common objects and functions which suits to any data type.
 6. Implementation of exception handling mechanism to control runtime errors and STL.

CO-PO Mapping

CO	PO4
1	3
2	3
3	3
4	3
5	3
6	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. **Exercise - 1**
Write a Simple Program on printing "Hello World" and "Hello Name" where name is the input from the user
 - a) Convert any two programs that are written in C into C++
 - b) Write a description of using g++ (150 Words)
2. **Exercise - 2**
 - a) Write a Program that computes the simple interest and compound interest payable on principal amount (in Rs.) of loan borrowed by the customer from a bank for a given period of time (in years) at specific rate of interest. Further determine whether the bank will benefit by charging simple interest or compound interest.
 - b) Write a Program to calculate the fare for the passengers traveling in a bus. When a Passenger enters the bus, the conductor asks "What distance will you travel?" On knowing distance from passenger (as an approximate integer), the conductor mentions the fare to the passenger according to following criteria.
3. **Exercise - 3**
 - a) Write a program to implement call by value and call by reference using reference variable.
 - b) Write a program to illustrate scope resolution, new and delete Operators. (Dynamic Memory Allocation)
 - c) Write a program to illustrate Storage classes
 - d) Write a program to illustrate Enumerations
4. **Exercises -4**
Write a program illustrating Inline Functions
 - a) Write a program illustrate function overloading. Write 2 overloading functions for power.
 - b) Write a program illustrate the use of default arguments for simple interest function.
5. **Exercise -5**
 - a) Write a program to illustrate function overloading. Write 2 overloading functions for adding two numbers
 - b) Write a program illustrate function template for power of a number.
 - c) Write a program to illustrate function template for swapping of two numbers.
6. **Exercise -6**
Create a Distance class with: feet and inches as data members, member function to input distance, member function to output distance, and member function to add two distance objects.
 - a). Write a main function to create objects of DISTANCE class. Input two distances and output the sum.
 - b). Write a C++ Program to illustrate the use of Constructors and Destructors (use the above

program.)

a) Write a program for illustrating function overloading in adding the distance between objects (use the above problem)

d). Write a C++ program demonstrating a Bank Account with necessary methods and variables

7. Exercise - 7

Write a program for illustrating Access Specifiers public, private, protected

a) Write a program implementing Friend Function

b) Write a program to illustrate this pointer

c) Write a Program to illustrate pointer to a class

8. Exercise -8

a). Write a program to Overload Unary, and Binary Operators as Member Function, and Non-Member Function.

i. Unary operator as member function

ii. Binary operator as nonmember function

b). Write a c ++ program to implement the overloading assignment = operator

c).Write a case study on Overloading Operators and Overloading Functions (150 Words)

9. Exercise -9

a) Write C++ Programs and incorporating various forms of Inheritance

i) Single Inheritance

ii) Hierarchical Inheritance

iii) Multiple Inheritances

iv) Multi-level inheritance

v) Hybrid inheritance

b) Write a program to show Virtual Base Class

c) Write a case study on using virtual classes (150 Words)

10. Exercise-10

a) Write a Program in C++ to illustrate the order of execution of constructors and destructors in inheritance

b) Write a Program to *show* how *constructors* are invoked in *derived class*

11. Exercise -11

a) Write a program to illustrate runtime polymorphism

b) Write a program to illustrate this pointer

c) Write a program illustrates pure virtual function and calculate the area of different shapes by using abstract class.

d) Write a case study on virtual functions (150 Words)

12. Exercise -12

a) Write a C++ Program to illustrate template class

b) Write a Program to illustrate class templates with multiple parameters

c) Write a Program to illustrate member function templates

13. Exercise -13

a).Write a Program for Exception Handling Divide by zero

b). Write a Program to rethrow an Exception

14. Exercise -14

a) Write a Program to implement List and List Operations

b) Write a Program to implement Vector and Vector Operations

c) Write a Program to implement Deque and Deque Operations

d) Write a Program to implement Map and Map Operations

List of Augmented Experiments

1. Implement Tic tac toe game
2. Implement banking system
3. Implement Library Management System
4. Implement student report card
5. Implement supermarket billing system
6. Casino number guessing system
7. Snake and ladder game
8. Cricket score sheet
9. Hospital management system
10. Bookshop management system

11. Telephone directory management system
12. Student database management system
13. Hotel management system
14. Bus reservation system
15. GMRIT Payroll management system

Reading Material (s)

1. C++ Lab Manual, Department of CSE, GMRIT, Rajam

20BEA01 Environmental Studies**0 0 0 0****Course Outcomes:**

1. Translate the learner's attitude to think globally and act locally
2. Motivate environmental organizations to create a concern about our present state of Environment.
3. Find solutions for conservation of natural resources
4. Identify the benefits of ecosystem conservation, biodiversity protection, implement pollution prevention and control measures
5. Illustrate social issues of environmental protection and adopt sustainable developmental practices
6. Perceives the basic structure of environmental policy and law pertaining to specific environmental issues (water quality, air quality, biodiversity protection, Forest, etc.)

COs - POs Mapping

CO	PO1	PO6	PO7	PO12
1	1	2	3	1
2	2	-	3	2
3	3	3	-	2
4	-	2	3	2
5	-	-	3	1
6	-	3	2	1

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Unit I**Multidisciplinary nature of Environmental Studies & Natural Resources**

Definition, Scope and Importance, Multidisciplinary nature of Environmental Studies, Value of Nature - Productive, Aesthetic/Recreation, Option, Need for Public Awareness, Institutions (BNHS, BVIEER, ZSI, BSI) and People in Environment (Medha Patkar, Sundarlal Bahuguna, Indira Gandhi, Rachael Carson).

Natural Resources: Renewable and Non-renewable resources - Importance, uses, overexploitation/threats, and conservation of (i) forest (ii) water (iii) mineral (iv) food and (v) energy resources. (The topics include benefits and problems associated with dams, mining and case studies), role of an individual in conservation of natural resources.

Unit II**Ecosystem & Biodiversity**

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Bio geological cycles (Energy flow, Carbon and Nitrogen Cycles), Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structures and functions of the following ecosystems:

a. Forest Ecosystem b. Aquatic Ecosystem

Biodiversity and its Conservation: Definition and levels of biodiversity, Bio-geographical classification of India, hot spots of biodiversity - India as a mega diversity nation, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation.

Unit III**Environmental Pollution & Social Issues**

Environmental Pollution: Definition, Cause, effects, control measures and case studies of: Air pollution b. Water pollution c. Soil pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Food and Household waste management, Disaster management (floods and cyclones)

Social Issues and the Environment: Sustainability, Urban problems related to energy, Water conservation and watershed management, Resettlement and rehabilitation of people; Environmental ethics: Issues and possible solutions, global warming, ozone layer depletion, Consumerism and waste products

Unit IV**Human Population and the Environmental Acts**

Human Population and the Environment: Population growth, Affluence, Technology and Environmental Impact (Master Equation), Population explosion and Family Welfare Programme, Value Education, HIV/AIDS, Women and Child Welfare, Role of information Technology in Environment and human health.

Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act. Issues involved in enforcement of environmental legislation.

Text Book(s) and Reading Material (s)

1. E. Bharucha, Textbook of Environmental Studies, 1st Ed., University Press (India) Pvt. Ltd., 2005.
2. W. P. Cunningham, M.A. Cunningham, Principles of Environmental Science, 6th Ed., Tata McGraw Hill, 2008.
3. A. Kaushik, C. P. Kaushik, Perspectives in Environmental Studies, 4th Ed., New Age International Publishers, 2008.
4. H. S. Peavy, D. R. Rowe, G. Tchobanoglous, Environmental Engineering, 1st Ed., McGraw Hill Int. ed., 2084.
5. T. E. Graedel, B. R. Allenby, Industrial Ecology and Sustainable Engineering, 1st Ed., Pearson Publications, 2009.
6. <http://172.30.1.222/wbc/it/schedule.aspx>.
7. <http://172.30.1.8/wbc/it/coursepage.aspx>.
8. <https://www.edx.org/course/environmental-protection-and-sustainability>.

20CS409 Employability Skills I**1 1 1 0****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Introspect & develop life skills with constructive approach
3. Assess and improve analytical skills
4. Illustrate the knowledge of the basics of Unix/Linux commands
5. Apply the concepts of shell scripting on data and files
6. Understand the utility of SED to work on specific data

COs -POs Mapping

COs	PO 1	PO 2	PO 3	PO 5	PO 6	PO 8	PO 10	PO 12
CO1	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	2	2
CO3	2	-	-	-	-	2	-	-
CO4	3	-	3	2	-	2	-	-
CO5	3	2	3	2	-	-	-	2
CO6	2	2	3	2	3	-	-	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Unit-I**Communication Skills****7 hours**

Communication Skills & Confidence: How Communication Skills affect Confidence? How to communicate effectively.(with Examples)

Listening: Listening? , Listening Vs Hearing, Possible reasons for why people do not Listen at times, Active Listening Vs Passive Listening, How Listening can affect our relationships? How Listening helps in Campus Placements also? (with Examples)

Goal Setting: SMART Technique to Goal Setting, Putting First things First, SWOT Analysis and Time Management

Attitude & Gratitude: Attitude Vs Skills Vs Knowledge, Attitude Vs Behaviour, How to develop Positive Attitude? Developing the attitude of Gratitude.

Public Speaking: JAM, J2M, Presentations by Students on General Topics.

Quantitative Aptitude**8 hours**

Number system, L.C.M and H.C.F, Problems on Ages, Averages, Time and work, Pipes and cisterns

Unit-II**Linux Programming****15 hours**

S.No	Topic	No. of Periods
1	Linux Basic Commands Basics: Overview of LINUX, Architecture of LINUX Linux commands: Path, man, echo, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip.	3
2	User Administrations and Disk Management Networking commands: Ping, host, finger, traceout, netstat, tracepath, dig, hostname, route, lookup, ps, w, finger, arp, ftp, telnet, rlogin.	3
3	Disk Management Commands: unlink, du, df, mount, umount, find, unmask, ulimit, Text Processing Utilities and Backup Utilities: tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio	3
4	Basics of Bash and Shell Scripting Introduction to Shells, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files. Sample programs as Annexure	6

TEXT BOOKS:

1. W. Richard. Stevens (2013), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.
2. Behrouz A. Forouzan, Richard F. Gilberg. Thomson (2003), Unix and shell Programming, Cengage Learning India

REFERENCES:

1. W. Richard Stevens, Andrew M. Rudoff, Bill Fenner (1998), UNIX Network Programming, PHI.
2. Graham Glass, King Ables (2006), UNIX for Programmers and Users, 3rd Edition, , Pearson Education

20HSX11 CC & EC Activities I**0 0 1 0****Course Outcomes**

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

COs -POs Mapping

COs	PO6	PO7	PO9	PO10
1				3
2	3	2		
3	3			
4			3	
5	3			
6	3			

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Co-Curricular and Extra Curricular (CCEC) Activities:

Students shall acquire 1 credit each in 2nd and 3rd years with the following scheme:

Scheme of evaluation for the CCEC activities:

- No. of slots in each Semester @ 1 slots every week : 12
- No. of Streams (1 CC + 1 EC + 1 Community Engagement) : 3
- No. of slots allotted for each stream : 4

Requirement for the award of 1-Credit

- Students shall choose at least two streams of events in each semester and among which Community engagement through NSS is mandatory
- Students shall secure an overall attendance of 75% in all events put together

The credits earned through these courses will be indicated in the grade memo and will be taken into account for CGPA calculation.

4th Semester**20IT304 Database Management Systems****3 1 0 3****Course Outcomes**

1. Understand the fundamental concepts of data base and data models
2. Explain the use of Relational Algebra and integrity constraints in databases
3. Use SQL's Commands to handle the Database
4. Apply Normalization for schema refinement
5. Make use of the concept of transaction management and recovery system in databases
6. Outline Indexing concepts, different types of data

CO-PO Mapping

CO	PO1	PO4	PO12
1	3	2	1
2	3	3	2
3	3	2	2
4	2	3	1
5	3	3	2
6	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to DBMS and ER Model****11+4 Hours**

DBMS Vs. File System, instance and schema, Data abstraction, Data independence, database users and database administrator, Database system structure, Introduction to Data Models (E-R Model, Relational Model, Hierarchical Model, Network Model, Object Oriented Data Model), Database Design Process, Entities, Attributes, Entity Sets, Relationships, Relationship Sets, Additional features of ER Model.

*Applications of DBMS, Object Relational Data Model***Unit II****Introduction to Relational Model and Basic SQL Queries****11+4 Hours**

Relational Algebra Operations: Selection, Projection, Rename, Set Operators, Joins, Division, Examples of Relational Algebra Queries, Relational Calculus: Tuple Relational Calculus.

Integrity Constraints over Relations, Introduction to Views.

SQL Queries: Basic Structure, Set Operations, Aggregate Functions, Null values, Sub Queries, Group By And Having Clauses, Outer Joins.

*Domain Relational Calculus, Query Optimization***Unit III****Normalization and Transaction Management****11+4 Hours**

Introduction To Schema Refinement - Problems Caused By Redundancy - Decomposition - Problems Related To Decomposition - Functional Dependency - Closure of a Set of Fds - Attribute Closure - First - Second - Third Normal Forms - BCNF - Multi Valued Dependencies - Fourth Normal Form, Join Dependency, Fifth Normal Form

Transactions: Acid Properties of Transaction - Transaction States - Schedule: Serial Schedule - Concurrent Schedules - Anomalies Associated with Concurrent Schedules (RW - WR - and WW Conflicts) - Serializability - Conflict Serializability - and View Serializability.

*EF Codd Rules, Domain Dependency***Unit IV****Locking, Recovery Systems, Indexing, Different Types of Data****12 + 3 Hours**

Introduction to Lock Management-Lock Based Concurrency Control: 2pl-Strict 2pl-Concurrency without Locking: Timestamp-Based Concurrency Control, Optimistic Concurrency Control. Introduction to Aries - the Log - the Write-Ahead Log Protocol-Check Pointing Indexing: Types of Single-Level Ordered Indexes, Multilevel Indexes Different Types of Data: Structured, Semi-Structured and Unstructured Data

Heap File, Hash File Organizations

Textbook (s)

1. Elmasri & Navatha, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2016
2. Silberschatz Korth, Database System Concepts, McGraw hill, 7th Edition, 2020

Reference (s)

1. Soraya Sedkaoui, Data Analytics and Big Data, Wiley, 1st Edition, 2018.
2. Peter Rob & Carlos Coronel, Database Systems design, Implementation and Management, 9th Edition, 2010.
3. Raghurama Krishnan & Johannes Gehrke, Database Management Systems, TATA McGraw-Hill, 3rd Edition, 2003
4. C.J.Date, An Introduction to Database Systems, Pearson Education, 8th Edition, 2006

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. List any four application of DBMS
2. Define data model
3. List any four applications for triggers
4. Define functional dependency
5. List the 4 properties of Transaction

Understand

1. Explain E-R Model with suitable example
2. Explain the role of integrity constraints in database design
3. Illustrate the working principle of 'write a head log' protocol
4. Differentiate 3NF and 4NF
5. Explain Two Phase Locking Protocol

Apply

1. When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
2. Classify various normal forms according to their applicability
3. Give some real-world applications of Normalization
4. Illustrate the Commit and Rollback operations of Transaction Control
5. Give some real-world applications for Database indexing techniques

Analyze

1. Compare File processing system with DBMS
2. Analyze different locking protocol for concurrency control and serializability
3. Normalization will increase the complexity of the database design. Justify
4. Compare DDL and DML of SQL
5. Compare and Contrast Serializability and Recoverability

Evaluate

1. Is database redesign is necessary? explain
2. How can you evaluate the performance of two data models?
3. Evaluate the performance of query processor and list the corresponding metrics
4. How can you assess the throughput and delay for any DBMS?
5. How can you evaluate the impact of data models on the query processing?

Open Book Exam Questions

Question 1:

Anitha has a large CD collection. Her friends like to borrow her CD's, and she has to keep track of who has what. She maintains a list of friends, identified by unique FID's and a list of CD's, identified by CID's. With each friend are the name and telephone numbers which she can call to get the CD back. With each CD is actor name and title. Whenever a friend borrows a CD, She will enter that fact into her database along with the date borrowed. Whenever the CD gets returned, that fact, too, gets noted along with the date returned. Anitha wants to keep a complete history of her friends' borrowing habits so that she can ask favors of the heavy borrowers.

Draw an ER diagram to figure out the above situation and identify types of attributes and cardinality. Represent this database as a collection of 3NF relational tables.

Question 2:

The relational scheme $R(A,B,C,D,E,F)$ and set of functional dependencies $AB \rightarrow D$, $E \rightarrow C$, $AF \rightarrow B$. From this, find out all super keys for this relation, and which of these super keys form a key.

20IT502 Operating Systems**Course Outcomes****3 1 0 3**

1. Understand computer resources and operating system management.
2. Analyze various CPU Scheduling Algorithms for Process Management.
3. Examine process synchronization and coordination of operating system.
4. Analyze the Main Memory Management and allocation strategies.
5. Identify the use of Virtual Memory management policies with respect to storage management.
6. Identify the need of File-System Interface and I/O Systems.

CO-PO Mapping

CO	PO1	PO12
1	3	2
2	3	2
3	3	2
4	3	2
5	3	2
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Operating-Systems Overview and Process Management****12+4 Hours**

Operating-System Overview: Computer-System Organization and Architecture, Operating-System Structure, Operating-System Operations & Services, System Calls & its types.

Threads: Multi Core Programming, Multithreading Models, Thread Scheduling algorithms.

Process Management: Process Concepts, Process Scheduling Criteria, Scheduling Algorithms and evaluation.

Thread issues, Multilevel Queue, Multilevel feedback Queue Scheduling.

Unit II**Inter Process Communication Mechanism****11+4 Hours**

Process Synchronization: Cooperative process, the Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Synchronization problems.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance & Detection, Recovery from Deadlock.

Monitors, Synchronization Examples.

Unit III**Memory Management****11+4 Hours**

Main Memory: Contiguous Memory allocation, Swapping, Segmentation, Paging, Segmented paging, Multilevel paging.

Virtual Memory Management: Demand Paging, Page Replacement algorithms, Allocation of Frames.

Structure of page table, Thrashing, Memory-Mapped Files.

Unit IV**File System Interface & I/O Systems****11+3 Hours**

Mass-Storage Structure: Disk structure, Disk Scheduling, Disk management, Raid Structure.

File System: Access Methods, Directory Structures, Allocation Methods, Free-Space Management.

I/O Systems: I/O hardware Application of I/O Interface, Kernel I/O Sub-System.

File Sharing, File System Recovery, Transforming I/O Requests to Hardware Operation.

Total: 45+15 Hours**Textbook (s)**

1. Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 9th Edition, Wiley, 2016.
2. Operating Systems, Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, 3rd Edition, Pearson Prentice Hall, 2004.

Reference (s)

1. Operating Systems: Internals and Design Principles, William Stallings, 7th Edition, Pearson Prentice Hall, 2013.
2. Operating systems: A Concept based Approach, D. M. Dhamdhare, 2nd Edition, TMH, 2006.
3. Operating System: A Design Approach, Crowley, 1st Edition, TMH, 2001.
4. Modern Operating Systems, Andrew S Tanenbaum, 3rd Edition, PHI, 2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any four operating systems
2. Define operating system
3. List any four operating system services

Understand

1. Explain System calls
2. Explain the role memory management in operating system
3. Illustrate the working principle critical section problem

Apply

1. When multiple transactions are being executed by the operating system in a multiprogramming environment, there are possibilities that instructions of one transaction are interleaved with some other transaction. Apply the suitable concept to overcome the problem
2. Give an example of a scenario that might benefit from a file system supporting an append-only access write.

Analyze

1. Context switching between two threads of execution within the operating system is usually performed by a small assembly language function. In general terms, what does this small function do internally?
2. Compare CPU scheduling algorithms
3. Analyze the general strategy behind deadlock prevention, and give an example of a practical deadlock prevention method.

Evaluate

1. Assuming the operating system detects the system is deadlocked, what can the operating system do to recover from deadlock?
2. Describe how to implement a lock using semaphores

Open Book Exam Questions

1. A file to be shared among different processes, each of which has a unique number. The file can be accessed simultaneously by several processes, subject to the following constraint: the sum of all unique numbers associated with all processes currently accessing the file must be less than n. Write a monitor to co-ordinate the access to the file. You may want to write start_access and end_access monitor procedures.
2. Consider a paging system with the page table stored in memory:
 - a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?
 - b. If we add associative registers, and 75% of all page-table references are found in the associative registers, what is the effective memory reference time?

20CS403 Computer Organization and Architecture**3 1 0 3****Course Outcomes**

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

1. Interpret the functional architecture of computing systems. (Understand).
2. Summarize the types of instruction and its micro operation with addressing modes (Understand)
3. Identify various arithmetic operations on fixed, floating point numbers and its representation (Apply)
4. Illustrate the concepts of control unit design and I/O processor(Understand)
5. Understand the memory hierarchy concepts (Understand)
6. Describe concept of parallelism and types of hazard(Understand)

CO-PO Mapping

CO	PO1	PO12
1	3	2
2	2	2
3	3	1
4	3	2
5	3	2
6	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Overview & Micro operation****12+4 Hours**

Components of a computer system – Performance measures - Classifying Instruction Set Architecture-Representing instructions -Micro operation – Logical operations – Shift operations - instruction codes - Computer Registers instruction –memory Reference instruction –Input-Output Reference instruction - Instruction cycle -Addressing and addressing modes.

Trends in Technology-Arithmetic micro-operations

Unit II**Arithmetic Operations****10+4 Hours**

ALU - Addition and subtraction with Signed Magnitude Data - Hardware Implementation – Multiplication – Hardware Implementation for Signed Magnitude Data – Division - Hardware Implementation for Signed Magnitude Data – Divide Overflow - Floating Point operations – Parallelism and Computer Arithmetic: Sub word Parallelism.

BCD Adder-BCD Subtraction

UNIT III**Control Unit and Memory Systems****11+3 Hours**

Basic MIPS implementation – Building data path – Control Implementation scheme – Memory hierarchy – Cache basics – Measuring and improving cache performance - Virtual memory- Input/output system-programmed I/O-DMA and Interrupts-I/O processors

Stack organization-RISC Vs CISC Architecture

Unit IV**Parallelism****12+4 Hours**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Multicore processors- Pipelining – Arithmetic pipeline –Instruction pipeline -Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.

Vector processing –single processor Vs parallel processor

Total: 45+15 Hours

Text Book(s):

1. David A. Patterson and John L. Hennessey, "Computer organization and design: The hardware /software interface", Morgan Kauffman / Elsevier, Fifth edition, 2014.
2. M.Morris Mano," Computer System Architecture", 3rd edition, Pearson/PHI,2092.

Reference(s):

1. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization ", 6th edition, Mc Graw-Hill Inc, 2012.
2. William Stallings "Computer Organization and Architecture, Seventh Edition, Pearson Education, 2007.
3. Andrew S Tanenbaum "Structured Computer Organization ", 5th edition, Pearson/PHI,2007

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Test ¹ (%)
Remember	40	--	--
Understand	40	50	--
Apply	20	50	80
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is micro operation?
2. Show the Register Reference Instruction format.
3. Define PC and MAR.
4. What are the two types of data representation?
5. Define Associative Memory

Understand

1. Identify the basic functional units of the system
2. Explain about logic micro operations and its applications with examples
3. Differentiate RISC and CISC architecture in terms of their instruction set and addressing modes.
4. Compare hardwired control unit is differing from micro programmed control unit designs
5. Demonstrate control memory

Apply

1. Starting from an initial value of R=11011101, determine the sequence of binary values in R after a logical shift-left, followed by a logical shift-right and a circular shift-right.
2. Analyze the contents of Register A that holds 8 bit binary 11011001 and Determine the B- operand and the logic micro operation to be performed in order to change the value in A to: (i) 01101101 (ii) 11111101 State the differences between register stack and memory stack.
3. Perform the arithmetic operations (+70) + (+80) and (-70) + (-80) with binary numbers in signed-2's complement representation. Use eight bits to accommodate each number together with its sign. Show that overflow occurs in both cases, that the last two carries are unequal, and that there is a sign reversal.
4. Show the hardware to be used for the addition and subtraction of two decimal numbers with negative numbers in signed- 10's complement representation. Indicate how an overflow is detected. Derive the flowchart algorithm and try a few numbers to convince yourself that the algorithm produces correct results.

5. The procedure for aligning mantissas during addition or subtraction of floating-point numbers can be stated as follows: Subtract the smaller exponent from the larger and shift right the mantissa having the smaller exponent a number of places equal to the difference between the exponents. The exponent of the sum (or difference) is equal to the larger exponents. Without using a magnitude comparator, assuming biased exponents, and taking into account that only the AC can be shifted, derive an algorithm in flowchart form for aligning the mantissas and placing the larger exponent in the AC

Open book questions

Apply

1. Smith and Goodman found that for a given small size, a direct-mapped instruction cache consistently outperformed a fully associative instruction cache using LRU replacement.
 - a. Explain how this would be possible (*Hint: You can't explain this with the three C's model because it "ignores" replacement policy*)
 - b. Explain where replacement policy fits into the three C's model, and explain why this means that misses caused by a replacement policy are "ignored"- or, more precisely, cannot in general be definitively classified by the three C's model.
 - c. Are there any replacement policies for the fully associative cache that would outperform the direct-mapped cache? Ignore the policy of "do what a direct-mapped cache would do".
 - d. Use a cache simulator to see if Smith and Goodman's results hold for memory reference traces that you have access to. If they do not hold, why not?
2. John takes two numbers in sign magnitude representation (the two numbers are same with different signs), The 1's complement of one number is 6. The difference between 1's complement of these two numbers is 32. Find the numbers. And also find the product of these two numbers using the result of 2's complement value of these two numbers.

Analyze

1. A two-word instruction is stored in memory at an address designated by the symbol W . The address field of the instruction (stored at $W + 1$) is designated by the symbol Y . The operand used during the execution of the instruction is stored at an address symbolized by Z . An index register contains the value X . State how Z is calculated from the other addresses if the addressing mode of the instruction is a. direct b. indirect c. relative d. indexed.
2. An 8-bit computer has a 16-bit address bus. The first 15 lines of the address are used to select a bank of 32K bytes of memory. The high-order bit of the address is used to select a register which receives the contents of the data bus. Explain how this configuration can be used to extend the memory capacity of the system to eight banks of 32K bytes each, for a total of 256K bytes of memory.

20CS404 Design and Analysis of Algorithms**3 0 2 4****Course****Outcomes**

1. Understand the fundamentals for analyzing time and space complexity of algorithms
2. Describe the basic principles of various algorithm design techniques
3. Choose and apply appropriate algorithm design technique to solve real time application
4. Analyze the performance of algorithm designed for real time application
5. Understand P and NP problems
6. Analyze the performance of algorithm designed for real time application

COs-POs Mapping

CO	PO2	PO3
1	3	2
2	2	2
3	3	3
4	3	3
5	2	2
6	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**10 + 6 hours****Introduction to Algorithms**

Fundamentals of algorithmic problem solving – Analysis framework - Performance Analysis: - Space complexity, Time complexity - Growth of Functions: Asymptotic Notation- Big oh notation, Omega notation, Theta notation, little oh, little omega. Mathematical Analysis of Non-recursive algorithms – Mathematical Analysis of Recursive algorithms - Brute Force: Bubble sort – Sequential search - String matching
Time complexities of basic operations on array, stack, queue

Practical Components

1. Problems on string matching using Brute Force approach
2. Analysis of recursive algorithms

Unit II**12 + 8 hours****Algorithm Design Techniques - I**

Decrease and Conquer: General method, Insertion sort, Topological sorting – Divide and Conquer: General method, Merge sort, Quick sort, Fibonacci search – Transform and conquer: General method, Heapsort – Disjoint sets: Operations, Simple Union and simple find, Weighted Union, Collapse Find.
Graph representation, graph applications

Practical Components

1. Problems on divide and conquer – median of 2 sorted arrays, inversion count
2. Problems on decrease and conquer

Unit III**14 + 10 hours****Algorithm Design Techniques - II**

Greedy method: General method, applications:-Job sequencing with deadlines, Minimum cost spanning trees (Prim's and Kruskal's Algorithms), Single source shortest path problem (Dijkstra's Algorithm), Optimal Merge Patterns (two way merge pattern) - Dynamic Programming: General method, applications:- Matrix chain multiplication, 0/1 knapsack problem, all pairs shortest path problem.
Optimal BST, Huffman trees and codes

Practical Components

1. Problems on Greedy technique
2. Problems on Dynamic Programming

Unit IV**9 + 6 hours****Limitations of algorithm power methods to cope up**

P, NP and NP-Complete Problems: - P and NP problems, NP-Complete problems. Backtracking: General method, applications:-n-queen problem, sum of subsets problem, Hamiltonian Circuit problem. Branch and Bound: General method, Applications: - Traveling sales person problem, Assignment Problem

Total: 45+30 hours*0/1 knapsack problem, graph coloring problem***Practical Components**

1. Problems on backtracking technique
2. Problems on branch and bound technique

Textbook (s)

1. Introduction to The Design and Analysis of Algorithms, 3rd Edition, Anany Levitin, Pearson Education, 2017.
2. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L. Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education
3. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekaran, University press.

Reference (s)

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Algorithms – Richard Johnson Baugh and Marcus Schaefer, Pearson Education.
3. www.geeksforgeeks.org
4. www.hackerearth.com
5. www.tutorialspoint.com

SAMPLE QUESTION (S)**Internal Assessment Pattern**

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test ² (%)
Remember	15	10	-
Understand	35	20	10
Apply	30	40	60
Analyze	20	30	30
Evaluate	--	-	-
Create	--	-	-
Total (%)	100	100	100

Remember

1. Define performance analysis of an algorithm.
2. Define recurrence relation
3. Define disjoint sets.
4. Define optimality principle

Understand

1. Explain back tracking algorithm
2. Explain Asymptotic notations
3. Explain the LC search algorithm
4. Explain the divide and conquer strategy. Write the applications of divide and conquer strategy and write the control abstraction for divide and conquer strategy
5. Explain the 4 cases of master theorem
6. What are implicit and explicit constraints in back tracking ?

Apply

1. Solve the fractional knapsack problem with capacity $m=20$, $W=(18,15,10)$, $P=(25,24,15)$ for the optimum solution.
2. Create two arrays that store all even no's in one array and all odd no's in another array for a given set of elements
3. Find the space and time complexity of an algorithm to find the maximum element from an array.
4. Solve the recurrence relation $T(n)=2T(n/2)+n\log n$ using master theorem.

²Assignment Test should contain only questions related to Higher Order Thinking (HOT) Skills

5. Demonstrate the process of Fibonacci search with an example
6. Find the shortest tour for the TSP for the given graph using FIFOB.

$$\begin{bmatrix} \infty & 20 & 30 & 10 & 11 \\ 15 & \infty & 16 & 4 & 2 \\ 3 & 5 & \infty & 2 & 4 \\ 19 & 6 & 18 & \infty & 3 \\ 16 & 4 & 7 & 16 & \infty \end{bmatrix}$$

Analyze

1. Analyze the time complexity of quicksort .
2. Differentiate greedy method with dynamic approach
3. Discuss the worst case time complexity of travelling sales person problem
4. How polynomial multiplication is best with FFT
5. Compute the time complexity of

```
fun()? int fun(int n)
{ int count = 0;
for (int i = n; i > 0; i /=
  2) for (int j = 0; j < i;
  j++)
  count +=
  1; return
count;
}
```

Course Outcomes

1. Understand HTML tags and CSS to design static web pages
2. Describe the basic concepts of Java Scripts to design dynamic web pages
3. Summarize object oriented programming concepts and develop applications using object oriented Principles
4. Develop interactive applications using AJAX, Servlets and JSP
5. Demonstrate database connectivity
6. Select appropriate tools for designing dynamic and interactive web applications

COs-POs Mapping

CO	PO1	PO2	PO3	PO5	PO6
1	3	2	1	2	1
2	3	1	3	2	1
3	2	1	3	2	1
4	2	1	3	2	1
5	2	1	3	3	2
6	2	2	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11+4 hours**

HTML Common tags- List, Tables, images, forms, Frames, Links and Navigation

CSS: Introduction, CSS Properties, Controlling Fonts, Text Formatting, Pseudo classes, Selectors

JavaScript: Learning Java script, Variables, operators, Functions, Control structures, Events, Validations, Objects, Document Object Model (DOM), Division Replacement, Browser Object Model (BOM).

Introduction to HTML5, introduction to CSS3

Unit II**13+4 hours****Introduction to Java**

Features of object-oriented programming, Overview of Object-Oriented Programming principles (Class, Object, Abstraction, Encapsulation, Polymorphism and Inheritance), Importance of Java to the Internet, Byte code, Java Virtual Machine, Data types, simple java programs, constructors, this keyword, methods, overloading methods and constructors

Inheritance: Basics, super keyword, Multilevel Hierarchy, Method overriding, Dynamic Method Dispatch, Abstract classes, final keyword, introduction to interface, differences between classes and interfaces, implementing interface, variables in interface and extending interfaces

Introduction to packages in JAVA, Java Built-in packages

Unit III**11+4 hours**

AJAX: Introduction, AJAX with XML

Servlets: introduction to servlets, Life cycle of servlets, JSDK, The servlet API, the javax.servlet package, Reading servlet parameters and initialization parameters, The javax.servlet HTTP package, Handling Http request and responses, Using cookie, session tracking.

Introduction to JSP: The problem with servlet, the anatomy of JSP page, JSP processing, JSP application design with MVC, Tomcat server and testing tomcats, using scripting elements implicit JSP objects.

Servlets in Net Beans-Servlets in Eclipse-Servlet filter: Authentication filter-Filter Config

Unit IV**10+3 hours**

JSP application development: Conditional processing display values using an expression to set an attribute, Declaring variables and methods, sharing data between JSP pages, Requests and users passing control and data between pages, Sharing sessions and application data, memory usage considerations

Database Access: Database Programming using JDBC, javax.sql. package; Accessing MySQL database- Accessing MS Access database- Accessing a Database from a Html Page

JSP Custom tags-Custom tag API-Custom URI

TEXT BOOKS

1. Internet and World wide web- How to program, Dietel and Nieto, Pearson.
2. Java: The Complete Reference, 11th Edition by Herbert Schildt, McGraw-Hill, 2018
3. Jon Duckett, Web programming with HTML, XHTML and CSS, 2nd Edition, Wiley India, 2010
4. Uttam Roy, Web Technologies, OXFORD University Press, 2010.

Sample Question(s)

Internal assessment pattern:

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test ² (%)
Remember	25	15	--
Understand	30	15	20
Apply	25	25	40
Analyze	20	25	20
Evaluate	--	--	--
Create	--	20	20
Total (%)	100	100	100

Remember

1. List all OOPs principles
2. Define class and object
3. State various access controls available in JAVA
4. Define inheritance
5. List out different form elements in HTML
6. List out different types of JDBC drivers
7. Write about XML DTD
8. Write MVC architecture

Understand

1. Explain byte code
2. Explain the use of super, static and final keywords
3. Explain types of polymorphism with Example
4. Explain AJAX technologies

Apply

1. Write a java program to implements final variable, Method and classes
2. Explain the reason for the following code giving

```

compiling errors. abstract class
AbstractClass
{
    abstract void abstractMethod()
}
    System.out.println("First Method");
}
    }
    
```

3. Demonstrate how to develop a servlet
4. Design an application using JSP
5. Use JSP MVC architecture in application development

Analyze

1. Compare and Contrast an abstract class and an interface
2. Differentiate method overloading and overriding

3. Differentiate abstraction and encapsulation
4. Identify the uses of calling a synchronize method inside a synchronize method
5. Identify memory leak problems in Java objects
6. Analyze the processing time of servlets with JSP
7. Analyze the process of web application deployment
8. Compare Servlets with JSP
9. Analyze the difference between XML and AJAX

Create

1. Generate cookies for three user authentication process
2. Produce a JSP code for user tasks in e-commerce
3. Construct an enterprise application for a real problem

20IT308 Database Management Systems Lab**0 0 3 1.5****Course Outcomes**

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

1. Demonstrate ER Modeling concepts to design the Database
2. Apply integrity constraints on a database
3. Make use of DDL, DML, DCL, TCL commands in creation and manipulation of Database
4. Utilize sub queries to make the complex queries more readable
5. Implementation of database queries using PL/SQL
6. Experiment with triggers to maintain the referential integrity of data

CO-PO Mapping

CO	PO4
1	3
2	3
3	3
4	3
5	3
6	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments

1. Design ER Model for a given application & Convert ER model to Relational Model.
2. Creating users - roles and Granting privileges.
3. Creating and altering tables for various relations in SQL using Integrity Constraints.
4. Implementing queries in SQL using
 - 4.1 Insertion
 - 4.2 Retrieval (operations like union - intersect - minus - in - exists - group by and having etc.)
 - 4.3 Updation
 - 4.4 Deletion
5. Implementing the concepts of Rollback – commit, checkpoints and Views
6. Implementing joins - sub queries - nested and co related nested queries.
7. Experiment with built in functions in oracle (Numeric, String, Date, Aggregate functions etc.)
8. Implementing operations on relations using PL/SQL.
9. Implementing functions, stored procedures using PL/SQL
10. Implementing cursors using PL/SQL
11. Implement Exception Handling using PL/SQL
12. Creating triggers using PL/SQL

List of Augmented Experiments

1. Inventory control management System
2. College Management System
3. Hospital management System
4. Library management System
5. Payroll management System
6. Health care organization Management System
7. Restaurant Management System
8. Blood Donation Management System
9. Art Gallery Management System
10. Hotel Management System
11. School Management System
12. Salary Management System
13. Wholesale Management System
14. Time Table Management System
15. Website Management

Reading Material (s)

1. Database Management Systems Lab Manual, Department of CSE, GMRIT, Rajam

20CS407 JAVA in Web Technologies Lab**0 0 3 1.5****Course Outcomes**

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

1. Create a static web pages using HTML and CSS
2. Develop JavaScript code for form validation
3. Integrate frontend and backend technologies in client-server systems
4. Demonstrate Servlet life cycle methods
5. Design dynamic web applications using JSP
6. Demonstrate database connectivity using JDBC for developing web applications

CO-PO Mapping

CO	PO2	PO3	PO4	PO5	PO8
1	3	3	1	2	1
2	3	3	3	2	3
3	2	2	3	2	1
4	2	3	3	2	3
5	2	3	3	3	2
6	2	2	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

The students have to choose one of the following project and do the all 12 experiments related to that project.

1. Hospital Management System
2. Training and placement cell
3. School Education System
4. University Management System

The following are the experiments related to Training and Placement cell project. For the remaining projects, the concern lab instructor has to decide the experiments according to the websites given as examples.

Experiment 1: Design the following static web pages required for a Training and placement cell web site.

- 1) Home Page
- 2) Login Page
- 3) Registration page
- 4) Alumni Details Page

Experiment 2:

- 5) Placement Staff Details Page
- 6) Student personal Info Page
- 7) Student Academic Info page

Experiment 3: Apply different font styles, font families, font colors and other formatting Styles to the above static web pages.

Experiment 4: Validate the above designed Login and Registration pages using JavaScript.

Experiment 5: Demonstrate the basics of Java using classes, methods and objects.

Experiment 6: Demonstrate the different types of inheritance concept.

Experiment 7: Demonstrate Inheritance concept using method overriding, super & final keywords and runtime polymorphism.

Experiment 8: Install **Eclipse IDE and tomcat server**, access above developed static web pages using these servers.

Experiment 9: Write a servlet to connect to the database, Insert the details of the users who register with the web site, whenever a new user clicks the submit button in the registration.

Experiment 10: Write a JSP to connect to the database, Insert the details of the student academic information with student academic info page.

Experiment 11: User Authentication:

Assume four users **user1**, **user2**, **user3** and **user4** having the passwords **pwd1**, **pwd2**, **pwd3** and **pwd4** respectively. Write a servlet for doing the following.

1. Create a Cookie and add these four user id's and passwords to this Cookie.

2. Read the user id and passwords entered in the Login form (week1) and authenticate with the values (user id and passwords) available in the cookies.

If he is a valid user (i.e., user-name and password match) you should welcome him by name (user-name) else you should display "**You are not an authenticated user**". Use init-parameters to do this. Store the user-names and passwords in the webinf.xml and access them in the servlet by using the getInitParameters () method.

Experiment 12: Write a JSP which does the following job:

Authenticate the user when he submits the login form using the user name and password from the database.

List of Augmented Projects¹⁰

1. Web Crawlers
2. Online Hospital Management
3. Online Shopping Project
4. Web based Appointment Systems
5. Scrapbook
6. Online Job Recruitment System
7. Attendance management system
8. Online Banking system
9. Online Exam
10. Railway Reservation system
11. Leave Application Management System
12. Address Book
13. Movie Rental Systems
14. Online Auction System
15. Student Information system

Reading Material (s)

1. Web Technologies Lab manual–Department of CSE & IT-GMRIT Rajam

20CS409 Employability Skills I**1 1 1 3****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Introspect & develop life skills with constructive approach
3. Assess and improve analytical skills
4. Apply the Inter Process Communication in Linux environment
5. Develop a simple communication application to communicate using TCP/UDP client server model
6. Develop solutions to real-world problems

COs – POs Mapping

COs	PO 1	PO 2	PO 3	PO 5	PO 6	PO 8	PO 10	PO 12
C01	-	-	-	-	-	-	3	-
C02	-	-	-	-	3	-	2	2
C03	2	-	-	-	-	2	-	-
C04	3	-	3	2	-	2	-	-
C05	3	2	3	2	-	-	-	2
C06	2	2	3	2	3	-	-	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Unit-I**Communication Skills****8 hours**

Building Confidence: Fear? Steps to Overcoming the Fear of Public Speaking? Self Esteem: Definition? Types of Self Esteem, Causes of Low Self Esteem, Merits of Positive Self Esteem and Steps to build a positive Self Esteem.

Group Discussions (Practice): GD? GD Vs Debate, Overview of a GD , Skills assessed in a GD, Dos & Don'ts, & Conducting practice sessions (Simple Topics).

Motivational Talk: Team Work: Team Vs Group? Stages in Team Building, Mistakes to avoid and Lessons to Learn (Through Stories or Can be a Case Specific)

Quantitative Aptitude**7 hours**

Percentages, Profit and loss, Mixtures and Allegations, Simple Interest, Compound Interest

Unit-II**Linux Programming****15 hours**

S.No	Topic	No. of Hours
1	Understanding System Files File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown,	4
2	Directory API opendir, readdir, closedir, mkdir, rmdir, umask.	2
3	Industry Essentials Network Configurations and Inter Process Communications, Signals, Pipes and Sockets	4
4	Services of Linux Running Services on Linux, KVM Virtualization, Logical Volume Machine, Tiger VNC, FTP Server, Yum Server	5

TEXT BOOKS:

1. W. Richard. Stevens (2013), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.
2. Behrouz A. Forouzan, Richard F. Gilberg. Thomson (2003), Unix and shell Programming, Cengage Learning India

REFERENCES:

1. W. Richard Stevens, Andrew M. Rudoff, Bill Fenner (1998), UNIX Network Programming, PHI.
2. Graham Glass, King Ables (2006), UNIX for Programmers and Users, 3rd Edition, , Pearson Education

20HSX11 CC & EC Activities I**0 0 1 1****Course Outcomes**

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

COs -POs Mapping

COs	PO ₆	PO ₇	PO ₉	PO ₁₀
1				3
2	3	2		
3	3			
4			3	
5	3			
6	3			

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Co-Curricular and Extra Curricular (CCEC) Activities:

Students shall acquire 1 credit each in 2nd and 3rd years with the following scheme:

Scheme of evaluation for the CCEC activities:

- No. of slots in each Semester @ 1 slots every week : 12
- No. of Streams (1 CC + 1 EC + 1 Community Engagement) : 3
- No. of slots allotted for each stream : 4

Requirement for the award of 1-Credit

- Students shall choose at least two streams of events in each semester and among which Community engagement through NSS is mandatory
- Students shall secure an overall attendance of 75% in all events put together

The credits earned through these courses will be indicated in the grade memo and will be taken into account for CGPA calculation.

5th Semester**20CSC11 Exploratory Data Analysis****3 1 0 3****Course Outcomes**

1. Explain the Data Analysis Fundamentals
2. Illustrate various data Visual aids
3. Categorise different data transformation and descriptive statistics
4. Identify different Correlation and Inferences from statistical tests
5. Make use of the concept Hypothesis Testing
6. Classify different Multivariate Analysis techniques

CO-PO Mapping

CO	PO1	PO4	PO12
1	3	2	1
2	3	3	2
3	3	2	2
4	2	3	1
5	3	3	2
6	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Exploratory Data Analysis Fundamentals****11+4 Hours**

Understanding data science, significance of EDA, steps in EDA. types of analysis (univariate, bivariate, multivariate). Making sense of data: Numerical data-Discrete&continuous data,categorical data, Measurement scales-Nominal, Ordinal,Interval, Ratio. Comparing EDA with classical and Bayesian analysis, getting started with EDA: Numpy, Pandas,Scipy, and Matplotlib.

Grouping data: groupby mechanics, rearranging, reshaping data structures, data aggregation methods, and cross-tabulation methods.

Objectives of Exploratory data Analysis, The applications of EDA.

Unit II**Visual aids for EDA****11+4 Hours**

Line chart, Bar charts,Box plot,residual plot, Scatter plot-bubble chart, scatterplot using seaborn, Area plot, stacked plot, and stem-and-leaf plot, pie chart, table chart, polar chart, histogram, lollipop chart, choosing the best chart.

Data transformation and descriptive statistics

Transformation techniques- performing data deduplication,replacing values, handling missing data, renaming axis indexes, outlier detection and filtering. Permutation and random sampling, computing indicators/dummy variables, string manipulations.

Descriptive statistics: Understanding statistics, distribution function (uniform, normal, exponential, binomial), cumulative distribution function, measure of central tendency, measure of dispersion (standard deviation, variance, skewness, kurtosis, percentiles, quartiles)

Violin Plots, Inter Quartile Range, Discretizaion & binning, heatmaps

Unit III**Correlation and Inferences from statistical tests :****11+4 Hours**

Introducing correlation, covariance, Pearson's Correlation, Spearman's Rank Correlation.

Hypothesis Testing: Testing a difference in mean, testing a correlation, chi-squared tests, errors, power. Model development and evaluation with regression techniques.

Correlation vs causation, ANOVA,

Unit IV

12 + 3 Hours

Multivariate Analysis: overview, Factor Analysis, Cluster Analysis, Discriminant analysis, EDA Case Study

Multidimensional Scaling, MANOVA vs ANOVA

Total: 45+15 Hours

Textbook (s)

1. Daniel J. Denis: Univariate, Bivariate, and Multivariate Statistics Using R: Quantitative Tools for Data Analysis and Data Science, Wiley,2020
2. Mukhiya Suresh Kumar Mukhiya, Ahmed Usman Ahmed: Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data, Packt, 2020
3. Downey, Allen. Think stats: exploratory data analysis. " O'Reilly Media, Inc.", 2014.
4. Neil H. Spencer: Essentials of Multivariate Data Analysis, CRC Press,2014

Reference (s)

1. Wes McKinney : Python for Data Analysis 2nd Edition,Wiley,2013
2. Glenn J. Myatt, Wayne P. Johnson: Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition,Wiley,2014
3. Wendy L. MartinezAngel R. MartinezJeffrey L. Solka: Exploratory Data Analysis with MATLAB, 2nd Edition,CRC Press,2011
4. Radhika Datar, Harish Garg : Hands-On Exploratory Data Analysis with R , Packt,2019
5. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is data science.
2. Define purpose of different data visualtion aids
3. List any two steps involved in EDA.

Understand

1. Explain different data representation
2. Explain the role of various data grouping methods
3. Explain purpose of hypothesis testing in detail

Apply

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data nanlysis
3. Examine data with various distribution function

Analyze

1. Comapre and contrast varius data grouping methods.
2. Distinguish various methods to address problems with dummy variables
3. Examine various string handling methods

Evaluate

1. Evaluate the statistics of a given dataset
2. Justify the importance of data skewness

3. Measure data dispersion methods on a dataset

Open Book Exam Questions

Question 1:

Perform below analysis on a house price prediction dataset.

- a) Univariate Analysis
 - i. Analysis of a numerical feature
 - ii. Analysis of a categorical feature
- b) Bivariate Analysis
 - i. Relationship of a numerical feature with another numerical feature
 - ii. Relationship of a numerical feature with a categorical feature

Question 2:

Perform below analysis on weather prediction dataset.

- a. Correlation Analysis
 - a. Correlation Heat Map
 - b. Zoomed Heat Map
- b. Investigation of missing values
 - a. What's missing? to what extent?
 - b. Visualizing missing values in a dataframe

20CSC21 Web Programming Languages**3 1 0 3****Course Outcomes**

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

1. Understand what web applications are.
2. Analyze the templates and common scenarios of web development.
3. Examine various web programming languages and their usages.
4. Analyze the flow of data through various layers of web.
5. Identify the use of data management and compatibility of web browsers.
6. Identify the need of security and performance for a web application.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₇	PO ₁₂
1	3	3	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	1	2
6	3	1	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****12+4 Hours****Overview of the web**

Web application Overview: Basic concepts of web, The importance of web technology, Web programming languages

Web server: Introduction, Anatomy of HTTP transaction, Request and response structures, REST APIs.

Data management: Browser storage - Local storage & Session storage, Database storage.

*HTML, CSS, HTTP, Status codes***Unit II****11+4 Hours****Web programming in JavaScript**

Introduction: Overview of fundamentals of JavaScript, ES6 JavaScript standard.

Node JS: Introduction, Node packages, HTTP web server – Creating a HTTP server that supports Create, Read, Update and Delete operations via various HTTP methods, Adding common request parser

Express: Creating a web server with express and body parser packages

*NodeJS, ES6, Node packages.***Unit III****11+4 Hours****Restful Programming**

Introduction: Evolution of RESTful services, REST API Architectural Constraints, Designing REST API, REST API Error Handling Patterns, REST API Handling Change- Versioning Patterns, REST API Cache Control Patterns, REST API Response Data Handling Patterns, REST API Security.

Spring Boot

Introduction, Framework Theory, Beans Implementation, Dao Implementation, Running Project, Creating Model Class,

*REST API Security, Creating XML Files***Unit IV****11+3 Hours****Web programming in Python**

Introduction: Basic concepts -, classes and interfaces, Python's HTTP package

HTTP server: Introduction, creating a server that supports Create, Read, Update and Delete operations

*HTTP server, Python packages***Total: 45+15 Hours****Textbook (s)**

1. Learn Web Development with Python, Fabrizio Romano, Gaston C. Hillar, Arun Ravindran, 1st Edition, 2018 Packt Publishing Pvt Ltd.
2. Learn Java for Web Development, Vishal Layka, 1st Edition, 2014. Apress Media LLC.
3. Node.js, John Bach, Alexander Aronowitz, 3rd Edition, 2021. mEm Inc.

Reference (s)

1. HTML 5 in simple steps, Kogent Learning Solutions Inc, Dreamtech Press.
2. Beginning HTML, XHTML, CSS, and JavaScript, John Duckett, Wiley India.

3. Beginning CSS: Cascading Style Sheets for Web Design, Ian Pouncey, Richard York, Wiley India.
4. Web Designing & Architecture-Educational Technology Centre, University of Buffalo.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Question(s)

Remember

1. List any four HTML tags and CSS properties
2. Define web server
3. List four browser storage methods

Understand

1. What HTTP method should be used for updating data in a server?
2. Explain the of CSS in web development
3. Illustrate the working of a HTTP server

Apply

1. When user opens a website, the underlying web application wants to store browser specific data. What is a good approach for saving the data?
2. Give an example of a scenario that might benefit from browser storage instead of backend storage.

Analyze

1. There is a common body parsing workflow that every request to a server must obey. What is a good way to implement it?
2. Compare Servlet and Java Server Page
3. Analyze the general strategy behind cookies and session management.

Evaluate

1. Assuming the server received a permission error from the database, what is the best way to propagate it to the user?
2. Describe how to implement user authentication in a web server.

Open Book Exam Questions

1. A file is to be stored in the web server. However, the access to this file is to be limited to specific set of users. How can once achieve this using a web server?
2. Consider a request that yields data of high cardinality. How can one send the data without affecting the performance of the website?

20ITC31 Fundamentals of Security**3 1 0 3****Course Outcomes**

7. Explain the fundamental concepts of information security
8. Illustrate the use of cryptography and its functions
9. Identify different types of Cryptography methods
10. List out different types of Security Threats and Vulnerability
11. Make use of the concept of network security
12. Outline transport and network layer security

CO-PO Mapping

CO	PO1	PO2	PO5
1	3	1	1
2	3	3	2
3	1	2	3
4	2	3	1
5	3	2	3
6	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Security concepts****11+4 Hours**

What is security, Data vs Information vs Cyber security, Goals of Information Security, Computer Security Concepts, threats, attacks, and assets, security functional requirements, fundamental security design principles, computer security strategy, networking, benefits of networking.

protocols suite, hacking, network sniffing, social engineering

Unit II**Cryptography****11+4 Hours**

Introduction to cryptography, Cryptographic functions (Authentication, Nonrepudiation, confidentiality, integrity), Cryptanalysis. Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, Message Integrity, Encryption and Decryption Techniques, Digital Signatures, Email Standards: MIME and PGP

Applications of Cryptography, cipher types, steganography

Unit III**Security Threats and Vulnerabilities****11+4 Hours**

Overview of Security Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability, Types of malware, Buffer Overflow

Security Counter-Measures: Passwords, Access Control (Authenticating users, Handling User Access), Antivirus Software, Firewalls, Intrusion Detection Systems and IPS.

Types of firewalls, advanced persistent threat

Unit IV**Network Security****12 + 3 Hours**

TCP/IP Suite, DNS, MITM, Attacks on TCP and DNS, VPN, Application layer security (PGP, S/MIME), Transport layer security (TLS), Network layer security (IPSec) Anonymous networks: Tor, I2P.

TCP Vulnerabilities, SSH vs SSL,

Total: 45+15 Hours**Textbook (s)**

1. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition, 2015
2. Nihad A. Hassan, Rami Hijazi, Digital Privacy and Security Using Windows: A Practical Guide, Apress, 2017

Reference (s)

5. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

6. Ross Anderson, Security Engineering: A Guide to Building Dependable Distributed, 3rd Edition, John Wiley & Sons Inc, 2021.
7. Kozierok, Charles M. The TCP/IP guide: a comprehensive, illustrated Internet protocols reference, 2005
8. Harris, Shon, "CISSP all-in-one exam guide." Sixth edition (2013).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

4. What is security.
5. Define cyber security
6. List any four computer security concepts
7. Define threat
8. Define intrusion

Understand

4. Explain Cryptographic functions
5. Explain the role of Symmetric key cryptography
6. Illustrate hashing techniques
7. Outline the purpose of digital signatures

Apply

4. RSA algorithm with example
5. Digital signature
6. Buila a firewall mechanism to protect laptop

Analyze

1. Compare and contrast RSA and ECC.
2. Distinguish differences between Symmetric and Asymmetric key cryptography.
3. Examine the key sharing techniques in both Symmetric and Asymmetric key cryptography techniques

Evaluate

1. Justify the ECC is best public key cryptosystem than other public key approaches.
2. Explain the importance of IPSec protocol.
3. Explain the importance of I2P protocol

Open Book Exam Questions

Question 1:

In a public-key system using RSA, you intercept the ciphertext $C=10$ sent to a user whose public key is $e=5$, and $n=35$. What is the plaintext M ? and Perform encryption and decryption using the RSA algorithm for the following: 1. $P=3$; $q=11$, $e=7$; $M=5$. 2. $P=17$; $q=31$, $e=7$; $M=2$.

Question 2:

Suppose we have a set of blocks encoded with the RSA algorithm and we don't have the private key. Assume $n=pq$, e is the public key. Suppose also someone tells us they know one of the plaintext blocks has a common factor with n . Does this help us in any way?

20ECE02 Microprocessors and Microcontroller Programming**3 0 2 4****Course Outcomes**

1. Summarize the architecture of 8086 microprocessor
2. Execute assembly language programs of 8086 microprocessor
3. Demonstrate the memory interfacing with 8086 microprocessor
4. Explain the architecture of 8051 microcontroller
5. Implement assembly language programs of 8051 microcontroller
6. Demonstrate the interfacing of peripherals with 8051 microcontroller

COs – POs Mapping

COs	PO1	PO2	PO3	PO4	PO5
1	2	1	1	-	-
2	2	2	2	2	3
3	2	2	2	2	2
4	2	1	1	-	-
5	2	2	2	2	3
6	3	3	3	3	3

3–Strongly linked | 2–Moderately linked| 1–Weakly linked

Unit I**14+8 Hours****8086 Microprocessors and Assembly Language Programming**

Introduction and evolution of processors, Architecture of 8086 microprocessor, Register organization of 8086, Memory segmentation, Addressing Modes. Instruction set of 8086 microprocessor: Data transfer instructions, Arithmetic instructions, Logical Instructions, String instructions, Stack related instructions, Branching instructions, Assembler directives.

Data transfer instructions of 8085 microprocessor, Architecture of 8085 microprocessor

Practical Components

1. Data transfer program using and without using string instruction in assembly language programming.
2. Program for addition and subtraction in assembly language.
3. Program for data conversion in assembly language.

Unit II**9+6 Hours****8086 Operational Modes and Peripheral Interfacing**

Procedures and macros, Stack Structure of 8086, Minimum and Maximum mode operations of 8086 with timing diagrams, Memory interfacing, 8255 Programmable Peripheral Interfacing.

Dynamic RAM, Direct memory access concept

Practical Components

1. Program to arrange three bytes in ascending and descending order in assembly language.
2. Program to reject negative numbers from a series of bytes in assembly language.

Unit III**12+8 Hours****8051 Microcontroller and Assembly Language Programming**

Comparison between microprocessor and microcontroller, 8051 family microcontroller, RAM architecture of 8051, Integrated Development Environment (IDE), Pin description of 8051 microcontroller, Machine cycle. Addressing Modes, Instruction set of 8051: Data transfer instructions, Arithmetic instructions, Logical Instructions, Stack related instructions, Branching instructions. Programming and Applications of Timers, Interrupts, Universal Asynchronous Receiver Transmitter (UART).

External memory interfacing with 8051 microcontroller, various constituents of hex file

Practical Components

1. Program to perform arithmetic operations.
2. Program to toggle the LED in assembly language.
3. Programming and interfacing of traffic light logic in assembly language.

Unit IV**10+8 Hours****Interfacing with 8051 microcontrollers with External Peripherals**

Interfacing with 8051 microcontrollers with: Keypad matrix, LCD, Seven segment displays, Stepper motor, Analog to Digital Converter (804), Digital to Analog Converter (808).

Interfacing of temperature sensor (LM 35) with 8051, interfacing of relay with 8051

Practical Components

1. Programming and interfacing of the key pad matrix.
2. Programming and interfacing of seven-segment display.
3. Programming and interfacing of the LCD.

Total: 45+30 Hours**Textbook (s)**

1. A.K. Ray & K. M Bhurchandi, Advanced Microprocessors & peripherals, Tata McGraw-Hill, 3rd Edition, 2012
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Micro controller and Embedded systems: using assembles and C, Pearson, 2nd Edition,2007

Reference (s)

1. D.V.Hall, Microprocessor and Interfacing, Tata McGraw Hill Publishing Company, 2nd Edition 2006
2. N. Sentil Kumar, M Sarvanan, S Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, 1st Edition, 2010
3. Kenneth J Ayala, The 8051 Microcontroller Architecture, Programming and Applications, Thomson Publishers, 3rd Edition, 2004

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination (%)
Remember	25	25	--
Understand	35	35	--
Apply	40	40	100
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. List out any four sixteen-bit registers of 8086 microprocessor which can't split into two eight bit registers.
2. State the advantages of memory segmentation.
3. State the significance of Reset pin of 8051 microcontroller.
4. List four differences between 8051 family of microcontroller.

Understand

1. Calculate the physical address generated by the 8086 microprocessor to fetch the code if CS = 2A40H & IP = AAAAH.
2. Explain the function of BIU and EU of 8086 microprocessor.
3. Explain the consequences of execution of MOV IP, #14H instruction of 8051 microcontroller.
4. Explain the structure of internal RAM of 8051 microcontroller.
5. Explain the significance of each bit of TMOD register of 8051 microcontroller.

Apply

1. Write a program for 8051 microcontroller in assembly language to generate a square wave of 10KHz from pin P2.1. Assuming frequency of crystal attached to the microcontroller is 12MHz.
2. Develop a program in assembly language for 8051 microcontroller to add five eight bit numbers.
3. Interface a seven-segment display with 8051 microcontroller and develop a program in assembly language to display even numbers from 0 to 9.
4. Interface a LCD with 8051 microcontroller and develop a program in assembly language to display a message in 1st row of LCD.

20CS502 Artificial Intelligence and Machine Learning**3 1 0 3****Course Outcomes**

1. Illustrate the scope of Artificial Intelligence in the real world
2. Demonstrate various machine learning algorithms and its preliminaries
3. Summarize and learn various supervised learning algorithms
4. Model the concepts of classification and regression
5. Summarize and learn various unsupervised learning algorithms
6. Demonstrate and resolve complex clusters using dimensionality reduction

CO-PO Mapping:

COs	PO1	PO2	PSO1
1	3	2	1
2	3	2	1
3	1	3	2
4	1	2	3
5	1	3	2
6	1	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit -I:**10+4 Hours**

Artificial Intelligence Foundation to AI, Problem Solving- State Space Search, Constraint Satisfaction Problems, AI Problems, AI Types and Agents, AI Tasks, AI Techniques, Heuristic Search Techniques- Best First Search Techniques, Expert Systems – Rule based system, Model & Hybrid Based System. Reasoning in uncertain environment. Math for Machine Learning- Linear Algebra, Multi-Variable Calculus and Vectors

*AI Models, AI Bots, Applications of AI, Applied AI***Unit -II:****11+4 Hours**

Machine Learning Foundation for Machine Learning – Types of Machine Learning, Machine Learning Process, Preliminaries- Over fitting, Training, Testing and Validating Sets, Splitting and Feature Scaling, Confusion Matrix, Accuracy Metrics, Data Pre-processing- Importing Libraries, Importing Datasets, Missing Data and Dependent Variables, Machine Learning Applications.

*Rules of Probability, Bayes Theorem, Bias, Variance and Co-variance.***Unit -III:****12+4 Hours**

Supervised Learning Classification- Naïve Bayes, Support Vector Machines, Extension to SVM, K-Nearest Neighbours. Regression – Decision Tree, Classify Vs Predict, Linear Regression, Gradient Descent and Logistic Regression, Regularization, Classification and Regression Tree.

*Margins and Vectors, Continuous and Discrete variables***Unit -IV:****12+3 Hours**

Unsupervised Learning Clustering- Iterative Distance based Clustering, Association Rule Learning, K-Means Clustering and Hierarchical Clustering, Measure of Quality Clustering. Dimensionality Reduction – Feature Selection, Principle Component Analysis, Independent Component Analysis and Linear Discriminant Analysis and Reinforcement Learning.

*Similarity and Distance Measures, Gaussian and Normal Deviation***Total: 45+15 Hours****Text Book (s)**

1. Russel and Norvig, Artificial Intelligence A modern Approach, 4th Edition, Pearson Education 2021
2. Raschka, Sebastian and Mirjalili, Vahid, Python Machine Learning, 3rd Edition, Packt Publishing, 2020
3. Stephen Marsland- Machine Learning – An Algorithmic Perspective – Second Edition – Chap Man & Hall CRC Press, 2015

Reference (s)

1. E. Rich K. Knight and B.Nair – Artificial Intelligence– Third Edition – Tata McGraw Hill, 2017

2. Tom M. Mitchell, –Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam ⁵ (%)
Remember	25	20	-
Understand	35	40	30
Apply	40	40	40
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define entropy.
2. What is pruning?
3. Define hypothesis

Understand

1. What is Machine Learning?
2. How KNN is different from K- means Clustering?
3. Explain confusion matrix with an example

Apply

1. 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.
2. Apply *k*-Nearest Neighbour algorithm to classify the iris data set and print both correct and wrong predictions in it.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.

Analyze

1. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw the relevant graphs
2. 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 Java/Python ML library classes/API in the program

Open Book Question(s)

1. The issue of the possibility of self-improvement of the system of artificial intelligence, which gained autonomy, got out of human control and by downloading data from the Internet it is becoming an increasingly powerful and threatening system for humans since the 2090s in science fiction literature and film. With each subsequent year, the technology of artificial intelligence is developed and improved.
 - a) Justify the detailed steps involved for getting the above scenario w.r.t. human brain and computer vision.
 - b) Is it possible now or in the future to create an artificial intelligence that will draw knowledge directly from the analysis of Internet resources and learn this knowledge?
2. A large room is filled with mousetraps, arranged in a grid. Each mousetrap is loaded with two ping-pong balls, carefully placed so that when the mousetrap goes off they will be flung, land on other mousetraps and set them off. The walls of the room are sticky, so any balls that hit the walls of the room are effectively absorbed. Every mousetrap that gets hit sends the two ping-pong balls in the same way: their movement is determined by a X and Y displacement relative to the launching mousetrap. You then decide to launch a single ping-pong ball into the room. It hits a mousetrap, setting it off, and launching its two balls. These two balls then set off two more mousetraps, and now four balls fly off... When the dust settles, many of the mousetraps have been set off, but some have been missed by all the flying balls.
 - a) Identify the attributes and the mousetraps which are involved in this process

- b) Justify and predict the common set offs in the process and identify which learning suits the above scenario.

20CS503 COMPUTER NETWORKS**3 0 2 4****Course Outcomes:**

1. Illustrate the knowledge of the basic Data Communication System and Computer Network Systems.
2. Classify various wired and wireless transmission media for data communication networks
3. Demonstrate different techniques of error detection and correction to detect and solve error bit during data transmission
4. Illustrate the subnetting, routing mechanisms and congestion issues in network design.
5. Experiment with different network tools.
6. Summarize the internal functionalities of main protocols such as HTTP, SNMP, TCP, UDP, IP

CO-PO Mapping

COs	PO1	PO2	PO4	PO5
1	3	1	1	1
2	3	3	3	2
3	1	3	2	2
4	2	3	2	3
5	1	3	2	3
6	3	1	2	2

UNIT - I**11 + 6 hours****Introduction to Data Communications:** Components, Data Representation, Data flow

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Physical Layer: Transmission media: Guided media- twisted pairs, coaxial cable, fiber optics, unguided media-Wireless transmission, Switching Techniques: Circuit Switching-Packet Switching-Message Switching.*Taxonomy of networking devices***Practical Components:**

- 1) a) Familiarization with Networking Components and devices: LAN Adapters - Hubs -Switches - Routers
b) Familiarization with Transmission media and Tools: Co-axial cable - UTP Cable - Crimping Tool - Connectors etc.
- 2) Preparing the UTP cable for cross and direct connections using crimping tool.

UNIT - II**11 + 8 hours****Design Issues:** Framing-error detection and correction-CRC**Elementary Data link Protocols:** Stop and wait-Sliding, Window protocols: Go-back-n-Selective Repeat, **Medium Access sub layer:** Channel allocation methods, Multiple Access protocols: ALOHA-CSMA-IEEE Standard 802.3 and Ethernet*Data Link Control Protocols: HDLC-SLIP-PPP***Practical Components:**

1. Implement the data link layer framing methods: a. Character stuffing method b. Bit Stuffing method
2. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.

UNIT - III**12 + 6 hours****Network Layer:** Design issues, Routing algorithms: shortest path routing, distance vector routing, Flooding, Hierarchical routing, Broadcast, Multicast, Congestion Control Algorithms-Approaches to Congestion Control, Quality of Service- leaky bucket algorithm, token bucket algorithm, The Network layer in the internet-IPv4 Protocol, IP Addresses, Subnetting.*Internet control protocols***Practical Components:**

1. Implement Dijkstra's algorithm to compute the shortest path through a network
2. Write a program for congestion control using Leaky bucket algorithm

UNIT – IV**11 + 10 hours**

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols. Application Layer –Domain name system, SNMP, Electronic Mail, World Wide Web, HTTP

Proxy Servers, Data compression

Practical Components:

1. Wireshark
 - i. Packet Capture Using Wire shark
 - ii. Starting Wire shark
 - iii. Viewing Captured Traffic
 - iv. Analysis and Statistics & Filters.

2. Do the following using NS2 Simulator
 - i. NS2 Simulator-Introduction
 - ii. Simulate to Find the Number of Packets Dropped
 - iii. Simulate to Find the Number of Packets Dropped by TCP/UDP
 - iv. Simulate to Find the Number of Packets Dropped due to Congestion
 - v. Simulate to Compare Data Rate& Throughput.
 - vi. Simulate to Plot Congestion for Different Source/Destination
 - vii. Simulate to Determine the Performance with respect to Transmission of Packets

Total: 45+30 hours**Textbook (s)**

1. Andrew S Tanenbaum, Computer Networks, 5th Edition, Pearson Education /PHI, 2013
2. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw Hill Higher Education, 2013
3. Reference (s)
4. Willam Stallings, Data and Computer Communications, 8th Edition, Pearson Prentice Hall, 2007
5. W.A. Shay, Thomson, Understanding communications and Networks, 3rd Edition, Cengage Learning, 2005

Internal Assessment Pattern

Cognitive Level	Internal Test 1 (%)	Internal Test 2 (%)
Remember	25	20
Understand	40	40
Apply	35	40
Analyze	-	-
Evaluate	-	-
Create	--	--
Total (%)	100	100

Sample Questions**Remember**

1. List the applications of Computer Networks
2. Write two differences between OSI and TCP/IP models.
3. State 5 key assumptions in Dynamic channel allocation?
4. State the purpose of DNS.
5. Define congestion.

Understand

1. Illustrate OSI Reference model.
2. Explain various design issues of data link layer

3. What are the responsibilities of Data Link layer and explain Pure Aloha and Slotted Aloha protocols.
4. Describe Distance Vector routing algorithm with example and explain count to infinity problem 5. Represent the Manchester encoding for the bit stream: 0001110101.

Apply

1. What is the check summed frame transmitted if the message is 1101011011 and the generator polynomial is $x^4 + x + 1$ using CRC
2. Can you think of any circumstances under which an open-loop protocol, (e.g., a Hamming code) might be preferable to the feedback-type protocols?
3. Assuming that all routers and hosts are working properly and that all software in both is free of all errors, is there any chance, however small, that a packet will be delivered to the wrong destination?
4. The following data fragment occurs in the middle of a data stream for which the byte-stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing?
5. The following character encoding is used in a data link protocol: A: 01000111; B: 11100011; FLAG: 01111110; ESC: 11100000 Show the bit sequence transmitted (in binary) for the four-character frame: A B ESC FLAG when each of the following framing methods are used:
 - (a) Character count.
 - (b) Flag bytes with byte stuffing. (
 - c) Starting and ending flag bytes, with bit stuffing.

20CS504 THEORY OF COMPUTATION**3 1 0 3****Course Outcomes:**

1. Define State machines, languages and computations
2. Design a state machine with and without outputs
3. Compare regular grammars and regular languages
4. Relate Context free languages and Context free grammars
5. Design Pushdown automata for Context free languages
6. Illustrate decidable and un-decidable problems

CO-PO Mapping

COs	PO1	PO2
1	3	3
2	2	2
3	3	2
4	2	3
5	2	2
6	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+4 Hours**

Finite Automata: Introduction to formal languages- language operations- Finite automata model- Deterministic Finite Automata – Nondeterministic Finite automata - Recognition of a language by an Automaton - Equivalence of DFA and NFA - Finite Automata with Null-Closure - Minimization of Finite Automata - Equivalence of FAs - Mealy and Moore Machine, Equivalence of Mealy and Moore machines.

Mathematical induction, strong principle, Complementation of Finite automata, Compound Automata

Unit II**11+4Hours**

Regular Languages: Regular Sets-Regular expressions- Equivalence of Finite automata and regular expressions -Pumping Lemma for Regular Languages - Closure Properties of Regular sets. Regular Grammars: Right linear grammar- Left linear grammar- Equivalence of RLG and finite automata- Equivalence of LLG and finite automata.

Myhill-Nerode theorem –applications of regular expressions

Unit III**11+4 Hours**

Context free language- Closure Properties of Context free languages, pumping lemma for context free languages- Context-free grammar-simplification of Context free Grammar-Normal forms: Chomsky Normal form and Greibach Normal form.

Pushdown Automata: PDA Model-Design-Acceptance by empty stack and final state- Non-deterministic PDA. Context free grammar to Pushdown automata conversion.

Context Sensitive Languages, Linear bounded automata

Unit IV**11+3 Hours**

Turing Machine: Chomsky classification of languages- Turing Machine Model - Design of TM- Turing Machines variants–Undecidable languages - properties of Recursive and Recursively Enumerable Languages -Post Correspondence Problem - Halting Problem - Polynomial Reducibility, P – NP, NP – Complete and NP – Hard problems

Computable Functions - Constant Functions, Recursive Functions

Total 45+15**Hours****Text Books:**

1. J. E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson/Addison Wesley, 2007
2. Mishra & Chandra Sekharan, Theory of Computer Science& Automata Language and Computation, 3rd Edition, Prentice Hall of India, 2007

Reference books:

1. P. Linz, Introduction to Formal Language and Computation, 2nd Edition, Narosa, 2006.
2. H. R. Lewis & C. H. Papadimitriou, Elements of the Theory of Computation, Prentice Hall of India,

2nd Edition - 2006.

Internal Assessment Pattern

Cognitive Level	Internal Test 1 (%)	Internal Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	20	--
Apply	30	40	60
Analyze	20	20	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Write the analytical representation of NFA.
2. Define context free grammar.
3. State Rice's theorem

Understand

1. Compare Mealy and Moore machine
2. Explain the closure properties of regular languages
3. Illustrate the Chomsky classification of languages.

Apply

1. Design pushdown automata for $L = \{anbn/n \geq 1\}$.
2. Construct Turing machine for palindrome strings over $\Sigma = \{a,b\}$

Analyse

1. How does a Mealy machine different from Moore machine?
2. Does PCP with 2 lists $X = \{10,110,11\}$ $Y = \{1,01,0\}$ has a solution? Justify your answer.

Open Book Exam Questions

1. Suppose r_1 and r_2 are regular expressions over the same alphabet Σ . We say $r_1 = r_2$ to denote equality of the languages represented by r_1 and r_2 . In other words, every string in the language represented by r_1 is also included in the language represented by r_2 and vice versa. For each of the following pairs of regular expressions over $\Sigma = \{0, 1\}$, either prove that they represent the same language, or give a string that is present in the language of one but not in the language of the other. In the latter case, you must also describe why your solution string is in the language of one regular expression, but not in that of the other.
 - (a) $r_1 = 1 * (1 + 0) * 0 *$ and $r_2 = (0 * 1 *) *$
 - (b) $r_1 = ((0 + 1) * 0) * 0$ and $r_2 = (0 + 1) * 0 * 0$
 - (c) $r_1 = (0 + 1) * 0 1 (0 + 1) *$ and $r_2 = 1 * (0 + 1) * 0 (0 + 1) * 1$
2. When we say that a TM M accepts a language L by halting, we mean that if M is started with a word w on its tape, it halts if and only if $w \in L$. In class, we have seen how every binary string can be thought of as encoding a deterministic Turing machine (DTM) that accepts by halting. Recall also that with the encoding studied in class, every DTM can be encoded as a binary string with no two consecutive 0's. Similarly, every binary string can be thought of as an input string on a given (possibly different) alphabet. We will use $[[w]]_{TM}$ to denote the Turing machine encoded by $w \in (0 + 1) *$. Similarly, we will use $[[w]]_{\Sigma}$ to denote the input string encoded by $w \in (0 + 1) *$. Let L_1 and L_2 be as defined below:
 - $L_1 = \{w \mid w \in (0 + 1) + \text{ and there is at least one input string on which } [[w]]_{TM} \text{ doesn't halt}\}$.
 - $L_2 = \{w100w2 \mid w_1, w_2 \in (0 + 1)^*, w_1 \text{ has no two consecutive zeros, and } [[w_1]]_{TM} \text{ does not halt on } [[w_2]]_{\Sigma}\}$.

Which of the following statements are true? Justify your answer.

- (a) If L_1 is recursively enumerable, then L_2 is recursive.
- (b) L_1 is co-recursively enumerable
- (c) The language $L_2 = \{wwR \mid w \in L_1\}$ is recursive. Here, wR means the reverse of the word w .

20CS004 Principles of Programming Languages**3 1 0 3****Course Outcomes**

13. Explain the concepts of programming languages.
14. Describe syntax and semantics of programming languages.
15. Explain data types, and basic statements of programming languages.
16. Illustrate the concept of subprogram.
17. Demonstrate the concepts of ADT and OOP.
18. Summarize the concept of exception handling and event handling.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4
1	3	1	2	2
2	3	2	1	2
3	3	1	3	1
4	3	2	2	2
5	3	2	2	3
6	3	2	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Preliminary Concepts****11+4 Hours**

Reasons for studying concepts of programming languages, programming domains, language evaluation criteria, influences on language design, language categories, language design trade-offs, implementation methods, programming environments, Evolution of Major Programming Languages.

Syntax and Semantics: General problem of describing syntax, formal methods of describing syntax, attribute grammars, describing the meanings of programs.

Unit II**Data types, Expressions and Statements, Control Structure****11+4 Hours**

Names, Bindings, and Scopes: Introduction, names, variables, concept of binding, scope, scope and lifetime, referencing environments, named constants

Data types: Introduction, primitive, character, string types, user defined ordinal types, array, associative arrays, record, tuple types, list types, union types, pointer and reference types, type checking, strong typing, type equivalence

Expressions and Statements: Arithmetic expressions, overloaded operators, type conversions, relational and Boolean expressions, short-circuit evaluation, assignment statements, mixed-mode assignment

Control Structures: introduction, selection statements, iterative statements, unconditional branching, guarded commands.

Unit III**Subprograms****11+4 Hours**

Subprograms: Fundamentals of subprograms, design issues for subprograms, local referencing environments, parameter passing methods, parameters that are subprograms, calling subprograms indirectly, overloaded subprograms, generic subprograms, design issues for functions, user defined overloaded operators, closures, co routines

Implementing subprograms: General semantics of calls and returns, implementing simple subprograms, implementing subprograms with stack-dynamic local variables, nested subprograms, blocks, implementing dynamic scoping.

Unit IV**ADT, OOP, Exception and Event Handling****12 + 3 Hours**

Abstract Data types: The concept of abstraction, introductions to data abstraction, design issues, language examples, parameterized ADT, encapsulation constructs, naming encapsulations

Object Oriented Programming: Design issues for OOP, OOP in Smalltalk, C++, Java, Ada 95, C#, Implementation of Object-Oriented constructs.

Exception Handling and Event Handling: Introduction, exception handling in Ada, C++, Java, introduction to event handling, event handling with Java and C#.

Total: 45+15 Hours

Textbook (s)

3. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley, 2012.
4. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH

Reference (s)

9. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, MIT Press, 2009.
10. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall, 2008.
11. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009.
12. W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	50	50	--
Apply	--	10	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define programming language?
2. Define named constants?
3. Define subprogram?

Understand

7. Explain numeric types?
8. Summarize grammars for simple assignment statements.
9. Discuss language evaluation criteria and the characteristics that affect them.

Apply

1. Identity the exceptions occurred in C++ and Ada.
2. Construct BNF notation for following:
 - a. For loop
 - b. If-else condition
 - c. Structure definition
3. Solve the given grammar is ambiguous or not.


```

<assign> -><id>=<expr>
<id>->A|B|C
<expr>-><expr>+<expr>
|<expr>*<expr>
|(<expr>)
|<id>
      
```

20CS005 Mobile Computing**3 1 0 3****Course Outcomes**

1. Explain the basic concepts and fundamentals of mobile computing and telecommunication systems along with various standards.
2. Illustrate the techniques, protocols related to GSM and GPRS architecture to perform requirements analysis.
3. Explain major components of Mobile IP to improve the service qualities of a network
4. Compare various ad hoc routing protocols to examine the performance of network
5. Explain the architecture of Wireless Sensor Network and WLAN design issues and limitations.
6. Outline the basic knowledge in developing smart phone applications using various platforms, toolkits, APIs and third party libraries

CO-PO Mapping

COs	PO3	PO8
1	3	2
2	2	2
3	1	2
4	2	2
5	2	2
6	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to Mobile Communications****12+4 Hours**

Overview: Mobile Communication and Mobile Computing – Architecture; Generations of Telecommunications – 1G, 2G, 3G, 4G and 5G; Wireless Technologies – WPAN, WLAN, WMAN; Wireless Medium Access Control (MAC) – Overview, SDMA, TDMA, FDMA, CDMA; 2G Technologies: GSM – Services, Architecture, Radio Interface, Protocol Stack, Localization, Call Handling, Handover, Security; 2.5G – GPRS and 3G – EDGE.

Networking: Communication Modes, Basic Network Designs, Cellular Infrastructures

Unit II**Mobile Network Layer and Transport Layer****11+4 Hours**

Mobile Network Layer: Mobile IP Overview, IP Packet delivery, Agent discovery and advertisement, Registration, Tunneling and Encapsulation, Optimizations, Security, and Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer – Motivation, Traditional TCP, Classical TCP Approaches: Indirect TCP, Snooping TCP, Mobile TCP, Transaction-oriented TCP; Optimizations, TCP for 2.5G/3G.

Multi Task gadget: wide area mobile data - air link standards for data - wireless application environment

Unit III**Mobile Ad-hoc Network (MANET)****11+3 Hours**

Introduction to Mobile ad-hoc networks, Characteristics and features, Applications, Limitations; Routing protocols – Design Issues, Routing algorithms: Proactive (DSDV & OLSR) and Reactive (DSR & AODV), Security in ad hoc networks; Wireless LAN – IEEE 802.11 – System Architecture, Protocol Layers.

Wireless Sensor Network (WSN): Introduction, Architecture, Applications, Properties and Security.

Satellite systems: history - applications - basics - broadcast systems

Unit IV**Mobile Platforms and Applications****11+4 Hours**

Mobile OS: Overview on Mobile Device Operation Systems (Android, iOS, Black Berry) – Architecture, App development Kit; Introduction to Network Simulators: Characteristics, Applications, Limitations, Types of Simulators: Wireless Application Protocol (WAP): Introduction, Architecture, Applications.

Application layer Protocols – FTP, SMTP, HTTP, DNS; Windows 10.

Total: 45+15 Hours

Textbook (s)

1. Raj Kamal, Mobile Computing, Oxford press, Third Edition, 2018
2. Jochen Schiller, Mobile Communications, Pearson Education, Second Edition, 2020

Reference (s)

1. Asoke K Talukder, Hasan Ahmad and Roopa Yavagal, Mobile Computing, Second Edition, McGraw Hill, 2010
2. Prasant Kumar Pattnail and Rajib Mall, Fundamentals of Mobile Computing, Second Edition, PHI Learning Pvt. Ltd., 2015
3. Frank Adelstein, et al., Fundamentals of Mobile and Pervasive Computing, McGraw Hill, 2005
4. http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf (NS2 manual)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	25	10
Understand	25	15	20
Apply	25	20	30
Analyze	20	20	30
Evaluate	--	10	10
Create	--	10	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

9. Define Mobile Computing
10. List the applications of mobile computing
11. List the limitations of mobile computing
12. Define Mobile Adhoc Network
13. List the MANET routing issues

Understand

8. Explain mobile computing with architecture
9. Explain tTDMA and FDMA with neat diagrams
10. Illustrate the different services provided by the GSM, Explain with system architecture
11. Explain IP Packet delivery with diagram
12. Describe DSSM (Direct Sequence Spread Spectrum)

Apply

10. Illustrate Registration process achieved in mobile network layer
11. Discuss the feature of tunneling and encapsulation
12. Illustrate the function of Dynamic Host Configuration Protocol (DHCP)
13. Discuss about security in Ad-hoc network
14. Illustrate the properties of MANETS

Analyze

1. Compare Snooping TCP and Indirect TCP
2. Analyze the performance of Dynamic Source Routing protocol
3. Compare about iOS and Blackberry Operating Systems
4. Compare NS2 and NS3 simulators
5. Explain about Android Operating System with architecture

Evaluate

1. Evaluate the performance of Wireless Datagram protocol
2. Evaluate the performance of DSDV
3. Evaluate the performance of DSR
4. How Traditional TCP is different from I-TCP
5. How localization and Call handling is performed

Open Book Exam Questions

Q1. Describe the functions of the MS and SIM. Why does GSM separate the MS and SIM? How and where is user-related data represented/stored in the GSM system? How is user data protected from unauthorized access, especially over the air interface? How could the position of an MS (not only the current BTS) be localized? Think of the MS reports regarding signal quality.

Q2. Describe the Concept of GPRS. Using the best delay class in GPRS and a data rate of 115.2 kbit/s – how many bytes are in transit before a first acknowledgement from the receiver could reach the sender (neglect further delays in the fixed network and receiver system)? Now think of typical web transfer with 10 Kbyte average transmission size – how would a standard TCP behave on top of GPRS (see chapters 9 and 10)? Think of congestion avoidance and its relation to the round-trip time. What changes are needed?

20CS006 Distributed Operating Systems**3 1 0 3****Course Outcomes**

1. Summarize the fundamental concepts of Distributed Operating Systems.
2. Illustrate the Concepts of Message passing system and Remote Procedure Calls.
3. Design and Implementation of Distributed Shared Memory and Structures.
4. Utilize the Synchronization and Distributed File Systems.
5. Make use of Resource Management and Process Management Concepts.
6. Outline the concept of Naming and Security in Distributed Operating Systems.

CO-PO Mapping

CO	PO1	PO2
1	3	2
2	3	2
3	3	2
4	2	2
5	3	2
6	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction and Communication in Distributed System****12+3 Hours**

Introduction: Design Issues - Distributed Computing Environment - Message Passing - Features of Good Message Passing System-Issues in IPC by Message Passing-Synchronization- Buffering
 Remote Procedure Calls: The RPC Model - Transparency of RPC- Implementing RPC Mechanism - Stub Generation - RPC Messages - Marshaling Arguments and Results - Server Management - Parameter-Passing Semantics- Call Semantics

*Communication Protocols for RPCs - Complicated RPCs - Client-Server Binding-Case Study: Sun RPC***Unit II****Distributed Shared Memory and Synchronization****11+4 Hours**

Distributed Shared Memory: General Architecture of DSM Systems- Design and Implementation Issues of DSM – Granularity - Structure of Shared Memory Space
 Synchronization: Clock Synchronization - Event Ordering - Mutual Exclusion –Deadlocks- Election Algorithms

*Consistency Models-Replacement Strategy - Thrashing***Unit III****Resource Management and Distributed File Systems****11+4 Hours**

Resource Management: Features of a Good Global Scheduling Algorithm - Task Assignment Approach – Load Balancing Approach – Load Sharing Approach
 Distributed File Systems: Introduction -Desirable Features of a Good Distributed File System - File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes - File Replication

*Process Management - Process Migration- Threads- Case Study: DCE Distributed File Service***Unit IV****Naming and Security****11 + 4 Hours**

Naming: Desirable Features of a Good Naming System - Fundamental Terminologies and Concepts - System-Oriented Names - Object-Locating Mechanisms - Human-Oriented Names - Name Caches
 Security: Potential Attacks to Computer Systems - Cryptography – Authentication

*Access Control - Digital Signatures - Design Principles- Case Study: DCE Directory Service***Total: 45+15 Hours****Textbook (s)**

1. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2009
2. Andrew S Tannebaum, ”Distributed Operating Systems”, Pearson Education, 2007

Reference (s)

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. List any four advantages of Distributed operating systems
2. Define distributed operating systems.
3. List any five reasons why to build distributed operating System.
4. What are the features of good distributed file systems?
5. List the features of a Good Naming System

Understand

1. Explain the design issues of distributed operating systems.
2. Explain the role of Naming in distributed operating systems
3. Summarize the internal and external synchronization of Physical clocks
4. Differentiate Resource Management and Process Management
5. Explain in detail about security and authentication.

Apply

1. Construct the different protocols of RPC.
2. Identify the File shearing Semantics and file caching Schemes.
3. Develop the Bully and Ring Algorithm
4. Develop the scenario how might the clocks in two computers that are linked by a local network be synchronized without reference to an external time source
5. Utilize the various deadlock prevention techniques with suitable example?

Analyze

1. Analyze the Concept of exception handling in RPC.
2. Examine the Concept of Thread.
3. Compare Fault tolerance and Thrashing.
4. Classify the deadlock avoidance techniques.
5. Simplify an algorithm using multicast and logical clocks for mutual exclusion.

Open Book Exam Questions**Question 1:**

A distributed system has DSM facility. The process-scheduling mechanism of this system selects another process to run when a fault occurs for the currently running process, and the CPU is utilized while the block is being fetched. Two system engineers arguing about how to better utilize the CPUs of this system have the following opinions:

(a) The first one says that if a large number of processes are scheduled for execution at a node, the available memory space of the node can be distributed among these processes so that almost always there will be a ready process to run when a page fault occurs. Thus, CPU utilization can be kept high.

(b) The second one says that if only a few processes are scheduled for execution at a node, the available memory space of the node can be allocated to each of the few processes, and each process will produce

fewer page faults. Thus, CPU utilization can be kept high. Whose argument is correct? Give reasons for your answer.

Question 2:

The password mechanism is used in a distributed system to authenticate users at login time. State the most suitable locations (according to you) for storing the login program and the password file in the following cases:

(a) The distributed system is based on the workstation-server model with each workstation having a small hard disk of about 20 megabytes capacity.

(b) The distributed system is based on the workstation-server model. Some of the workstations are diskless and others have a small hard disk of about 20 megabytes capacity.

(c) The distributed system is based on the processor-pool model.

20CS001 Fundamentals of Artificial Intelligence**3 1 0 3****Course Outcomes**

1. Summarize the fundamental concepts of Artificial Intelligence.
2. Illustrate the Concepts of Heuristic Search Techniques.
3. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
4. Make use of concept of Game Playing Algorithms.
5. Outline the concept of Planning System
6. Explain the Natural language processing system

CO-PO Mapping

CO	PO1	PO2	PO3
1	2	1	2
2	2	2	3
3	3	1	1
4	1	2	2
5	1	3	2
6	1	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+3 Hours****Introduction**

Definition, AI problems, AI techniques, Defining problem as a state space search, Production systems-Control Strategies, Problem characteristics, Production system characteristics. Problems – tic-tac-toe, 8-puzzle problem, Chess problem, Water Jug Problem, Missionaries and cannibals problem, Monkey and banana problem.

Application of AI-Tower of Hanoi problem- Travelling Salesman Problem

Unit II**11+4 Hours****Heuristic Search Techniques**

Generate-and-test, Hill climbing, Best-first-search – OR Graphs – A* Algorithm, Problem reduction – AND-OR Graphs – AO* Algorithm, constraint satisfaction - cryptarithmic problem.

Depth-first search – Breadth-first search- Data abstraction

Unit III**11+4 Hours****Knowledge representation**

Knowledge Representation Issues, Representation and mapping, Approaches to Knowledge Representation, Frame Problem, Propositional logic, Predicate logic, Resolution, weak slot and filler structure-semantic nets.

Filler structures-conceptual dependency-scripts

Unit IV**11+4 Hours****Game Playing and Planning**

Mini-max search, Alpha-beta cutoffs, planning system, Block world problem, goal stack planning, hierarchical planning, Natural language processing, syntactic processing. Decision trees, Perception, Vision, Speech recognition.

Learning - Navigation – Manipulation - Robot Architecture

Total: 45+15 Hours**Textbook (s)**

1. E. Rich K.Knight, and B. Nair, Artificial Intelligence, 3rdEdition, TMH, 1 July 2017
2. Russel Norvig, Artificial Intelligence A modern Approach, 3rd Edition, Pearson Education, 2010

Reference (s)

1. Patrick Henry Winston, Artificial Intelligence, third edition, Pearson Education Asia, 2005
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, 2nd Edition, PHI, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	70
Analyze	--	--	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. State the tasks, which are associated with A.I.
2. Give an example of crypt-arithmetic problem.
3. Define Speech Recognition.
4. Recall Intelligence

Understand

1. Explain Turing Test.
2. Explain the characteristics of production system.
3. Write A* algorithm in detail and explain its functionality to solve 8-puzzle problem.
4. Explain the semantic analysis phase done through case grammars in Natural Language understanding

Apply

1. Distinguish between weak and strong slot filler structures
2. Discuss the tic-tac-toe problem in detail and explain how it can be solved using AI technique
3. Construct semantic net representation for the following:
 - (i) Pompeian (Marcus), Blacksmith (Marcus)
 - (ii) Mary gave the green flowered vase to her favorite cousin.

Analyze

1. Show that the tower of Hanoi problem can be classified under the area of AI. Give a state space representation of the problem.
2. Give an example of a problem for which breadth-first search would work better than depth-first search. Justify your answer.
3. Consider the following sentences:

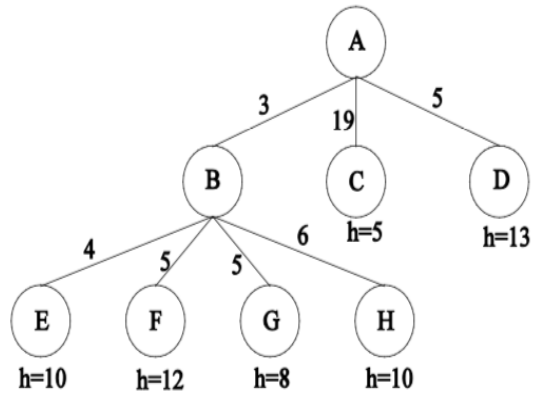
John likes all kinds of food.
Apples are food.
Chicken is food
Anything anyone eats and isn't killed by food.
Bill eats peanuts and is still alive.
Sue eats everything Bill eats.

 - (a) Translate these sentences into formula in predicate logic.
 - (b) Convert the formulas of part a into clause form.

Prove that John likes peanuts using resolution.

Open Book Exam Questions**Question 1:**

Consider the following search tree produced after expanding node A, where each arc is labeled and the leaves are labeled with the value of a heuristic function, h.



- (i) Identify the node, which is expanded next by each of the following search methods?
 - (a) Breadth First Search
 - (b) Depth-First Search
 - (c) Best-First Search
 - (d) A* Search
 - (e) AO* Search
- (ii) Construct the Min Max Tree for the above figure (ignoring the cost values)
- (iii) Identify whether the tree is eligible for pruning or not, if it is yes trace the alpha beta prunes

20CS507 Artificial Intelligence and Machine Learning Laboratory**0 0 3 1.5****Course Outcomes:**

1. Design and develop problem statements for solving real time problems using expert systems
2. Outline the role of data repositories and various data preprocessing tools
3. Illustrate the use of consistent data in implementing machine learning algorithms
4. Distinguish valid datasets for the machine learning algorithms
5. Identify and develop various machine learning algorithms suitable to the problem statement
6. Demonstrate and resolve complex clusters using dimensionality reduction

CO-PO Mapping

CO	PO4	PO5	PO8
1	3	2	2
2	3	3	2
3	3	1	3
4	2	2	2
5	2	2	3
6	1	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Expert System

Week 1: Develop a Rule Based system (Consider any Problem from the Annexure any Real Time)

Data Pre-Processing and Data Pre-Processing ToolsWeek 2: Importing Libraries, Importing Datasets, Missing Data, Encoding Dependent Variable,
Week 3: Splitting Datasets to Training Dataset and Test Dataset, Feature Scaling**Classification:**Week 4: K-Nearest Neighbours, Support Vector Machines
Week 5: Naïve Bayes and Decision Tree Classification**Regression**Week 6: Simple Linear Regression, Multiple Linear Regressions
Week 7: Polynomial Regression, Logistic Regression**Clustering**Week 8: Association Rule Learning
Week 9: K Means Clustering
Week 10: Hierarchical Clustering**Dimensionality Reduction**Week 11: Principal Component Analysis
Week 12: Linear Discriminate Analysis**Text Book (s)**

1. Raschka, Sebastian and Mirjalili, Vahid, Python Machine Learning, 3rd Edition, Packt Publishing, 2020
2. Stephen Marsland- Machine Learning – An Algorithmic Perspective – Second Edition – Chap Man & Hall CRC Press, 2015

Reference (s)

1. Tom M. Mitchell, –Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Machine Learning A-Z: Hands-On Python, Udemy.

Annexure:

1. Banking System
2. Weather System
3. Medical System
4. Gaming System
5. Dressing System

6. Disease Diagnose or Prediction System

Augmented Experiments:

1. Rule Based Expert System: Design, Suiting and Shirting for an event/ occasion
2. Gaming: Chess, Water Jug Problem, 8 Queens Problem
3. Real Time: Traffic Lights
4. Real Time: Banking Transactions (Only Debit and Credit)
5. Mathematical Approach for Theorem Proving
6. Financial Approach for Loans via Cash / Vehicle / Gold
7. Medical Expert Systems
8. Disease Classification Strategies
9. Disease Prediction Strategies
10. Work on a Real Dataset.

20TPX01 Term Paper**0 0 3 1.5****Course Outcomes**

1. Interpret the literature to link the earlier research with the contemporary technologies
2. Communicate effectively as an individual to present ideas clearly and coherently
3. Review the research findings and its correlation to the latest applications
4. Prepare documents and present the concepts clearly and coherently
5. Inculcate the spirit of enquiry for self-learning
6. Identify interdisciplinary oriented topics

COs - POs Mapping

COs	PO1	PO4	PO10	PO12
1	-	2	-	-
2	-	-	3	3
3	3	-	-	-
4	-	-	3	-
5	-	-	-	3
6	1	-	-	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Term Paper: The Term Paper is a self-study report and shall be carried out either during 5th or 6th semester in choice with Mini Project. Every student will take up this term paper individually and submit a report. The scope of the term paper could be an exhaustive literature review choosing any engineering concept with reference to standard research papers or an extension of the concept of earlier course work in consultation with the term paper supervisor. The report will be evaluated by a committee as nominated by HoD with the approval of CoE

20ESX02 Employability Skills II**1 1 1 0****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Introspect & develop life skills with constructive approach
3. Assess and improve analytical skills
4. Understand the GUI of WEKA tool and can create new ARFF data.
5. Discover different Pre-Processing Techniques for different kinds of databases
6. Use Association rule mining algorithms to generate association rules

COs - POs Mapping

COs	PO 1	PO 2	PO 3	PO 5	PO 6	PO 8	PO 10	PO 12
CO1	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	2	2
CO3	2	-	-	-	-	2	-	-
CO4	3	-	3	2	-	2	-	-
CO5	3	2	3	2	-	-	-	2
CO6	2	2	3	2	3	-	-	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Soft Skills:

Sl No.	5th Semester (Topic & Content)	No. of Periods
1.	Introduction to Campus Placements: Stages of Campus Placement, Skills assessed in Campus Placements & How to get ready?	01
2.	Motivational Talk on Positive Thinking: Beliefs, Thoughts, Actions, Habits & Results (Success)	01
3.	Resume Preparation: Resume? Templates? Mistakes to be avoided in a Resume, Steps to be followed in preparing it.(with examples)	02
4.	Group Discussions (Recap): GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? (through Practice Sessions)	02
5.	Psychometric Tests: Definition, Types of Psychometric Tests: Numerical Computation, Data Interpretation, Verbal Comprehension, Verbal Critical Reasoning and Personality Questionnaires	01
6.	Exercises related to Communication: Story Writing, TAT etc	01
Total Periods		08

Quantitative Aptitude:

Sl No.	Semester-V (Topic)	No. of Periods
1.	Square & Cube roots	01
2.	Partnership	01
3.	Partnership	01
4.	Logarithms	01
5.	Progressions	01
6.	Mensuration	01
7.	Mensuration	01
8.	Data Sufficiency	01
Total Periods		08

Domain Specific: (Data Mining using WEKA)

S. No.	Topic Name	No. of Periods
1	Introduction to Data Mining and Warehousing Overview of Data warehouse- Introduction to Data Mining	1
2	Basic Data Mining Tasks -Different sources of Data Mining-Types of Data-Data Pre-processing	3
3	1. Introduction to Graphical User Interface (GUI) of WEKA (Practical)	2

	2. Creating ARFF files (Practical)	
4	Statistical Perspective on Data Mining-Similarity and Dissimilarity Measures.	2
5	Perform Data Pre-processing on a sample data set. (Practical)	1
6	Examine the Similarity and Dissimilarity Measures of the given dataset (Practical)	1
7	Mining Association Rules in Large Databases Association Rule Mining-Mining Single-Dimensional Boolean Association Rules from Transactional Databases.	3
8	Perform Association Analysis to derive the association rules using Apriori and FP Growth Algorithms. (Practical)	2
Total Periods		15

Textbook (s)

1. Pang, Ning Tan, Michael Steinbach, Vipin Kumar Introduction to Data Mining, 3rd Edition, Pearson Addison Wesley, 2016
2. Jiawei Han & Micheline Kamber, Data Mining Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012

Reference (s)

1. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann Publishers, 2011
2. Margaret H Dunham, Data Mining Introductory and advanced topics, 2nd Edition, Pearson Education, 2004
3. Arun K Pujari, Data Mining Techniques, 2nd Edition, University Press, 2099.

20HSX12 CC & EC Activities II**0 0 1 0****Course Outcomes**

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

COs - POs Mapping

COs	PO6	PO7	PO9	PO10
1	-	-	-	3
2	3	2	-	-
3	3	-	-	-
4	-	-	3	-
5	3	-	-	-
6	3	-	-	-

Co-Curricular and Extra Curricular (CCEC) Activities:

Students shall acquire 1 credit each in 2nd and 3rd years with the following scheme:

Scheme of evaluation for the CCEC activities:

- No. of slots in each Semester @ 2 slots every week : 24
- No. of Stream (2-CC + 1-EC) : 3
- No. of slots allotted for each stream : 8

Requirement for the award of 1- Credit

- Students shall choose at least two streams of events in each semester
- Students shall secure 75% attendance in each stream of events to obtain a certificate
- Students shall obtain 2 certificates of Participation in each semester.

The credits earned through these courses will be indicated in the grade sheet and will not be aken into account for CGPA calculation.

20SIX01 Summer Internship I**0 0 0 1.5****Course Outcomes**

1. Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s
2. Solve real life challenges in the workplace by analyzing work environment and conditions, and selecting appropriate skill sets acquired from the course
3. Articulate career options by considering opportunities in company, sector, industry, professional and educational advancement
4. Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means
5. Demonstrate the ability to harness resources by examining challenges and considering opportunities
6. Demonstrate appreciation and respect for diverse groups of professionals by engaging harmoniously with different company stakeholders

COs - POs Mapping

COs	PO1	PO2	PO8	PO10	PO12
1	3	-	-	-	-
2	3	-	-	-	-
3	-	-	-	-	3
4	-	-	-	3	-
5	-	2	-	-	-
6	-	-	3	-	-

Summer Internship: As a part of curriculum in all branches of Engineering, it is mandatory for all students to undergo summer internship Programme at industries (core or allied) / R & D organization to get practical insight of their subject domain during summer break after the 4th semester. This summer internship Programme shall be availed to a maximum duration of 4 weeks and the assessment shall be carried out with both internal and external experts leading to “Satisfactory” and “Non-Satisfactory Performance”, and it will not be accounted for the calculation of CGPA.

Audit Course**0 0 0 0****Course Outcomes**

1. Interpret the meaning of values and select their goals by self- Investigation based on personal values activity
2. Interpret the major events and issues related to a period in Indian history
3. Assess the benefits and limitations of science and its application in technological developments towards human welfare
4. Check the awareness regarding basic human rights and to uphold the dignity of every individual
5. Assess the individual and group behaviour, and understand the implications of organizational behaviour on the process of management
6. Determine the appropriateness of various leadership styles and conflict management strategies used in organizations

COs - POs Mapping

COs	PO 12
1	3
2	3
3	3
4	2
5	3
6	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Audit Courses: Audit courses are among the compulsory courses and do not carry any credits. All the students shall register for one Audit courses in the beginning of 3rd semester. List of the courses will be notified at the beginning of the third semester for all students and the student has to choose one audit course under self-study mode at the beginning of third semester. All the students (regular and lateral entry students) shall complete the audit course similar to other regular courses and the results will be indicated with "Satisfactory" or "Not Satisfactory" performance.

6th Semester**20CS601 COMPILER DESIGN****3 1 0 3****Course Outcomes**

1. Explain different translators and acquire knowledge of compiler & its Phases
2. Identify formal grammars for specifying the syntax and Semantics of programming languages
3. Construct parse table for a given grammar
4. Examine the intermediate code for a given program
5. Illustrate the symbol table management and storage organization.
6. Develop code optimization techniques to improve the performance of a program

CO-PO Mapping

CO	PO1	PO2
1	3	2
2	3	2
3	3	2
4	2	2
5	2	2
6	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11+3 Hours**

Overview of Language Processing-Compiler-Assembler-Interpreters-Linkers & Loaders- Phases of a Compiler-Lexical Analysis-Role of Lexical Analysis-Token-Patterns and Lexemes-Lexical Errors- Regular definitions for the Language constructs- Transition diagrams for recognition of Tokens-Reserved Words and Identifiers.

*Input buffering, LEX tool***Unit II****12+4 Hours**

Syntax Analysis-Top-down Parsing-First and Follow-Recursive predictive parsing- Non-Recursive Predictive Parsing- LL(1) Grammar-Bottom-up parsing-Shift Reduce Parsing-Model of an LR Parsers- Construction of SLR(1) Tables-Construction of CLR (1)-LALR(1)- Parsing tables

*Handling Ambiguous grammars- Dangling ELSE ambiguity***Unit III****11+4 Hours**

Semantic Analysis-SDT: Synthesized and Inherited Attributes-Intermediate Code-Three Address Code-Quadruples-Triples-Indirect Triples-Abstract Syntax Trees-DAG for Expressions-Symbol Table management-Runtime Environment: Storage Organization-Storage Allocation strategies

*Data structures used in symbol table, Three address code for control statements***Unit IV****11+4 Hours**

Machine Independent Code Optimization-Common Sub-expression Elimination-Constant Folding-Copy Propagation-Dead Code Elimination-Strength Reduction-Loop Optimization-Basic Blocks-Flow Graph-DAG for basic Blocks-Machine Dependent Code Optimization: Peephole Optimization-Register Allocation-Instruction Scheduling

*Code generation algorithm-optimization among basic blocks***Text Books:-**

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers, Principles Techniques and Tools, 2nd Edition, Pearson, 2007.
2. V. Raghavan, Principles of Compiler Design, 2nd Edition, TMH, 2011.

Reference Books:-

1. Nandini Prasad, Principles of Compiler Design, 2nd Edition, Elsevier, 2012.
2. Yunlin Su Song Y. Yan, Principles of Compilers, A New approach to Compilers including the Algebraic Methods, Springer, 2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	40	40	--
Apply	30	20	60
Analyze	10	20	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define Lexeme.
2. What is Bottom-up parsing?
3. What is inherited attribute?
4. What is constant folding?

Understand

1. Explain the phases of compiler.
2. Explain about various intermediate code representations.
3. Illustrate the machine independent code optimization techniques with an example for each.

Apply

1. Calculate the first and follow functions for the given grammar-
 $S \rightarrow (L) / a$
 $L \rightarrow SL'$
 $L' \rightarrow ,SL' / \epsilon$
2. Construct CLR(1) parsing table for the following grammar
 $S' \rightarrow S$
 $S \rightarrow C C$
 $C \rightarrow c C$
 $C \rightarrow d$

Analyse

1. Compare and contrast different storage organization strategies.
2. How does machine dependent code optimization is different from machine independent code optimization?

Open book Questions

1. Construct the basic block and flow graph for the following C fragments

```

a=3;
  b=4;
  for(i=0;i<n;i++)
  {
      a=a*b+5;
      a=a-4;
  }
c=a+b*3;

```
2. Write the recursive C function to generate Fibonacci sequence. Represent the activation record for each recursive call in case of Fibonacci (8).

20CS602 Internet of Things (IoT)**3 1 0 3****Course Outcomes:**

On completion of this course the students are able to:

1. Illustrate IoT framework, architecture and design principles of M2M Communication
2. Outline the design principles of Web and Internet Connectivity and its protocols
3. Summarize MAC and IP addressing in IoT, 6LowPAN and LoRaWAN protocols
4. Identify the suitable sensor technology for data collection and how to store and use it for Computing
5. Develop business models in IoT by identifying vulnerabilities and attacks involving in IoT
6. Inspect an application using IoT technology

CO-PO Mapping

COs	PO3	PO4	PO7
1	3	3	3
2	2	2	2
3	1	1	2
4	3	2	2
5	3	2	3
6	2	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I**10 + 3 Hours**

Overview of IoT: Overview of Wireless Sensor Networks, Overview of Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication.

Design Principles: IoT/M2M Systems Layers and Design Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway

Examples of IoT, Ease of Designing and Affordability

UNIT II**12 + 4 Hours**

Design Principles for Web Connectivity: Introduction, Web Communication Protocols: Constrained Applications Protocol (CoAP), Lightweight Machine-to-Machine Communication; Message Communication Protocols: Message Queue Telemetry Transport (MQTT);

Internet Connectivity Principles: Introduction, Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Media Access Control, Introduction to 6LowPAN and LoRaWAN

Application Layer Protocols: HTTP, HTTPS, FTP and Telnet

UNIT III**12 + 4 Hours**

Sensor Technology: Sensing the Real World using Analog and Digital Sensors, Industrial IoT, Automotive IoT, Actuator, RFID Technology – Principles, Architecture, Applications & Components, Web of Things of RFIDs. **Data Collection, Storage and Computing:** Introduction, Cloud computing Paradigm for Data Collection, Storage and Computing, Everything as a Service and Cloud Service Models for IoT

Sensor Data Communication Protocol: Serial Bus – USB, CAN

UNIT IV**12 + 3 Hours**

Business Models and Processes using IoT: Introduction, Business Models, Business Scenarios in IoT.

IoT Privacy, Security and Vulnerabilities Solutions: Security and Privacy Requirements, Threat Analysis, IoT Layered Attacker Model, Access Control and Secure Message Communication, Security Models

Case Studies: Smart Home, Smart City, Precision Agriculture

IoT Hardware: Raspberry pi, Arduino

Textbook:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles". TMH Publications, 2017.
2. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014

Reference:

1. Ovidiu Vermesan & Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communications, 2017.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	25	25	-
Understand	30	30	40
Apply	20	20	30
Analyze	25	20	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Write the major significance of Internet of Things.
2. State the crucial requirement of IoT in terms of application and its supporting natures.
3. List the dominant technologies behind IoT development.
4. Identify two major differences between Internet of Everything and Industrial IoT.
5. Write about the data-center based cloud tools that use to run the machine learning algorithm internally.
6. Recognizes an alternative approach that results in better adaptivity in case of network fluctuations and increased latency.
7. Identify the on-demand processing and storage capabilities that is used to analyze the data generated by IoT objects in batch or stream format.

Understand

1. Identify the evolutionary terms of Internet of Things (IoT) that use to interact and live with the physical objects.
2. Illustrate the reference architecture of IoT that unifies the smart objects and human beings to provide the ubiquitous communication
3. Illustrate the service-oriented architecture of IoT that ensures the interoperability among the heterogeneous devices
4. Illustrate the API-Oriented Architecture of IoT that use SOAP and Remote Method Invocation (RMI) as a means for describing, discovering, and calling services
5. Discuss the resource capacity, selecting and provisioning the resources that greatly impact Quality of Service (QoS) of the IoT applications
6. Classify the taxonomy of resource management activities of IoT.
7. Report the standard requirement of real time analytics to fulfill the demand of real-time stream processing engine.

Apply

1. Interpret a study analysis on open-source prototyping platform for the industrial IoT.
2. Implement a suitable OPENIoT Architecture for IoT/Cloud Convergence that provides an abstract presentation of the functional elements of architecture.
3. Sketch W3C SSN-XG ontology and how to semantically enable real time sensor feeds.
4. Execute the two-tier data dissemination model for large-scale wireless sensor network.
5. Demonstrate SPARQL query caching in order to improve the performance of semantic web applications.

6. Illustrations a technique to cluster semantically similar QA pairs for retrieving an answer for a newly given query without asking the QA engine on the cloud side.

Analyze

1. Comparative analysis on real-time analytics in Cloud-IoT and fog computing.
2. Compare the communication efficiencies for the following protocols such as AMPQ, CoAP, DDS, MQTT, UPnP and XMPP in terms of Transport Layer Protocols.
3. Differentiate the major significances of nesC, keil C and Dynamic C.
4. Relate a set of minimal features to be fulfilled by the programming frameworks for IoT.
5. Comparative analysis on IoT programming approaches

Evaluate

1. Select an example that utilizes the device-collaboration framework for the proactive suggestion application
2. Appraise a semantic QA cache that implement the device/cloud collaboration framework to compute the probability of the on-device semantic QA cache to answer a given query correctly. Select a suitable example that use automatically tagging recognized images to display the additional information such as social sentiment in order to achieve similar performance improvement for speech-recognition application with DL through device/cloud collaboration framework
3. Critique on fog-computing assisted distributed analytics system that uses a set of fall-detection algorithms, including algorithms based on acceleration measurements and time-series analysis methods, as well as filtering techniques to facilitate the fall-detection process.
4. Defend the augmented reality applications in terms of Game based on Fog Computing and Linked Data

OBE Questions:

1. Whenever a person wants to find a parking space on the campus, he has to login to the application using his user id and password, a request message will then be sent to the server. The server will send back a response with the available parking details, real-time mapped directions and real-time parking space to allocate parking according to the size of the vehicle. The application would be smart enough to identify whether the car is heading towards the same parking space or not. If not, the application would re-route the same car to another nearest available parking space. The above mentioned will be applicable to those vehicles that have logged in to the system and used the navigating system. But we also need to consider those vehicles which have not logged in and are manually finding parking space and heading towards the same parking slot. Can you solve this problem? Develop a smart efficient application system to solve the problem related to real-time parking space.
2. From the underground storage tank, water is pumped using motors to overhead water tanks, which are placed at the highest elevated floor of the building for optimum pressure. The system should also continuously monitor the soil moisture along with rain predictions to water the landscapes in the campus. . How can the system work? The system should check water quality whether it is drinkable or brackish i.e. it should check PH-level, oxygen level, etc. It should check water level of over-head as well as lower-head tanks and control the pumping of water as per the required limit of the over-head tank. The system should also give real time water volume of both the tanks, through the android application. Watering system mobile app should display type of soil, which is being taken, how much water is needed, and its moisture level. It should check weather forecast online and act accordingly, verifying if the forecast was appropriate or not. Develop a smart efficient application system to solve the problem related to "Water Management System"

20CS603 Software Engineering**3 1 0 3****Course Outcomes**

1. Explain the need of Software Life Cycle Models
2. Build end-user requirements into system and software requirements,
3. Summarize the system models of software engineering
4. Identify and apply appropriate software architectures and patterns to carry out high level design
5. Choose various testing techniques during software development
6. Categorize Risk management and Software quality for software products

CO-PO Mapping

COs	PO4	PO5	PO8	PO11	PSO1
1	3	3	2	2	2
2	3	3	2	2	2
3	3	2	2	2	2
4	2	2	2	2	2
5	2	3	2	2	2
6	2	3	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT - I**11+4 Hours**

Introduction to Software Engineering and SDLC, Software Myths, CMMI, Process models: Linear Sequential model, Prototyping model, Evolutionary models: Spiral model, Agile developmental methodologies-Scrum & XP

Incremental model, software development : Product based and application based

Unit II**11+4 Hours**

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification.

Software Requirements Engineering Process, Feasibility studies, Requirements elicitation and analysis, requirements validation.

System models: Context models, behavioral models, data models, object models.

Structure of Software Requirements Document, Structured analysis methods

Unit III**11+4 Hours**

Design concepts, data design, software architecture, Architectural styles and patterns, User interface design - Golden rules, User interface analysis and design and steps. Conceptual model of UML, basic structural modeling, Sattic and Dynamic UML diagrams : class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, etc.,

Data Acquisition System - Monitoring and Control System

Unit IV**11+4 Hours**

Testing strategies and Risk Management: Testing levels: Unit testing, integration testing, system testing – alpha and beta testing, Testing Types: black box and white box testing techniques, Cyclomatic Complexity, debugging, Risk management - Risk types, strategies, estimation and Planning. Software Quality - Quality assurance and its techniques

Software measurement, metrics for software quality

Total: 45+15 Hours = 60 Hours**Textbook (s)**

1. Roger S. Pressman, Software Engineering, A practitioner's Approach, 8th Edition, McGraw-Hill International Edition, 2015
2. I. Sommerville, Software Engineering, 7th Edition, Pearson education, 2004.
3. Rajib Mal, Fundamentals of software Engineering, 4th Edition, Eastern Economy Edition, 2014.

Reference(s)

1. K. K. Aggarwal and Yogesh Singh, Software engineering, 3rd Edition, New Age International Publication, 2008

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	30	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define software engineering.
2. List different types software myths.

Understand

1. Describe software architecture styles and patterns .
2. Illustrate golden rules for user interface design.

Apply

1. Applying the process of requirement analysis, discuss how the requirements can be collected for a project.
2. Applying debugging strategy find an error from a code?

Analyze

1. Compare and Contrast software life cycle models.
2. Analyze risk types in the risk management.

Open Book Exam Questions

Assume that 10 errors have been introduced in the requirements model and that each error will be amplified by a factor of 2:1 into design and an additional 20 design errors are introduced and then amplified 1.5:1 into code where an additional 30 errors are introduced. Assume further that all unit testing will find 30 percent of all errors, integration will find 30 percent of the remaining errors, and validation tests will find 50 percent of the remaining errors. No reviews are conducted. How many errors will be released to the field.

20CS007 Cloud Computing Essentials**3 0 2 4****Course Outcomes**

1. Interpret the architecture and infrastructure models of cloud computing, strengths, and limitations of cloud computing.
2. Understand the virtualization concepts of machines and data centers.
3. Infer the design concepts of cloud ready applications
4. Compare different cloud centre's implementation
5. Understand the concepts of cloud scaling and disaster recovery
6. Analyze the performance, scalability, and availability of the underlying cloud technologies and software

CO-PO Mapping

CO	PO ₂	PO ₅	PO ₆	PO ₇	PO ₈
1	3	3	2	3	1
2	3	1	1	2	3
3	2	2	3	1	2
4	2	1	3	3	1
5	2	1	3	1	2
6	2	3	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**14+8 Hours**

Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges. System Models: Introduction, Architectural Models- Software Layers, System Architecture, Variations, Interface and Objects, Design Requirements for Distributed Architectures, Fundamental Models- Interaction Model, Failure Model, Security Model.
Communication between Distributed Objects- Object Model, Distributed Object Model.

Practical Components:

1. Study of Cloud Computing & Architecture.
2. Install KVM/VMware Workstation for creating a virtual environment on windows platform.
Concept: Virtualization
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

Unit II**9+6 Hours****Introduction to Cloud Computing**

Overview of Computing Paradigm: Recent Trends in Computing, Evolution of Cloud Computing. Introduction to Cloud Computing: Cloud Computing (NIST Model), Properties, Characteristics & Disadvantages, Role of Open Standards. Cloud Computing Architecture: Cloud Computing Stack, Service Models (XaaS), Deployment Models. Infrastructure as a Service (IaaS): Introduction to IaaS, Resource Virtualization. Platform as a Service (PaaS): Introduction to PaaS, Cloud Platform and Management. Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS.
Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud, Windows Azure, Tata Cloud, Salesforce.com

Practical Components:

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Unit III**12+8 Hours****Virtualization & Design**

Virtualization, Virtual machine, Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Data centre, Virtualization for Data-Centre Automation. Service Levels for Cloud Applications Ready for the cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management.

various hypervisors like VMware, KVM, oracle VM, HTTPS, Electronic Payment

Practical Components:

1. Find a procedure to transfer the files from one virtual machine to another virtual machine.
2. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
3. Install Hadoop single node cluster and run simple applications like wordcount.

Unit IV

Cloud Service Providers

10 + 8 Hours

EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud.

Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, Aneka Platform

Practical Components:

1. Working and installation of Microsoft Azure.
2. Working with Mangrasoft Aneka Software.
3. Installation and Configuration of Justcloud

Total: 45+30 Hours

Textbook (s)

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems- Concepts and Design", Fourth Edition, Pearson Publication
2. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
4. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
5. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Reference (s)

- a) Michael Miller, Cloud Computing-Web Based Applications that change the way you work and collaborate online, 1st Edition, Pearson Education, Publishing, 2011
- b) Kai Hwang, Geoffrey C Fox and Jack J.Dongarra, Distributed & Cloud Computing from Parallel Processing to the Internet of Things , 1st Edition, MK Publishing, 2010
- c) David S Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, 1st Edition, Addison-Wesley, 2009
- d) Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	30	30
Understand	40	40
Apply	30	30
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)

Remember

1. Define Cloud Computing.
2. List types of virtualizations.
3. Define proactive scaling.
4. What is CIA Triad?

Understand

1. Explain different cloud Infrastructure models.
2. Explain different levels of virtualization.
3. Explain about cloud Network security in detail.
4. Explain about Recovery Point Objective.
5. With neat diagram explain the functioning of Xen Architecture.
6. List and explain various cloud service providers risks.

Analyze

1. Compare cloud center and service infrastructure.
2. Analyze different cloud services provided by Amazon

20CS008 Cryptography and Network Security**3 0 2 4****Course Outcomes**

1. Explain the fundamentals of Cryptography, encryption and decryption algorithms
2. Make use of the symmetric and public key cryptographic algorithms
3. Choose the various authentication applications for security
4. Interpret the functionalities of IP and web security.
5. Demonstrates the functionalities of firewalls
6. Explain various non-cryptographic protocol vulnerabilities

CO-PO Mapping

CO	PO3	PO6	PO8
1	2	2	3
2	2	2	3
3	2	1	3
4	2	1	2
5	2	2	3
6	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**14+8 Hours**

Introduction: Security Attacks, Security Goals, Computer criminals, Methods of Defence, Security Services, Security Mechanisms. **Basics of Cryptography:** Symmetric Cipher Model, Substitution Techniques, Transportation, Techniques, Other Cipher Properties- Confusion, Diffusion, Block and Stream Ciphers. Block Cipher Design Principles and Modes of Operations, **Symmetric Key Cryptosystems:** Principles of Private Key System, Data Encryption Standard (DES), Strength of DES, Triple DES, International Data Encryption algorithm(IDEA), Advanced Encryption Standard (AES) *Blowfish, CAST-128.*

Practical Components:

1. Write a program that contains a string (char pointer) with a value "Hello world". The program should XOR each character in this string with 0 and displays the result.
2. Write a program that contains a string (char pointer) with a value "Hello world". The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a program to perform encryption and decryption using the following algorithms
 - a. Ceaser cipher
 - b. Substitution cipher
 - c. Hill Cipher

Unit II**9+6 Hours**

Public Key Cryptography: Principles of Public Key Cryptosystems, RSA Algorithm, Diffie-Hellman Key Exchange. Cryptographic Hash Functions: Principles of Cryptographic Hash functions, Applications of Cryptographic Hash Functions, Secure Hash Algorithm (SHA), Message Authentication Codes – Message Authentication Requirements and Functions, HMAC, Digital Signatures, Elgamal Digital Signature Schemes

*Digital Signature Standards***Practical Components:**

1. Write a program to implement the Play-fair Cipher algorithm.
2. Write a program to implement the DES algorithm logic.
3. Write a program to implement the Blowfish algorithm logic.

Unit III**12+8 Hours**

Authentication Applications: Kerberos, Key Management and Distribution, X.509 Directory Authentication service, Public Key Infrastructure, Electronic Mail Security: Pretty Good Privacy, S/MIME. **IP Security:** Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining security Associations, Internet Key Exchange,

Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, *HTTPS, Electronic Payment*

Practical Components:

1. Write a Java program to implement RSA algorithm.
2. Calculate the message digest of a text using the SHA-1 algorithm.

Unit IV**Locking, Recovery Systems, Indexing, Different Types of Data****10 + 8 Hours**

IDS and Firewalls: Intruders, Intrusion Detection, Password Management, Firewalls-Characteristics, Types of Firewalls, Placement of Firewalls, Firewall Configuration, Trusted Systems. Non-cryptographic

protocol Vulnerabilities: DoS, DDoS, Session Hijacking and Spoofing, Software Vulnerabilities- Phishing, Buffer Overflow.

Format String Attacks, SQL Injection Cybercrime and Computer Crime, Intellectual Property.

Practical Components:

4. Implement the Diffie-Hellman Key Exchange mechanism.

Total: 45+30 Hours

Textbook (s)

6. William Stallings, "Cryptography And Network Security – Principles and Practices", 7th edition, Pearson Education Limited 2017.
7. AtulKahate, "Cryptography and Network Security", 2nd edition Tata McGraw-Hill, 2003.
8. Behourz A Forouzan, Cryptography and Network Security, 2nd edition, Tata McGraw-Hill 2011

Reference (s)

13. Matt Bishop, "Computer Security art and science ", Second Edition, Pearson Education, 2002
14. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007
15. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
16. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
17. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.
18. OWASP top ten security vulnerabilities: <http://xml.coverpages.org/OWASPTopTen.pdf>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)
Remember	30	30
Understand	40	40
Apply	30	30
Analyze	--	--
Evaluate	--	--
Create	--	--
Total (%)	100	100

SAMPLE QUESTION (S)

Remember

1. Mention any two security attacks
2. List any two goals of security
3. Define Hash function

Understand

1. Differentiate between asymmetric and symmetric key cryptography
2. How do we achieve authentication?
3. Differentiate between the two applications of hash function.

Apply

1. How do we apply PGP to the Email Security?
2. Implement firewall using iptables command.
3. Can message encryption itself provide measure of authentication?

Open Book Exam Questions

Question 1:

A man named Jones wanted to chat with his girlfriend Goldie. But he can see that all his family is around him and even his girlfriend is also with her parents. So, he thought to send a secret message to his girlfriend. They usually love to meet in the "Central Park". Now jones wants to send a message to Goldie as "Hi Goldie. How are you. Because you are with your parents, and I am with my parents we cannot speak

with each other. But I want to meet you at our favourite place central park tomorrow after your class". Help jones to convert the message to unreadable format using the key of their favourite place. Also suggest him how would jones tell Goldie that the letter is originated from jones only.

Question 2:

You have decided to start a startup after graduation. But you alone cannot be doing this, so you have to ask help from your friends. Suggest what techniques you require and which sort of people you would select so that your company will be a huge success. Explain the techniques clearly to your friends and tell them what they have to do in detail.

20CS002 Machine Learning (Open Elective II)**3 1 0 3****Course Outcomes:**

1. Classify the variety of learning algorithms.
2. Choose a learning algorithm to data using various tools of Machine Learning.
3. Identify the strengths and weaknesses of many popular machine learning approaches.
4. Examine the performance of learning algorithms and model selection.
5. Identify mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
6. Model Artificial Neural Networks and Deep Neural Networks in solving complex real world problems.

COs-POs Mapping

CO	PO2	PO3
1	1	2
2	3	2
3	3	1
4	3	2
5	3	2
6	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I**12+4 Hours**

Overview of Machine Learning, **Learning**: Types of Machine Learning, Hypothesis Formulation and Model Selection, **Phases of ML**: Training, Testing and Validation-Splitting, Cross Validation; **Evaluation of Machine Learning Models**: Error Analysis, Performance Indices, Confusion Matrices, The Bias-Variance Trade-off, Feature Selection; **Regression**: Linear Regression, Linear Regression with Multiple Variables, Logistic Regression.

Basic Statistics: Variance and Covariance, Correlation Vs Regression, Feature Scaling and Standardisation, Machine Learning Tools: Weka, R, Python, MATLAB.

UNIT II**10+3 Hours**

Learning with Trees: Constructing Decision Trees, ID3 Classifier, Constructing Rules from a Decision Trees Classification; **Graphical Models**: Baye's Theorem, Bayesian Learning, Bayesian Networks, Naïve-Bayes Classifier, **Instance based Learning**: Nearest Neighbor Classifiers.

Modelling a Supervised Learning System, Conditional Probability

UNIT III**12+4 Hours**

Clustering: Similarity and Distance Measures, **Clustering Techniques**: K-Means Algorithm, Hierrarchical Clustering, Clustering of Categorical Attributes; **Dimensionality Reduction**: Linear Discriminant Analysis, Principal Component Analysis; **Ensemble Learning**: Boosting, Bagging, Stacking;

Comparison of Clustering Techniques, Curse of Dimensionality

UNIT IV**11+4 Hours**

Artificial Neural Networks: Model, Activation functions, Perceptron, The Multilayer Perceptron (MLP), Error Propagation, Delta Rule, Back Propagation Algorithm, **Deep Learning**: Convolutional Neural Networks (CNN), Applications, A case study on Object Recognition using CNN.

Linear Separability, Gradient Descent, XOR Gate

Total: 45+15 Hours**Textbook (s)**

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", (Chapman & Hall/CRC Machine Learning & Pattern Recognition), Second Edition, 2014.
2. Sunila Gollapudi and Rodolfo Bonnin, "Practical Machine Learning: Experimental algorithms and techniques for machine learning and artificial intelligence", Packt Publishing Ltd., Mumbai, Second Edition, 2018.

Reference (s)

1. Tom M. Mitchell, "Machine Learning ", Tata McGraw Hill, New Delhi, 2017.
2. Raschka Sebastian and Mirjalili Vahid, "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2", Packt Publishing Ltd., Mumbai, 3rd Edition, 2020.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination ¹ (%)
Remember	40	30	--
Understand	40	20	--
Apply	20	30	80
Analyze	--	20	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Define Machine Learning.
2. List the types of Machine Learning.
3. State Bayes Theorem.
4. What is Regularization?

Understand

1. Demonstrate Linear Regression.
2. Explain Back Propagation Algorithm.
3. Illustrate Decision Tree Induction process in detail.
4. Demonstrate Genetic Operations in detail.

Apply

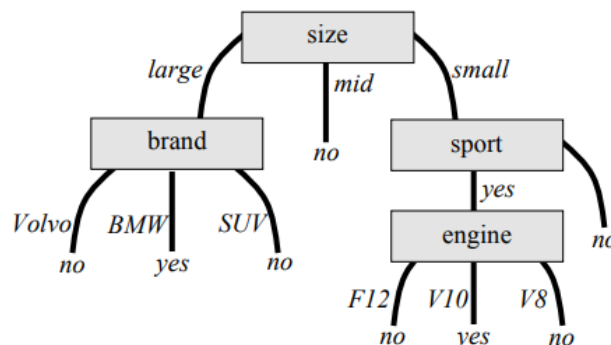
1. Apply the concept of Regularization to solve overfitting problem.
2. Build a Linear Regression for a given dataset.
3. Apply k-Means algorithm on a given dataset to identify clusters.
4. Apply Back Propagation Algorithm to the the given dataset.

Analyze

1. Distinguish between Logistic Regression and SVM.
2. Analyze Dimensionality Reduction using PCA
3. Analyze various Neural Network Architectures in Machine Learning.

Open Book Examination

1. Suppose that we want to solve the problem of finding out "what a good car is" by using Decision Tree algorithm.



- a) Generate rules from the constructed decision tree?
- b) Which parameters required for generating the tree?

¹Assessment test should contain only questions related to Higher Order Thinking (HOT) Skills

- c) What would be the suitable values of those parameters for the given problem? Provide a short explanation for each.
- d) Explain your answer in a clear and compact manner by providing the pseudo code of the algorithm
2. About 2/3 of your email is spam so you downloaded an open source spam filter based on word occurrences that uses the Naive Bayes classifier. Assume you collected the following regular and spam mails to train the classifier, and only three words are informative for this classification, i.e., each email is represented as a 3-dimensional binary vector whose components indicate whether the respective word is contained in the email.

'study'	'free'	'money'	Category
1	0	0	Regular
0	0	1	Regular
1	0	0	Regular
1	1	0	Regular
0	1	0	Spam
0	1	0	Spam
0	1	0	Spam
0	1	0	Spam
0	1	1	Spam
0	1	1	Spam
0	1	1	Spam
0	1	1	Spam

- a) You find that the spam filter uses a prior $p(\text{spam}) = 0.1$. Explain why this might be sensible.
- b) Give the following model parameters when estimated as maximum-likelihood with add-one smoothing (i.e., using pseudocounts of one).
 $P(\text{study}|\text{spam})$, $P(\text{study}|\text{regular})$, $P(\text{free}|\text{spam})$, $P(\text{free}|\text{regular})$, $P(\text{money}|\text{spam})$, $P(\text{money}|\text{regular})$
- c) Based on the prior and conditional probabilities above, give the model probability $P(\text{spam}|s)$ that the sentence $s = \text{"money for psychology study"}$ is spam.
- d) What should be the value of the prior $p(\text{spam})$ if we would like the above sentence to have the same probability as being spam as not spam, i.e., it would be classified as spam with probability 0.5?

20CS606 Case Tools Lab**0 0 3 1.5****Course Outcomes**

1. Interpret the concepts of UML
2. Design various Use cases to showcase the functional Requirements of the system
3. Construct UML diagrams for Static and Dynamic view of the system
4. Inference various case studies and design the model
5. Construct the code from Model for the given application
6. Demonstrate and deploy the solutions for various real time problems.

COs-POs Mapping

CO	PO4	PO5	PO11
1	3	2	2
2	3	3	2
3	3	1	3
4	2	2	2
5	2	2	3
6	1	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

List of Experiments**CASE TOOLS (UML) LAB EXPERIMENTS:**

Case studies given below should be Modelled using Rational Rose tool in different views i.e. Use case diagram, Class diagram, Sequence Diagram, Collaboration Diagram, State Diagram, Activity Diagram, Component Diagram, Deployment Diagram and Forward and Reverse Engineering.

CASE STUDY 1:**LIBRARY MANAGEMENT SYSTEM:**

This case study on the library management system gives us the complete information about the library and the daily transactions done in a Library. We need to maintain the record of new s and retrieve the details of books available in the library which mainly focuses on basic operations in a library like adding new member, new books, and up new information, searching books and members and facility to borrow and return books.

CASE STUDY 2:**A HOSPITAL MANAGEMENT SYSTEM:**

Entry in the hospital management system is done through system users. Master form for users is used to create user profile. Whole system is display in user's selected language. For example if user knows Germany then whole hospital management system is display in German language after login. Above all modules are related to patient. So when patient is admit then patient information is enter from patient entry form like patient name, patient initial, patient sex, patient birth date, blood group, patient ID.

CASE STUDY 3:**AUTOMATED TELLER MACHINE (ATM)**

Software is designed for supporting a computerized ATM banking network. All the process involved in the bank is computerized these days. All the accounts maintained in the bank and also the transactions effected, including ATM transactions are to be processed by the computers in the bank. An ATM accepts a relevant cash card, interacts with user, communicates with the central system to carry out the transaction, dispenses cash, and prints receipts. The system to be designed and implemented must include appropriate record keeping and security provisions. The system must handle concurrent access to the same account.

CASE STUDY 4:**DESIGN A STUDENT REGISTRATION SYSTEM :**

Each student has access to his or her course and grade information only and must be authenticated prior to viewing or updating the information. A course instructor will use the system to view the list of courses he or she is assigned for a given semester or has taught previously, view the list of students registered for the course(s) he or she is teaching and record final grades for each student in the course(s). TA assignments will also be viewable through this system. Instructors must also be authenticated prior to viewing or updating any information.

List of Augmented Experiments

1. Create a UML model for Passport automation system.
2. Create a UML model for Book bank
3. Create a UML model for Exam Registration
4. Create a UML model for Stock maintenance system.
5. Create a UML model for Online course reservation system
6. Create a UML model for E-ticketing
7. Create a UML model for Credit card processing
8. Create a UML model for e-book management system
9. Create a UML model for Recruitment system
10. Create a UML model for Quiz system

Reading Material (s)

1. Case tools Lab manual, Department of CSE, GMRIT, Rajam

20MPX01 Mini Project**0 0 3 1.5****Course Outcomes**

1. Identify a contemporary engineering application to serve the society at large
2. Use engineering concepts and computational tools to get the desired solution
3. Justify the assembled/fabricated/developed products intended
4. Organize documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation
6. Execute the project in a collaborative environment

COs – POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	-	-	-	3	2	-	-	-	-	-
2	3	3	-	-	3	-	-	-	-	-	-	-
3	3	3	3	2	-	-	-	-	-	-	2	-
4	-	-	-	-	-	-	-	-	-	3	-	2
5	-	-	-	-	-	-	-	3	-	-	-	-
6	-	-	-	-	-	-	-	-	3	-	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Mini Project: The curriculum offers Mini Projects in two different forms viz: (i) Mini Project as a mandatory component in all lab courses (ii) 2 credit Mini Project during 5th or 6th semester. With respect to second one (ii) student will take mini project batch wise and the batches will be divided as similar to lab courses. The report will be evaluated by a committee as nominated by CoE constituted with internal & external panels

20ESX02 Employability Skills II**1 1 1 3****Course Outcomes**

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Introspect & develop life skills with constructive approach
3. Assess and improve analytical skills
4. Choose appropriate Supervised Learning techniques for a given dataset
5. Apply different clustering techniques to characterize subgroups.
6. Communicate results in terms relevant to science, business etc.

COs – POs Mapping

COs	PO 1	PO 2	PO 3	PO 5	PO 6	PO 8	PO 10	PO 12
CO1	-	-	-	-	-	-	3	-
CO2	-	-	-	-	3	-	2	2
CO3	2	-	-	-	-	2	-	-
CO4	3	-	3	2	-	2	-	-
CO5	3	2	3	2	-	-	-	2
CO6	2	2	3	2	3	-	-	-

3-Strongly linked | 2-Moderately linked| 1-Weakly linked

Soft Skills:

Sl No.	Topic & Content	No. of Periods
1.	Resume (Recap): Resume? Templates? Mistakes to be avoided in a Resume and Steps to be followed in preparing it.	01
2.	Group Discussions (Recap) & Practice: GD? Stages of a GD, Skills assessed in a GD, Blunders to be avoided, How to excel in a GD? Practice sessions and sharing Feedback. (Screening sample Videos)	01
3.	Interview Skills: Interview? Types of Interviews, Dos & Don'ts, Skills assessed in an Interview, Mistakes to be avoided, How to equip oneself to excel? How to handle the Typical Interview Questions? (with Examples)	03
4.	Mock Interviews: Practice sessions with Feedback.	02
5.	Exercises related to Communication: Email Writing, Voice Versant., etc.	01
Total Periods		08

Quantitative Aptitude:

Sl. No.	Topic	No. of Periods
1.	Time and Distance	01
2.	Time and Distance	01
3.	Problems on Trains	01
4.	Problems on Trains	01
5.	Blood relations	01
6.	Ratio and Proportions	01
7.	Calendars	01
8.	Clocks	01
Total Periods		08

Domain Specific: (Data Mining using WEKA)

Sl. No	Topic	No. of Periods
1.	Classification of Data General Approach to Solving Classification Problem-Decision Tree Induction -Regression- Nearest- Neighbor Classifiers -Bayesian Classifiers	3
2.	Implement the Classification using Decision Tree Induction Algorithm. (Practical)	2
3.	Implement the Classification using Regression (Practical)	2
4.	Implement the Bayesian Classification Algorithm (Practical)	1
5.	Cluster analysis & Mining Complex Types of Data Cluster analysis -K-means-Agglomerative Hierarchical Clustering	4
6.	1. Implement K-means clustering Algorithm. (Practical) 2. Implement Hierarchical clustering Algorithm (Practical)	3
Total Periods		15

Textbook (s)

1. Pang, Ning Tan, Michael Steinbach, Vipin Kumar Introduction to Data Mining, 3rd Edition, Pearson Addison Wesley, 2016
2. Jiawei Han & Micheline Kamber, Data Mining Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012

Reference (s)

1. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, 3rd Edition, Morgan Kaufmann Publishers, 2011
2. Margaret H Dunham, Data Mining Introductory and advanced topics, 2nd Edition, Pearson Education, 2004
3. Arun K Pujari, Data Mining Techniques, 2nd Edition, University Press, 2099.

20HSX12 CC & EC Activities II**0 0 1 1****Course Outcomes**

1. Interpret and present the abstractive technical information through an activity
2. Think critically in providing solutions to the generic and common problems
3. Demonstrate the creative thinking in dealing with liberal arts
4. Instill team sprit through active engagement with the peer
5. Develop programs of common interest having social impact
6. Empower the under privileged through motivational activities

COs - POs Mapping

COs	PO6	PO7	PO9	PO10
1	-	-	-	3
2	3	2	-	-
3	3	-	-	-
4	-	-	3	-
5	3	-	-	-
6	3	-	-	-

Co-Curricular and Extra Curricular (CCEC) Activities:

Students shall acquire 1 credit each in 2nd and 3rd years with the following scheme:

Scheme of evaluation for the CCEC activities:

- No. of slots in each Semester @ 2 slots every week : 24
- No. of Stream (2-CC + 1-EC) : 3
- No. of slots allotted for each stream : 8

Requirement for the award of 1- Credit

- Students shall choose at least two streams of events in each semester
- Students shall secure 75% attendance in each stream of events to obtain a certificate
- Students shall obtain 2 certificates of Participation in each semester.

The credits earned through these courses will be indicated in the grade sheet and will not be aken into account for CGPA calculation.

AUDIT COURSE**Course Outcomes**

At the end of the Audit Course the students will be able to

CO1: Interpret the meaning of values and select their goals by self- Investigation based on personal values.

CO2: Interpret the major events and issues related to a period in Indian history.

CO3: Assess the benefits and limitations of science and its application in technological developments towards human welfare

CO4: Check the awareness regarding basic human rights and to uphold the dignity of every individual.

CO5: Assess the individual and group behaviour and understand the implications of organizational behaviour on the process of management.

CO6: Determine the appropriateness of various leadership styles and conflict management strategies used in organizations.

Cos-POs Mapping:

COs	P012
CO1	3
CO2	3
CO3	3
CO4	2
CO5	3
CO6	2

Career Path I (Artificial Intelligence & Machine Learning)**20CSC11 Exploratory Data Analytics****3 1 0 3****Course Outcomes**

1. Explain the Data Analysis Fundamentals
2. Illustrate various data Visual aids
3. Categorize different data transformation and descriptive statistics
4. Identify different Correlation and Inferences from statistical tests
5. Make use of the concept Hypothesis Testing
6. Classify different Multivariate Analysis techniques

CO-PO Mapping

CO	PO1	PO4
1	3	2
2	3	3
3	3	2
4	2	3
5	3	3
6	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Exploratory Data Analysis Fundamentals****11+4 Hours**

Understanding data science, significance of EDA, steps in EDA. types of analysis (univariate, bivariate, multivariate). Making sense of data: Numerical data-Discrete&continuous data,categorical data, Measurement scales-Nominal, Ordinal,Interval, Ratio. Comparing EDA with classical and Bayesian analysis, getting started with EDA: Numpy, Pandas,Scipy, and Matplotlib.

Grouping data: groupby mechanics, rearranging, reshaping data structures, data aggregation methods, and cross-tabulation methods.

Objectives of Exploratory data Analysis, The applications of EDA.

Unit II**11+4 Hours****Visual aids for EDA**

Line chart, Bar charts,Box plot,residual plot, Scatter plot-bubble chart, scatterplot using seaborn, Area plot, stacked plot, and stem-and-leaf plot, pie chart, table chart, polar chart, histogram, lollipop chart, choosing the best chart.

Data transformation and descriptive statistics

Transformation techniques- performing data deduplication,replacing values, handling missing data, renaming axis indexes, outlier detection and filtering. Permutation and random sampling, computing indicators/dummy variables, string manipulations.

Descriptive statistics: Understanding statistics, distribution function (uniform, normal, exponential, binomial), cumulative distribution function, measure of central tendency, measure of dispersion (standard deviation, variance, skewness, kurtosis, percentiles, quartiles)

Violin Plots, Inter Quartile Range, Discretization & binning, heatmaps

Unit III**11+4 Hours****Correlation and Inferences from statistical tests :**

Introducing correlation, covariance, Pearson's Correlation, Spearman's Rank Correlation.

Hypothesis Testing: Testing a difference in mean, testing a correlation, chi-squared tests, errors, power. Model development and evaluation with regression techniques.

Correlation vs causation, ANOVA

Unit IV

12 + 3 Hours

Multivariate Analysis: overview, Factor Analysis, Cluster Analysis, Discriminant analysis, EDA Case Study

Multidimensional Scaling, MANOVA vs ANOVA

Total: 45+15 Hours

Textbook (s)

1. Daniel J. Denis: Univariate, Bivariate, and Multivariate Statistics Using R: Quantitative Tools for Data Analysis and Data Science, Wiley,2020
2. Mukhiya Suresh Kumar Mukhiya, Ahmed Usman Ahmed: Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data, Packt, 2020
3. Downey, Allen. Think stats: exploratory data analysis. " O'Reilly Media, Inc.", 2014.
4. Neil H. Spencer: Essentials of Multivariate Data Analysis, CRC Press,2014

Reference (s)

6. Wes McKinney : Python for Data Analysis 2nd Edition,Wiley,2013
7. Glenn J. Myatt, Wayne P. Johnson: Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition,Wiley,2014
8. Wendy L. MartinezAngel R. MartinezJeffrey L. Solka: Exploratory Data Analysis with MATLAB, 2nd Edition,CRC Press,2011
9. Radhika Datar, Harish Garg : Hands-On Exploratory Data Analysis with R , Packt,2020
10. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is data science.
2. Define purpose of different data visualtion aids
3. List any two steps involved in EDA.

Understand

1. Explain different data representation
2. Explain the role of various data grouping methods
3. Explain purpose of hypothesis testing in detail

Apply

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data nanlysis
3. Examine data with various distribution function

Analyze

1. Comapre and contrast varius data grouping methods.
2. Distinguish various methods to address problems with dummy variables
3. Examine various string handling methods

Evaluate

1. Evaluate the statistics of a given dataset
2. Justify the importance of data skewness
3. Measure data dispersion methods on a dataset

Open Book Exam Questions

Question 1:

Perform below analysis on a house price prediction dataset.

- a) Univariate Analysis
 - i. Analysis of a numerical feature
 - ii. Analysis of a categorical feature
- b) Bivariate Analysis
 - i. Relationship of a numerical feature with another numerical feature
 - ii. Relationship of a numerical feature with a categorical feature

Question 2:

Perform below analysis on weather prediction dataset.

- c. Correlation Analysis
 - i. Correlation Heat Map
 - ii. Zoomed Heat Map
- d. Investigation of missing values
 - i. What's missing? to what extent?
 - ii. Visualizing missing values in a dataframe

20CSC12 Deep Learning**3 0 2 4****Course Outcomes**

1. Explain the fundamental of Artificial Neural Networks
2. Identify different data representations for Neural Networks
3. Make use of different CNN models.
4. Compare different character encoding techniques.
5. Exemplify different Deep unsupervised models
6. Examine different deep learning applications.

CO-PO Mapping

CO	PO1	PO2	PO4	PSO1
1	3	2	1	1
2	2	3	1	1
3	3	2	2	2
4	2	3	1	3
5	1	3	2	3
6	1	2	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to Neural Networks****11+7 Hours**

Artificial Neural Networks: Introduction, Neuron Model, Neural Network Architecture, Learning Rules, Single Layer Perceptrons, Multilayer Perceptrons, adaptive resonance theory (ART), Back propagation Networks : Kohnen's self organizing networks, Hopfield network, Applications of NN, Data representations for neural networks : 0D tensors, 1D tensors, 2D tensors, tensor attributes, data tensors (Vector data, Timeseries data, images, video), tensor operations.

Model Parameters vs Hyperparameters, Types of activation functions, Gradient descent, delta rule

Practical Component:

1. Build a Neural Network with backpropagation algorithm and test the same using appropriate dataset.
2. The implementation of tensors and various operations on tensors.

Unit II**11+8 Hours**

convolution networks: Building blocks of CNNs, Architectures, Filters and Feature Maps, pooling layers, Convolutions over volumes, Softmax regression, Deep Learning frameworks, Training and testing on different distributions, Bias and Variance with mismatched data distributions, Transfer learning, Multi-task learning, end-to-end deep learning.

CNN models: AlexNet, VGG -16, Residual Networks, YOLO

Keras, tensorflow, data augmentation, Batch Normalization, Dropout

Practical Component:

1. Digit and Character recognizer using CNN
2. Explore AlexNet
3. Explore YOLO

Unit III**Recurrent Networks****11+7 Hours**

One-hot encoding of words and characters, using word embeddings, Recurrent Neural Network Model, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU), LSTM (long short term memory), Encoder Decoder sequence to sequence architectures,

Deep Unsupervised Learning: Autoencoders, variational Autoencoders, Generative adversarial network, Deep Boltzmann Machines

n-grams, bag-of-words, Bi directional RNN, Exploding gradient

Practical Componet:

1. One-hot encoding of words and characters using word embeddings.
2. Study the construction and working of Recurrent Neural Network
3. Explore LSTM and GRU to predict stock prices based on historic data.

Unit IV

Applications of Deep Learning

12 + 8 Hours

Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models. Attention models for computer vision tasks

Batch Gradient Descent vs Stochastic Gradient Descent, limitations of deep learning

Practical Component:

1. Explore applications like Image segmenation and object detection.
2. Automatic image captioning and video to text models.

Total: 45+30 Hours

Textbook (s)

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation. (2015).
2. Fundamentals of Deep Learning: Designing Next-generation Machine Intelligence Algorithms by Nicholas Locascio and Nikhil Buduma O'Reilly Media; 1 edition (June 29, 2017)
3. Simon S. Haykin, Neural Networks, Prentice Hall, 2nd edition
4. B. Yegnanarayana , "Artificial Neural Networks" , PHI.

Reference (s)

1. Franchois Chollet, Deep Learning with Python
2. Deep Learning: A Practitioner's Approach by Adam Gibson and Josh Patterson Shroff/O'Reilly; First edition (2017)
3. Python Deep Learning by Daniel Slater and Gianmario Spacagna, Packt Publishing; 2/e (January 16, 2020)
4. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006
5. Kevin P. Murphy.,Machine Learning:A Probabilistic Perspective

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE (%)
Remember	40	40	-
Understand	30	40	-
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is neuron.
2. List any two learning rules.
3. Define Convolution neural network
4. Define one-hot encoding technique
5. Define LSTM

Understand

1. Explain Multilayer perceptron
2. Explain data representation through tensors
3. Outline different character encoding techniques
4. Illustrate usage of autoencoders
5. Construct Gated Recurrent Unit (GRU)

Apply

1. Apply 2D tensors to represent image data
2. Develop CNN model to classify digits.
3. Build a CNN model to recognize images
4. Apply LSTM to extract text from a video
5. Build an appropriate DL model for image segmentation

Analyze

1. Examine differences between ANN and CNN.
2. Compare ML with DL
3. Compare and contrast different activation functions.

Evaluate

1. Evaluate performance of DL and ML for an image classification problem.

Open Book Exam Questions

Question 1:

List out any four datasets available in keras API and explain the features of each dataset and take an handwritten “**mnist**” numeric numbers dataset from keras API to classify handwritten digits.

Question 2:

Take a dataset which consists student photos and apply appropriate CNN models to display name of each student or object which appears on image. Note: Each image in a dataset consists group of mixed objects.

Career Path II (Full Stack Developer)**20CSC21 Web Programming Languages****3 1 0 3****Course Outcomes**

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

7. Understand what web applications are.
8. Analyze the templates and common scenarios of web development.
9. Examine various web programming languages and their usages.
10. Analyze the flow of data through various layers of web.
11. Identify the use of data management and compatibility of web browsers.
12. Identify the need of security and performance for a web application.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₇
1	3	3	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	1
6	3	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12+4 Hours****Overview of the web**

Web application Overview: Basic concepts of web, Hyper Text Mark-up Language (HTML) and Cascading stylesheets (CSS), Web programming languages

Web server: Introduction, Anatomy of HTTP transaction, Request and response structures, REST APIs.

Data management: Browser storage - Local storage & Session storage, Database storage.

HTML, CSS, HTTP, Status codes

Unit II**11+4 Hours****Web programming in JavaScript**

Introduction: Basic concepts – Arrays, objects, functions, classes and interfaces, ES6 JavaScript standard.

Node JS: Introduction, Node packages, HTTP web server – Creating a HTTP server that supports Create, Read, Update and Delete operations via various HTTP methods, Adding common request parser

Express: Creating a web server with express and body parser packages

NodeJS, ES6, Node packages.

Unit III**11+4 Hours****Web programming in Java**

Introduction: Basic concepts – Arrays, objects, methods, classes and interfaces, Extensible Markup Language (XML).

Web programming techniques – Servlets, Java Server Pages (JSP)

Servlets: Introduction, creating a HTTP servlet for Create, Read, Update and Delete operations

Java Server Pages (JSP): Introduction, creating a JSP for Create, Read, Update and Delete operations

Servlet, XML, JSP

Unit IV**11+3 Hours****Web programming in Python**

Introduction: Basic concepts – Arrays, objects, methods, classes and interfaces, Python's HTTP package

HTTP server: Introduction, creating a server that supports Create, Read, Update and Delete operations

HTTP server, Python packages

Total: 45+15 Hours**Textbook (s)**

4. Learn Web Development with Python, Fabrizio Romano, Gaston C. Hillar, Arun Ravindran, 1st Edition, 2018.
5. Learn Java for Web Development, Vishal Layka, 1st Edition, 2014.
6. Node.js, John Bach, Alexander Aronowitz, 3rd Edition, 2021

Reference (s)

5. HTML 5 in simple steps, Kogent Learning Solutions Inc, Dreamtech Press.
6. Beginning HTML, XHTML, CSS, and JavaScript, John Duckett, Wiley India.
7. Beginning CSS: Cascading Style Sheets for Web Design, Ian Pouncey, Richard York, Wiley India.
8. Web Designing & Architecture-Educational Technology Centre, University of Buffalo.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Question(s)**Remember**

4. List any four HTML tags and CSS properties
5. Define web server
6. List four browser storage methods

Understand

4. What HTTP method should be used for updating data in a server?
5. Explain the of CSS in web development
6. Illustrate the working of a HTTP server

Apply

3. When user opens a website, the underlying web application wants to store browser specific data. What is a good approach for saving the data?
4. Give an example of a scenario that might benefit from browser storage instead of backend storage.

Analyze

4. There is a common body parsing workflow that every request to a server must obey. What is a good way to implement it?
5. Compare Servlet and Java Server Page
6. Analyze the general strategy behind cookies and session management.

Evaluate

3. Assuming the server received a permission error from the database, what is the best way to propagate it to the user?
4. Describe how to implement user authentication in a web server.

Open Book Exam Questions

3. A file is to be stored in the web server. However, the access to this file is to be limited to specific set of users. How can once achieve this using a web server?
4. Consider a request that yields data of high cardinality. How can one send the data without affecting the performance of the website?

20CSC22 Web Application Developments Framework**3 0 2 4****Course Outcomes**

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

1. Understand the fundamentals of web framework.
2. Classify model, view and controller layers of a web application.
3. Design a web application using a framework.
4. Know the concept of Java web framework.
5. Understand and analyze how modern-day web applications are different from web sites.
6. Learn the technologies of Python web framework.

CO-PO Mapping

COs	PO ₁	PO ₃	PO ₄
1	3	3	2
2	3	2	2
3	3	3	3
4	3	3	2
5	3	2	3
6	2	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT- I**10+6 Hours****Fundamentals of Web Framework**

Web framework- History, Types of framework architectures, Model-view-controller (MVC), Three-tier organization

Introduction to frameworks- Framework applications, General-purpose website frameworks-Server-side, Client-side features

*MVC, Three-tier organisation, Framework***Practical Components**

1. Realisation of separation of data, data fetch and representation logics
2. Realization of mark-up language and it's styling

UNIT- II**12+8 Hours****Angular – JavaScript web framework**

Introduction – Angular MVC, Model, View, Controller, Ajax, Data binding

Angular concepts - Directives, Scopes, Controllers, Modules, Expressions

Developing a simple To-Do application using AngularJS (Developing a single page application)

*MVC, Ajax, Data binding***Practical Components**

1. Implementation of angular directives
2. Implementation of scope and controller
3. Implementation of custom/user-defined directive

Unit III**12+6 Hours****React framework**

Introduction to React: What is Full-Stack Web Development?, Node.js and NPM, Front-end JavaScript Frameworks and Libraries Overview, Introduction to React, React App Overview, Introduction to JSX, React Components, React Components: State and Props, React Components: Lifecycle Methods Part 1

React Router and Single Page Applications: Presentational and Container Components, React Components: Lifecycle Methods Part 2, Functional Components, React Virtual DOM, React Router, Single Page Applications, React Router: Parameters

React Forms, Flow Architecture and Introduction to Redux: Controlled Forms, Uncontrolled Components, The Model-View-Controller Framework, The Flux Architecture, Introduction to Redux, React Redux Forms

Practical Components

1. React Components

2. React Router and Single Page Applications
3. Controlled Form Validation, Uncontrolled Forms

Unit IV

11+10 Hours

Django – Python web framework

Introduction to Django- History-Django Components-Alternate Components-MVC Architecture in Django
 MVC creation in Django – Configuring Django, Creating model, view and controller in Django, REST in Django and templates
MVC, Django, REST

Practical Components

1. Creating models for database queries
2. Writing Django templates for rendering data
3. Implementation of REST API using Django

Total: 45+30 Hours

Textbook (s)

1. Angular: Up and Running, Shyam Seshadri, 1st Edition, O’Reilly, 2018
2. Struts the Complete Reference, James Holmes, 2nd Edition, Mc. Graw Hill Professional, 2006.
3. Programming with Django, Wiley Publishing

Reference (s)

1. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st edition, 2018
2. The Definitive Guide to Django, Adrian Holovaty, Jacob Kaplan-Moss, Apress, 2009.
3. Struts 2 In Action, Donald Brown, Chad Michael Davis, Scott Stanlick, Dreamtech press, 2008.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	10	--
Understand	50	40	--
Apply	30	30	--
Analyze	--	20	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

Sample Question (S)

Remember

1. Explain model, view and controller
2. List any 4 directives in Angular
3. List the Struts Tag Libraries.
4. Define a scope in Angular
5. Define a template in Django

Understand

1. Write a template in Django that conditionally renders data.
2. Write an example custom tag in Struts
3. Illustrate form validation in Struts.
4. Illustrate the use of ng-filter directive in AngularJS
5. Write an example snippet for ng-if directive in AngularJS
6. Differentiate between plain-validator and field-validator in Struts.
7. For a single Struts application, can we have multiple struts-config.xml files?

Apply

1. Write a snippet that uses ng-for, ng-if and compare it with usage of ng-filter directives in AngularJS
2. Write a sample code for creating a User model in Django that has the following properties:
 - a. Name (string)
 - b. Age (number)
 - c. Email (email)
 - d. Phone number (number)

3. Write a sample Django template that renders the User data whose age is > 15.
4. Create an actionForm bean in Struts.
5. Illustrate the steps required for setting up validator framework in Struts.

Analyse

1. What does the following code snippet in struts-config.xml do?

```
<exception
  key="stockdataBase.error.invalidCurrencyType"
  path="/AvailbleCurrency.jsp"
  type="Stock.account.illegalCurrencyTypeException">
</exception>
```
2. When can global scope be used over local scope in AngularJS?
3. Why is ng-filter more preferable than ng-if in AngularJS?
4. What happens to existing data in the database when models are edited in Django?
5. Write User and Group models with relevant attributes, where a User can be part of multiple groups. Ensure that when a User is queried, the groups he belongs too are also part of the response.

Career Path III (Cyber Security)**20ITC31 Fundamentals of Security****3 1 0 3****Course Outcomes**

1. Explain the fundamental concepts of information security
2. Illustrate the use of cryptography and its functions
3. Identify different types of Cryptography methods
4. List out different types of Security Threats and Vulnerability
5. Make use of the concept of network security
6. Outline transport and network layer security

CO-PO Mapping

CO	PO1	PO2
1	3	1
2	3	3
3	1	2
4	2	3
5	3	2
6	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Security concepts****11+4 Hours**

What is security, Data vs Information vs Cyber security, Goals of Information Security, Computer Security Concepts, threats, attacks, and assets, security functional requirements, fundamental security design principles, computer security strategy, networking, benefits of networking.

protocols suite, hacking, network sniffing, social engineering

Unit II**Cryptography****11+4 Hours**

Introduction to cryptography, Cryptographic functions(Authentication, Nonrepudiation, confidentiality, integrity), Cryptanalysis. Types of Cryptography: Symmetric key and Asymmetric Key Cryptography, Message Integrity, Encryption and Decryption Techniques, Digital Signatures, Email Standards: MIME and PGP

Applications of Cryptography, cipher types, steganography

Unit III**Security Threats and Vulnerabilities****11+4 Hours**

Overview of Security Threats and Vulnerability: Types of attacks on Confidentiality, Integrity and Availability, Types of malware, Buffer Overflow
Security Counter-Measures: Passwords, Access Control (Authenticating users, Handling User Access), Antivirus Software, Firewalls, Intrusion Detection Systems and IPS.

Types of firewalls, advanced persistent threat

Unit IV**Network Security****12 + 3 Hours**

TCP/IP Suite, DNS, MITM, Attacks on TCP and DNS, VPN, Application layer security (PGP, S/MIME), Transport layer security (TLS), Network layer security (IPSec) Anonymous networks: Tor, I2P.

TCP Vulnerabilities, SSH vs SSL,

Total: 45+15 Hours**Textbook (s)**

1. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition,2015
2. Nihad A. Hassan, Rami Hijazi, Digital Privacy and Security Using Windows: A Practical Guide, Apress, 2017

Reference (s)

1. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.
2. Ross Anderson, Security Engineering: A Guide to Building Dependable Distributed, 3rd Edition, John Wiley & Sons Inc, 2021.
3. Kozierok, Charles M. The TCP/IP guide: a comprehensive, illustrated Internet protocols reference, 2005
4. Harris, Shon, "CISSP all-in-one exam guide." Sixth edition (2013).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is security.
2. Define cyber security
3. List any four computer security concepts
4. Define threat
5. Define intrusion

Understand

1. Explain Cryptographic functions
2. Explain the role of Symmetric key cryptography
3. Illustrate hashing techniques
4. Outline the purpose of digital signatures

Apply

1. RSA algorithm with example
2. Digital signature
3. Buila a firewall mechanism to protect laptop

Analyze

4. Compare and contrast RSA and ECC.
5. Distinguish differences between Symmetric and Asymmetric key cryptography.
6. Examine the key sharing techniques in both Symmetric and Asymmetric key cryptography techniques

Evaluate

4. Justify the ECC is best public key cryptosystem than other public key approaches.
5. Explain the importance of IPSec protocol.
6. Explain the importance of I2P protocol

Open Book Exam Questions**Question 1:**

In a public-key system using RSA, you intercept the ciphertext $C=10$ sent to a user whose public key is $e=5$, and $n=35$. What is the plaintext M ? and Perform encryption and decryption using the RSA algorithm for the following: 1. $P=3$; $q=11$, $e=7$; $M=5$. 2. $P=17$; $q=31$, $e=7$; $M=2$.

Question 2:

Suppose we have a set of blocks encoded with the RSA algorithm and we don't have the private key. Assume $n=pq$, e is the public key. Suppose also someone tells us they know one of the plaintext blocks has a common factor with n . Does this help us in any way?

20ITC32 Cybernet Security**3 0 2 4****Course Outcomes**

1. Explain the fundamental concepts of Cyber security
2. Demonstrate the web security and different attacks
3. Identify different network scanning and security measures
4. List out different types of Intrusion detection.
5. Model different types of Intrusion prevention systems
6. Outline different cyber crimes, IT laws and acts.

CO-PO Mapping

COs	PO1	PO3	PO4	PO5	PSO1
1	3	3	1	1	1
2	3	3	1	3	1
3	1	2	3	3	2
4	3	1	1	3	3
5	1	3	3	3	3
6	1	3	2	1	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Introduction to Cyber Security****11+7 Hours**

What is Cyber Security, its need, cyber-threats, Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage), Career Growth, Statistics, Inferences, Need for a Comprehensive Cyber Security Policy, Classification of Cyber Crimes,kinds of cyber crimes, Reasons for Cyber Crimes, Cyber Security Tools : Nmap, Metasploit, wireshark, tcpdump, snort.

*Cyber security awareness, social engineering, cyber stalking***Practical Components**

1. Lab Activity: Study the use of network reconnaissance tools like WHOIS, dig, ping, hping, traceroute, nslookup to gather information about networks and domain registrars.
2. Lab Activity: Study of packet sniffer tools like tcpdump , wireshark etc.

Unit II**Web security****11+8 Hours**

Same origin Policy, Cross Origin Resource Sharing, DDOS, SQL Injection, XSS, Homograph, Generating and storing session tokens.

Networking Scanning & Security Measures:

Packet Sniffing and spoofing, Network scanning types, port scanning & its tools, and Network Architecture

Security Measures : IPTables(firewalls) , Webservers (Nmap & Metasploit for securing webservers), Cyber Threats and Attacks (Malware, DOS, MITM, Social engineering attacks, Spoofing, Phishing)

*Cross-Site Request Forgery (XSRF/CSRF), spear phishing.***Practical Components**

1. Lab Activity: Perform port scanning using Nmap
2. Lab Activity: Penetration Testing and Exploiting with Metasploit, Armitage and msfconsole
3. Lab Activity: Simulate DOS and DDOS attacks using various tools.
4. Lab Activity: Study of SQLMap to explore SQL Injection attacks

Unit III**Intrusion Detection System****11+8****Hours**

Intruders, Intrusion Detection, Analysis Approaches, Network-Based IDS, Host-Based IDS, signature based IDS, anomaly based IDS, advantages and disadvantages of NIDS and HIDS

Intrusion Detection Tools, snort architecture, snort rules, case studies of intrusion detection systems,Intrusion detection exchange format.

Honeypots, different types of honeypots, benefits and dangers of honeypots

firewall vs IDS, Physical IDS, honeynet

Practical Components

1. Lab Activity: Use iptables in linux to create firewalls..
2. Lab Activity: Use Snort as packet sniffer and write your own IDS rules

Unit IV

Cyber Laws and Digital Forensics

12 + 7 Hours

Digital Forensics: Introduction to Digital Forensics, historical background of digital forensics, Forensic Software, and Hardware, need for computer forensics science, special tools and techniques digital forensic life cycle, challenges in digital forensic.

Law Perspective: Introduction to the Legal Perspectives of Cybercrimes and Cybersecurity, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws, The Indian IT Act, Cybercrime Scenario in India, Digital Signatures and the Indian IT Act.

Cybercrime and Punishment

Practical Components

1. Lab Activity: Write a security policy for password protection
2. Lab Activity: Case Study on Indian IT ACT 2000

Total: 45+30 Hours

Textbook (s)

1. Wenliang Du, Computer & Internet Security: A Hands-on Approach, (2020)
2. William Stallings, Lawrie Brown, Computer Security Principle sand Practice Third Edition,2015
3. Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives, Wiley India Pvt. Ltd, 2011.
4. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi

Reference (s)

1. Pande, Jeetendra. "Introduction to Cyber Security.", (2017)
2. Pavan Duggal, Cyber frauds, cybercrimes & law in India.
3. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010
4. Roberto Di Pietro, Luigi V. Mancini (2008), Intrusion Detection System, Springer
5. Dafydd Stuttard and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley Publication

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE (%)
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	-

SAMPLE QUESTION (S)

Remember

1. What is cyber security.
2. Define security policy.
3. List classification in cyber security.
4. Define network scanning.
5. What is digital forensics.

Understand

1. Explain security policy for password protection.
2. Explain reasons for cyber crime.

3. Outline SQL injection attack.
4. Classify different approaches for packet filtering using firewall.
5. Explain IP Spoofing.

Apply

1. Apply IPS methods to prevent intruder.
2. Apply snort rules to detect intrusion
3. Identify open ports in a network using nmap.
4. Plan to filter unauthorized packets using iptables
5. Build host based IPS.

Analyze

1. Compare and contrast iptables and snort.
2. Compare and contrast different tools to address DOS.
3. Examine different port scanning methods.
4. Distinguish nmap and metasploit.
5. Compare different tools related to digital forensics

Open Book Exam Questions

Question 1:

	Source Address	Source Port	Dest Address	Dest Port	Action
1	Any	Any	202.168.1.0	> 1023	Allow
2	202.168.1.1	Any	Any	Any	Deny
3	Any	Any	202.168.1.1	Any	Deny
4	202.168.1.0	Any	Any	Any	Allow
5	Any	Any	202.168.1.2	SMTP	Allow
6	Any	Any	202.168.1.3	HTTP	Allow
7	Any	Any	Any	Any	Deny

The above table shows a sample of a packet filter firewall ruleset for an imaginary network of IP address that range from 202.168.1.0 to 202.168.1.254. Describe the effect of each rule.

Question 2:

Perform following activities using nmap tool:

- c) Write an nmap command to check/find list of open ports for "gmr.it.org" website.
- d) Nmap to reveal open services and ports by IP address as well as by domain name (Note: IP number is of your choice).
- e) Nmap command to scan multiple hosts at once.
- f) Nmap command to find OS information of a host (host IP address is of your choice).
- g) Nmap command to check firewall settings of a host (host IP address is of your choice).

B. Tech. (Honors)
Domain I (Data Engineering)

20CSH11 Advanced Data Structures

4 0 0 4

Course Outcomes

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

1. Recognize the variations in implementation of fundamental linear data structures
2. Describe and implement different types of search and balanced trees
3. Demonstrate the concepts and implementations of heaps and its types
4. Identify heap data structure for appropriate use cases
5. Outline the applications of hash table data structure
6. Illustrate the use of data structure for strings

CO-PO Mapping

CO	PO2	PO3	PO4
1	2	3	2
2	3	3	3
3	3	3	3
4	3	3	3
5	3	3	3
6	2	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Elementary Data Structures: Review

10+3 Hours

List – Stack – Queue – Double Ended Queue – Dynamic Allocation of nodes – Shadow copies of Array based structures – Generic List

Unit II

Search Trees and Balanced Trees

12+4 Hours

Two models of search trees – General properties and Transformations – Height of search tree – Basic insert, delete operations – Dealing with non-unique keys – Building Optimal search trees – Converting trees into lists – Height balanced trees – Weight balanced trees – Red-Black trees – Splay trees – Skip lists – Interval trees – Segment trees

Unit III

Heaps

12+4 Hours

Balanced search trees as heaps – Array based heaps – Heaps as trees – Leftlist heaps – Skew heaps – Binomial heaps – Changing keys in heaps – Fibonacci heaps – Heaps of optimal complexity – Double ended heap structures

Unit IV

Hash Tables and Data Structures for Strings

11+4 Hours

Hash Tables

Basic hash tables and collision resolution – Universal families of hash functions – perfect hash functions – hash trees – Extendible hashing – Bloom filters

Tries and Compressed tries – Dictionaries – Suffix trees – Suffix arrays

Textbook (s)

1. Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, “Introduction to Algorithms”, MIT Press, Cambridge, 2009

Reference (s)

1. Alfred L Aho, John E Hopcroft, Jeffery D Ullman, “Data Structures and Algorithms, Pearson Publications, 2016
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2002
3. Michael Main, Walter Savitch, Data Structures and other objects using C++, 4th Edition, Addison Wesley, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	20	20	--
Understand	35	35	--
Apply	25	25	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

- List out linear data structures
- Name the basic operations of stack data structure
- Define balance factor of AVL tree
- Define complete binary tree
- What is self-referential structure?
- Name two basic operations on stack data structure supports
- Define a double linked list structure
- What are advantages and disadvantages of circular linked list?

Understand

- Explain Bubble Sort Process with an example
- Demonstrate with neat diagram and algorithm to insert a node before the given key
- Explain Deletion process using an example binary search tree
- Explain why the selection sort is more efficient than the bubble sort
- Explain with suitable example of LL rotation after inserting a new node into an AVL tree
- Demonstrate the application of singly linked lists for the addition of the polynomials P1 and P2

Apply

- Construct a symbol parse tree for the key words of following program

```
void main()
{
    long int n,num,d;
    char prime;
    clrscr();
    printf("Enter the range for prime no");
    scanf("%ld",&n);
    for(num=2;num<=n;num++)
    {
        prime='t';
        for(d=2;d<=sqrt(num);d++)
            if (num%d==0)
            {
                prime='f';
                break;
            }
        if(prime==t)
            printf("%10ld",num);
    }
    getch();
}
```

- Develop an algorithm to concatenate two single linked lists
- Construct a priority queue and implement all basic operations to demonstrate priority queue
- Build a recursive procedure to count the number of nodes in a binary tree
- Develop a queue using single linked list data structure

Analyze

- Analyze the efficiency of insertion sort for the following inputs to sort
A={12, 23, 3, 11, 56, 6, 78, 7} B={12, 14, 23, 45, 56, 67, 78, 81}
- Analyze the efficiency of BST deletion to delete a node with two children
- Compare BST deletion and AVL deletion methods according to time efficiency.
- Choose a suitable data structure to implement a linked stack

5. Analyze the efficiency of BFS graph traversal method

Evaluate

1. Justify that the height of the AVL tree is $O(\log n)$ where n is the no of nodes in the tree
2. Prove that the height of a complete, balanced binary tree of 'n' nodes is " $\log (n+1)$ "
3. The worst time complexity of binary search is $O(\log n)$, Justify
4. Choose a suitable data structure to implement double ended queue
5. Compare the height by successive insertion of following numbers if inserted into a BST and AVL tree
{12, 14, 23, 45, 56, 67, 78, 81}

20CSH12 Advanced Databases**4 0 0 4****Course Outcomes**

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

1. Interpret Distributed Databases and its architectures
2. Utilize various fragmentation techniques given a database
3. Illustrate query optimization and Transaction Management in DDBMS
4. Compare various approaches to concurrency control in Distributed database
5. Choose various algorithms and techniques for deadlock and recovery in Distributed database
6. Explain about data on external storage and indexing

COs – POs Mapping

COs	PO ₂	PO ₃	PO ₄
1	3	2	1
2	3	3	2
3	3	2	1
4	2	2	2
5	3	2	1
6	3	3	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Unit I**9+3 Hours**

Introduction to DDBMS: Distributed data processing; what is a DDBS; Features of Distributed versus Centralized Databases, Advantages and disadvantages of DDBS; Principles of Distributed Databases, Levels of Distribution Transparency, Distributed DBMS Architecture.

Distributed Database Design: Top-Down Design Process, Distribution design issues, fragmentation, allocation, Data Directory.

UNIT – II**7+4 Hours**

Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries. The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions.

UNIT-III**8+3 Hours**

Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, and Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control. Basic Concepts of reliability, Non-blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration.

UNIT-IV**7+4 Hours**

Data on External Storage: File Organization and Indexing, Clustered Indexing, Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing, Hash Tables, Tree-Based Indexing, B-Tress, Comparison of File Organization.

Total: 45 Hours**Textbook (s)**

1. Principles of Distributed Database Systems, M. Tamer Özsu, and Patrick Valduriez Prentice-Hall, 4th Edition, 2020.
2. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, Tata Mcgraw-Hill, 2017.
3. Database System Concepts, Silberschatz Korth, McGraw hill, 7th Edition, 2020

Reference (s)

1. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley.
2. Distributed Database Management Systems: A Practical Approach, Saeed K. Rahimi, Frank S. Haug, Willey, 2015.

3. Principles of Transaction Processing, Philip A. Bernstein, Eric Newcomer, 2nd Edition, Elsevier, 2009.
4. Distributed Database Systems, Chhanda Ray, Pearson Education
5. Distributed Database Systems, D. David Arthur Bell, Jane B. Grimson, Addison-Wesley

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any two types of fragmentation
2. Define data directory
3. Define clustered indexing
4. List the 4 properties of Transaction

Understand

1. Explain advantages and disadvantages of Distributed Databases
2. Explain the levels of distributed transparency
3. Illustrate about join queries
4. Explain about B+ trees

Apply

1. Apply fragmentation on any example data and show the results.
2. Illustrate the Commit and Rollback operations of Distributed Transactions
3. Compare various File organizations.

Open Book Exam Questions

Question 1:

Consider a database consisting of a single relation R:

A	B
1	10
2	0

(a) The following two transactions run concurrently on this database:

Line	T1	T2
1	begin transaction;	begin transaction;
2	update R set B = B-10 where A=1;	select sum(B) from R;
3	update R set B = B+10 where A=2;	commit;
4	commit;	

Is it ever possible for T2 to see a value of zero in its output? Explain why or why not.

(b) The following two transactions run concurrently on this database:

Line	T1	T2
1	begin transaction;	begin transaction;
2	insert into R values (3,150)	select sum(B) from R;
3	commit	select sum(B) from R;
4		commit;

Is it ever possible for T2 to see a different value as the output of the select sum(B) from R statements?

Question 2:

1. SELECT DISTINCT name, address FROM Repayment WHERE borrower_id = ?;
2. SELECT * FROM Repayment WHERE borrower_id = ? AND repayment_date > ?;
3. SELECT borrower_id, loanamount FROM Repayment WHERE loanamount BETWEEN ? AND ?;
4. INSERT INTO Request VALUES (?, ?, ?, ?, ?, ?);

Suggest one or more indexes, taking into account of the above. State the indexed attributes for each index, along with the index type (primary or secondary). Argue shortly for your choices. Emphasis is on the suggested indexes supports the SQL commands as effectively as possible.

20CSH13 Programming, Data Structures and Algorithms Using Python**4 0 0 4****Course Outcomes**

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

1. Recall the fundamental Concepts of Python Programming
2. Identify the various data structures in Python
3. Illustrate sorting techniques by using python language
4. Recall the basic algorithmic notations and complexity analysis
5. Differentiate algorithmic approaches for problem solving
6. Experiment exception handling mechanism using Object Oriented paradigm

CO-PO Mapping

COs	PO2	PO3	PO4	PO5
1	2	2	2	2
2	2	2	2	2
3	3	3	3	3
4	3	3	3	3
5	3	3	3	3
6	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-1**12+4 Hours****Basic Python Fundamentals:**

Introduction to programming, algorithms and data structures; Python: variables, operations, control flow - assignments, conditionals, loops, functions Python: types, expressions, strings, lists, and tuples. Python memory model: names, mutable and immutable values; Inductive function definitions: numerical and structural induction.

Python functions: optional arguments, default values Passing functions as arguments Higher order functions on lists: map, filter, and list comprehension.

local, global, nonlocal names Nested functions.

Unit-2**11+4 hours**

Data structures: lists, Dictionaries, Tuples, Sets, stack, queue, heaps

Linked lists: find, insert, delete; Binary search trees: find, insert, delete; Height-balanced binary search trees

Sorting Techniques:

Elementary inductive sorting: selection, Insertion sort In-place sorting, Merge sort, Quicksort, Stable sorting

Disjoint Sets, heaps

Unit-3**12+4 hours**

Basic algorithmic analysis: input size, asymptotic Notation and complexity;

Algorithmic Approaches: Backtracking: N Queens, recording all solutions; Brute Force: Maximum element; Divide and Conquer: Maximum Subarray Sum; Greedy Approach: Huffman Coding Dynamic programming: Longest Common Subsequence, Coin Change Problem;

Back tracking, Branch and Bound

Unit-4**10+3 hours**

Exception Handling: Exception handling, Basic input/output, Handling files, String processing

Object Oriented Programming: Abstract data types, Classes and Python Object; Inheritance in Python Class, Encapsulation, Polymorphism, Data abstraction

Operator Overloading, Regular Expression

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	30	30	--
Understand	35	35	--
Apply	35	35	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Text Books:

1. Martin C. Brown, 1st Python: The Complete Reference, Edition, Publisher: Osborne/McGraw-Hill , 2018
2. Introduction to Algorithms, second edition, T.H.Cormen, C.E.Leiserson, R.L. Rivest, and C.Stein,PHI Pvt. Ltd./ Pearson Education
3. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekaran, University press.

References:

1. Introduction to The Design and Analysis of Algorithms, 3rd Edition, Anany Levitin, Pearson Education, 2017.
2. R. Nageswara Rao, "Core Python Programming", 2nd Edition: DreamTech Press, 2020

Weblink:

[Programming, Data Structures and Algorithms Using Python - Course \(nptel.ac.in\)](https://nptel.ac.in/courses/106-106-001/)

Domain II (Modern Software Engineering)**20CSH21 DevOps****4 0 0 4****Course Outcomes:**

On completion of this course the students are able to:

1. Illustrate the need of Improvement and value of DevOps
2. Outline the Value Stream using DevOps
3. Describe the Organizational Change and transformation
4. Illustrate the Concept and Goal of Accelerate Flow
5. Outline Feedback Loops and its usage
6. Demonstrate the Concept and Goal of Learning

CO-PO Mapping:

COs	P01	P03	P05	P08	P010
1	3	3	3	3	3
2	2	2	2	2	2
3	1	2	1	1	2
4	3	2	2	1	2
5	3	3	3	3	2
6	2	3	2	1	2

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

UNIT I**12+4 Hours**

Introduction to DevOps: Understanding Improvement, The Convergence, History, and Value of DevOps;
Understanding the Value Stream using DevOps: Analyzing the technology Value Stream; The ways of DevOps: Flow, Feedback Loops, Culture of Continual Experimentation and Learning.

UNIT II**11+4 Hours**

Value Stream in DevOps: Concept and Goals of Streams, Picking a Value Stream, Understanding Organizational Change, Enabling Transformation;

UNIT III**12+4 Hours**

Accelerate Flow: Concept and Goal of Accelerate Flow, Continuous Delivery Patterns and Practices, the Deployment Pipeline, Creating Consistency in the Pipeline, Automated Testing, Deployment Strategies;
Amplifying the Feedback Loops: Concept and Goals of Feedback Loops, Creating a Service Reliability Culture, Fast Feedback, Understanding Monitoring, Understanding Complexity

UNIT IV**10+3 Hours**

Learning Acceleration with DevOps: Concept and Goal of Learning, Learning Organizations, Communication, Blameless Culture.

Text Books:

1. Kim, G., Behr, K., and Spafford, G. (2013). The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win. IT Revolution Press
2. Kim, G., Humble, J., Debois, P., and Willis, J. (2016). The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations. IT Revolution Press

Reference Books:

1. Julian Fish, The Practical Guide to Enterprise DevOps and Continuous Delivery

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE Test (%)
Remember	25	25	
Understand	40	30	40
Apply	20	20	30
Analyze	15	20	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Questions**Remember**

- 1) What is DevOps
- 2) Define Value Stream
- 3) What is **Accelerate Flow**

Understand

- 1) Explain about Ways of DevOps
- 2) Explain Picking Value Stream min DevOps
- 3) Describe Feedback Loops

Apply

- 1) Give Some Real Time Applications of DevOps

20CH22 Design Patterns**4 0 0 4****Course Outcome:**

At the end of the course students are able to:

1. Explain the catalogue of design patterns
2. Exemplify the appropriate pattern to solve object-oriented design problems using design patterns
3. Identify design solution using creational patterns
4. Identify structural patterns to solve design problems.
5. Design solutions by using behavioural patterns.
6. Choose a design pattern from the Pattern Community

COs-POs Mapping:

COs	PO2	PO3	PO5
1	3	3	1
2	2	2	1
3	3	3	2
4	2	2	1
5	3	2	2
6	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT - I**10+4 Hrs**

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

UNIT - II**13+3 Hrs**

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns. Structural Pattern Part-I: Adapter, Bridge, Composite.

UNIT-III**11+4 Hrs**

Structural Pattern Part-II: Decorator, Façade, Flyweight, Proxy. Behavioral Patterns Part-I: Chain of Responsibility, Command, Interpreter, Iterator

UNIT-IV**11+4 Hrs**

Behavioral Patterns Part-II: Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns: A Brief History, the Pattern Community an Invitation, A Parting Thought.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	20	20	--
Understand	35	35	--
Apply	25	25	50
Analyze	20	20	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

TEXT BOOK:

1. Erich Gamma, Design Patterns, Pearson Education, 2015

REFERENCE BOOKS:

1. Mark Grand, Pattern's in JAVA Vol-I, Wiley Dream Tech, 2098
2. Mark Grand, JAVA Enterprise Design Patterns Vol-III, Wiley Dream Tech.2001
3. Eric Freeman, Head First Design Patterns, Oreilly-SPD, 2004
4. Alan Shalloway, Design Patterns Explained, Pearson Education, 2004

Remember

1. Define Prototype
2. Define Decorator pattern

Understand

1. List the Related patterns of Observer
2. Define Intent of State Pattern
3. Explain about motivation, Structure, Participants and consequences of Observer pattern
4. Explain about motivation, Structure, Participants and consequences of Mediator pattern

Apply

1. Identify all the Participants for Proxy Pattern.
2. Develop the Motivation, Structure, Collaborations and Implementation of Prototype and Singleton Pattern
3. Develop the Intent, Applicability, Sample code, and Known uses of the Factory Method

Analyze

1. Formulate the benefits of design Patterns to the Young Designers
2. Formulate Pattern community features
3. Analyze the Flyweight pattern in detail

20CSH23 Advanced Software Engineering**4 0 0 4****Course Outcomes:**

1. Explain various system models, their prototyping and specifications
2. Demonstrate the different phases involved in Agile models
3. Outline and understand Various types of System Architectures
4. Outline Object-Oriented Design Process required for software development
5. Utilise the Verification and Validation techniques to software project
6. Interpret various Agile testing Methods

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PSO1
1	3	3	2	2	2
2	3	3	2	2	2
3	3	2	2	2	2
4	2	2	2	2	3
5	2	3	2	2	3
6	2	3	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-1**10+4 Hours**

System Models and Software Prototyping and Specifications: System Models, Software Prototyping and Specifications System models: Context, Behavioural, Data, and Object models, CASE Workbenches; Software Prototyping: Prototyping in the Software Process, Rapid Prototyping Techniques, User Interface Prototyping; Specifications: Formal Specification in the Software Process, Interface Specification, Behavioural Specification, , Agile models, Phases of agile models, When to use the Agile Model?, Advantages and Disadvantages of Agile Method.

Unit-2**10+4 Hours**

Architectural Design: Introduction: System Structuring; Control Models; Modular Decomposition; Domain- Specific Architectures; Distributed Systems Architectures: Multiprocessor Architectures; Client-Server Architectures, Distributed Object Architectures; CORBA (Common Object Request Broker Architecture)

Unit-3**10+3 Hours**

Software Design: Object Oriented Design: Objects and Object Classes, Object-Oriented Design Process, Design Evolution; Real Time Software Design: Systems Design, Real-Time Executives, Monitoring and Control Systems, Data Acquisition Systems; Design with Reuse: Component-Based Development, Application Families

Unit-4**10+4 Hours**

Verification, Validation and Testing: Verification and Validation (V & V): Static and Dynamic V & V, V & V Goals, V & V vs. Debugging, Software Inspections / Reviews, Clean-Room Software Development; Software Testing: Defect Testing, Integration Testing, Interface Testing, Object-Oriented Testing, Testing Workbenches, Agile testing Methods.

Total: 45+15 Hours**Text Books:**

1. J.F.Peters and W. Pedrycz, Software Engineering: An Engineering Approach, 1st edition, John Wiley and Sons, 2000
2. Roger Pressman and Bruce R. Maxim, Software Engineering: A Practitioner's Approach, 8th Edition, McGraw-Hill, 2020
3. Rajesh R V, Becoming an Agile Software Architect: Strategies,

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define software engineering.
2. List different types software myths.

Understand

1. Describe software architecture styles and patterns .
2. Illustrate golden rules for user interface design.

Apply

1. Applying the process of requirement analysis, discuss how the requirements can be collected for a project.
2. Applying debugging strategy fin an error from a code?

Analyze

1. Compare and Contrast software life cycle models.
2. Analyze risk types in the risk management.

Open Book Exam Questions

Assume that 10 errors have been introduced in the requirements model and that each error will be amplified by a factor of 2:1 into design and an addition 20 design errors are introduced and then amplified 1.5:1 into code where an additional 30 errors are introduced. Assume further that all unit testing will find 30 percent of all errors, integration will find 30 percent of the remaining errors, and validation tests will find 50 percent of the remaining errors. No reviews are conducted. How many errors will be released to the field.

Domain III (Security)**20CSH31 Fundamentals of System Security****4 0 0 4****Course Outcomes**

1. Explain the fundamental concepts of computer security
2. Illustrate hacking and defense
3. Choose appropriate confidentiality policies
4. Identify different Secure architecture principles
5. Identify various Web security methods
6. Choose appropriate internet security methods

CO-PO Mapping

COs	PO1	PO2
1	3	1
2	3	3
3	1	2
4	2	3
5	3	2
6	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**Computer System Security Introduction:****11+4 Hours**

Introduction, What is computer security and what to I earn? Sample Attacks, The Marketplace for vulnerabilities, Error 404 Hacking digital India part 1 chase.

Hijacking & Defense: Control Hijacking, More Control Hijacking attacks integer overflow, More Control Hijacking attacks format string vulnerabilities, Defense against Control Hijacking -Platform Defenses, Defense against Control Hijacking - Run-time Defenses, Advanced Control Hijacking attacks.

Unit II**11+4 Hours****Confidentiality Policies:**

Confinement Principle, Detour Unix user IDs process IDs and privileges, More on confinement techniques, System call interposition, Error 404 digital Hacking in India part 2 chase, VM based isolation Confinement principle, Software fault isolation, Rootkits, Intrusion Detection Systems.

Unit III**Secure architecture principles isolation and leas:****11+4 Hours**

Access Control Concepts, Unix and windows access control summary, other issues in access control, Introduction to browser isolation.

Web security landscape: Web security definitions goals and threat models, HTTP content rendering. Browser isolation, Security interface, Cookies frames and frame busting, Major web server threats, Cross site request forgery, Cross site scripting, Defenses and protections against XSS, Finding vulnerabilities, Secure development.

Unit IV**Internet Infrastructure:****12 + 3 Hours**

Basic security problems, Routing security, DNS revisited, Summary of weaknesses of internet security, Link layer connectivity and TCP IP connectivity, Packet filtering firewall, Intrusion detection.

Total: 45+15 Hours

Textbook (s)

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
2. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

Reference (s)

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
2. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2001.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	40	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is security.
2. Define cyber security
3. List any four computer security concepts
4. Define threat
5. Define intrusion

Understand

1. Explain Cryptographic functions
2. Explain the role of Symmetric key cryptography
3. Illustrate hashing techniques
4. Outline the purpose of digital signatures

Apply

1. RSA algorithm with example
2. Digital signature
3. Buila a firewall mechanism to protect laptop

Analyze

1. Compare and contrast RSA and ECC.
2. Distinguish differences between Symmetric and Asymmetric key cryptography.
3. Examine the key sharing techniques in both Symmetric and Asymmetric key cryptography techniques

Evaluate

7. Justify the ECC is best public key cryptosystem than other public key approaches.
8. Explain the importance of IPSec protocol.
9. Explain the importance of I2P protocol

20CSH32 Python Programming for Security**4 0 0 4****Course Outcomes:**

After completion of the course, students can able to:

1. Explain the basic data structures and multithreading in python
2. Outline about Socket Programming
3. Experiment with Client server approach using TCP and UDP.
4. Analyze Network Traffic using python
5. Identify proper Authentication and Authorization.
6. Choose appropriate Password management approach.

COs-POs Mapping

COs	PO ₁	PO ₃	PO ₄
CO ₁	3	2	1
CO ₂	3	2	2
CO ₃	1	1	3
CO ₄	3	1	2
CO ₅	3	1	2
CO ₆	2	1	3

3-Strongly linked|2-Moderately linked| 1-Weakly linked

Unit -1:**11+4 Hours**

Python Introduction: python data structures, functions, classes, inheritance, Managing exceptions, modules and packages, managing dependencies and virtual environment, working with file system, managing threads: multi-threading and concurrency, working with socket.

Unit -2:**10+3 Hours**

Socket Programming: Network Sockets in python, TCP/IP Suite, Implementing a simple TCP client and TCP server, implementing a simple UDP client and UDP server.

Unit-3:**11+4 Hours**

Network Traffic Analysis with Python: Scapy: Capturing and injecting packets, Port-scanning and traceroute, reading, writing and sniffing a pcap files; network monitoring: PySNMP for SNMP, data visualization pygal, matplotlib, graphviz for network monitoring.

Unit-4:**13 + 4 Hours**

Authentication and Authorization: HTTP session management: HTTP session, HTTP cookies, Session-state persistence; User authentication: User registration, authentication and testing; User password management: Password-change workflow, Password storage, configuring password hashing, Password-reset workflow; Authorization: Application-level authorization, enforcing authorization.

Total: 45+15 Hours**Text Books:**

1. José Manuel Ortega (2018). Mastering Python for Networking and Security. Packt Publishing Ltd
2. Dennis Byrne (2021) Full Stack Python Security by Manning Publications Co
3. Chou, E. (2017). Mastering Python Networking. Packt Publishing Ltd.

References:

1. O'Connor, T. J. (2012). Violent Python: A Cookbook for Hackers, Forensic Analysts, Penetration Testers and Security Engineers, Syngress (Elsevier)
2. Sarker, M. F., & Washington, S. (2015). Learning Python Network Programming. Packt Publishing Ltd.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. What are the benefits of Python?
2. What is an Interpreted language?
3. List any four string handling functions

Understand

1. Explain lists and tuples?
2. Differentiate between the two?
3. What are Dict and List comprehensions?

Apply

1. Explain user defined exception
2. Justify multiple inheritance is supported in python?
3. Design a simple GUI page using Tkinter

Open Book Exam Questions

1. Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55,33,12,98.
Then, the output should be:
['34', '67', '55', '33', '12', '98']
('34', '67', '55', '33', '12', '98')
2. A website requires the users to input username and password to register. Write a program to check the validity of password input by users. Following are the criteria for checking the password:
At least 1 letter between [a-z]
At least 1 number between [0-9]
At least 1 letter between [A-Z]
At least 1 character from [\$#@]
Minimum length of transaction password: 6
Maximum length of transaction password: 12
Your program should accept a sequence of comma separated passwords and will check them according to the above criteria. Passwords that match the criteria are to be printed, each separated by a comma.
Example: If the following passwords are given as input to the program:
ABd1234@1,a F1#,2w3E*,2We3345
Then, the output of the program should be:
ABd1234@1

20CSH33 Management of Information Security**4 0 0 4****Course Outcomes:**

After completion of the course, students are able to:

1. Explain the basic requirement of managing security
2. Outline the strategies of planning of security system
3. Define the Security policies.
4. Develop and implement the security programs in an organization
5. Identify a proper framework of security management
6. Define the risk management and ethics of the security management for an organization.

COs-POs Mapping

COs	PO3	PO6	PO7
1	3	1	
2	3	2	3
3	2	2	
4	3	1	2
5	1	1	1
6	1	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT-1**12+4 Hours**

Introduction to ISMS: what is Security and management definition, Principles of information security management; Project management, applying project management to security; Project management tools.

Planning for Security: Introduction, the role of planning; Precursors to planning; Strategic planning; Information security governance; Planning for information security implementation.

UNIT-2**11+3 Hours**

Planning for contingencies: Introduction, Fundamentals and Components of contingency planning.

Information Security Policy: Introduction, Why policy?, EISP; ISSP, SSSP, Guidelines for effective policy.

UNIT-3**12+4 Hours**

Developing the Security Program: Organizing for security: Placing for information security within an organization, Components of the security program; Information security roles and titles; Implementing Security Education, Training and Awareness Programs.

Security Management Models: Blueprints, Frameworks, and Security Models, Access Control Models, Security Architecture, and management Models.

UNIT-4**10+4 Hours**

Risk-Management: Risk management, Identification and assessment, Documenting the Results of Risk Assessment; Risk control strategies, managing risk; Feasibility and cost benefit analysis, Recommended risk control practices.

Laws and Ethics: InfoSec and the Law, Ethics in InfoSec, Professional Organizations and their Codes of Ethics, Organizational Liability and the Need for Counsel, Managing Investigations in the Organization.

Total: 45+15 Hours**Text Book:**

1. Michael E. Whitman and Herbert J. Mattord, Management of Information Security, 6th Edition, Cengage Learning. 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	50	40	--
Apply	10	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. List the various security metrics
2. List advantages of security audit
3. Define Vulnerability.

Understand

1. Explain need of configurations
2. Explain Identification of Digital Evidence,
3. Write about NIST sample metrics
4. Discuss about vulnerability scanning.

Apply

1. Apply any auditing tool to perform security audit.
2. Apply different network scanning tools to collect vulnerable information.

Analyze

1. Analyze log files of IDS&IPS tools to find level of risk

Domain IV (User Interface Design)**20CSH41 Computer Graphics****4 0 0 4****Course Outcomes**

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

1. Demonstrate fundamental concepts of computer graphics and interpret mathematical foundation of computer graphics
2. Examine Filled area primitives , two-dimensional transformations and Viewing pipeline
3. Identify the usage of various clipping algorithms
4. Recall Three-dimensional object representation and Projection
5. Differentiate between 2-D and 3-D transformations and Viewing pipeline
6. Illustrate the Animation Design techniques and hidden surface elimination methods

COs-POs Mapping

COs	PO1	PO2	PO3	PO4
1	3	2	1	1
2	2	3	2	2
3	3	2	2	2
4	3	3	2	2
5	3	2	2	2
6	2	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I:**10+3 Hours****Introduction:** Application of Computer Graphics, raster scan systems, random scan systems, raster scan display processors.**Output primitives :** Points and lines, line drawing algorithms(Bresenham's and DDA Line derivations and algorithms), mid-point circle and ellipse algorithms.**Filled area primitives:** Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms, inside and outside tests.**UNIT II:****12+4 Hours****2-D geometrical transforms:** Basic transformations (translation, scaling, rotation, reflection and shear), matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.**2-D viewing:** The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland -Hodgeman polygon clipping algorithm.**UNIT III:****12+4 Hours****3-D object representation:** Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces.**3-D Geometric transformations and Viewing:** Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3D Viewing pipeline, clipping, projections (Parallel and Perspective).**UNIT IV:****11+4 Hours****Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSPtree methods, area sub-division and octree methods.**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.**Total: 45+15 Hours**

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, –Computer Graphics”, Prentice Hall, New Delhi, 2007
2. Newman W.M. and Sproull R.F., Principles of Interactive Computer Graphics, 2ndEdition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2097

REFERENCE BOOKS:

1. S. Harrington, Computer Graphics, A Programming Approach, MGH Publication, New Delhi, 2094
2. J.D. Foley et. Al, A Fundamental of Computer Graphics, Addition Wesley, London, 2093

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	20	20	--
Understand	35	35	--
Apply	25	25	40
Analyze	20	20	40
Evaluate	--	--	20
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. List the applications of computer graphics
2. Write 2D transformation matrix for translation, rotation and scaling
3. Define parallel projection
4. List the steps to design computer animation

Understand

1. Explain Bresenham’s Line drawing algorithm
2. Explain Sutherland-Hodgeman polygon clipping algorithm
3. Write about Depth sorting visible surface detection method

Apply

1. Draw a circle with center (5,8) and radius 7 units using Midpoint circle generation algorithm
2. Obtain the reflection of a point A(10, 10) with respect to the line $y=x+2$
3. Use Cohen Sutherland clipping algorithm to clip two lines p1p2 and p3p4 with p1(40,15) p2(75,45) p3(70,20) p4(100,10) against window a(50,10) b(80,10) c(80,40) d(50,40).
4. Clip the polygon v1-v6 against the window ABCD. Assume any convenient numerical values for the vertices preserving the information containing the figure. Employ Sutherland-Hodgeman algorithm.

Analyze

1. Compare raster scan and random scan systems
2. Write the functionalities of B-spline curves
3. Test the Bresenham’s line drawing algorithm to draw a line between the points (20,10) and (30,18)
4. Compare and contrast parallel and perspective projection

Open Book Exam

Question 1:

- a) Write a procedure to compute the elements of the matrix for transforming object descriptions from one Cartesian coordinate system to another. The second coordinate system is to be defined with an origin point P_o and a vector V that gives the direction for the positive y-axis of this system
- b) Develop a procedure, based on a back-face detection technique, for identifying all the visible faces of a convex polyhedron that has different-colored surfaces. Assume that the object is defined in a right-handed viewing system with the xy-plane as the viewing surface.

Question 2:

- a) Write a procedure to display a line graph for any input set of data points in any selected area of the screen, with the input data set scaled to fit the selected screen area. Data points are to be displayed as asterisks joined with straight line segments, and the x and y axes are to be labeled

according to input specifications. (Instead of asterisks, small circles or some other symbols could be used to plot the data points.)

- b) Write a routine to visualize a two-dimensional, vector data set using an arrow representation for the vector values. Make all arrows the same length, but display the arrows with different colors to represent the different vector magnitudes

20CSH42 Multimedia Systems**4 0 0 4****Course Outcome:**

1. Explain the different realizations of multimedia tools.
2. Interpret the types of signals.
3. Make use of the Action Scripts to design multimedia systems
4. Illustrate various multimedia applications
5. Categorize various compression techniques.
6. Choose a video compression technique for real time application.

COs - POs Mapping

COs	PO ₃	PO ₄
1	3	2
2	3	3
3	3	2
4	2	2
5	3	2
6	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT-I**12+4 Hours**

Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats

Colour in image and video: colour science, color models in images, colour models in video.

Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI

UNIT - II**11+4 Hours**

Action Script I: ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class.

Action Script II: Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

UNIT - III**11+4 Hours**

Application Development: An OOP Application Framework using Components with Action Script Movie Clip Subclasses.

Multimedia Data Compression: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, and Arithmetic Coding.

UNIT - IV**12+3 Hours**

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG.

Total: 45+15 Hours**TEXT BOOKS:**

1. Fundamentals of Multimedia by Ze-Nian Li and Mark S. Drew PHI/Pearson Education.
2. Essentials ActionScript 2.0, Colin Mook, SPD O, REILLY.

REFERENCES:

1. Digital Multimedia, Nigel Chapman and Jenny Chapman, Wiley-Dreamtech
2. Macromedia Flash MX Professional 2004 Unleashed, Pearson.
3. Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press).

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	45	40	--
Understand	35	30	--
Apply	20	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)**Remember**

1. Define Multimedia.
2. What is Hypermedia?
3. Define Inheritance.
4. Define Video.

Understand

1. Illustrate ActionScript Features
2. Illustrate Object-Oriented ActionScript
3. Formulate overview of interaction diagrams

Apply

1. Choose the best algorithm for data compression.
2. Demonstrate an Authoring script in ActionScript Class
3. Construct a sample Action Script for a small movie.

Analyse

1. Categorise the different Action Script features.
2. Examine the suitability of the different colour schemes applied in the application.

20CSH43 Human Computer Interaction**4 0 0 4****Course Outcomes**

1. Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
2. Interpret typical human-computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Choose an interactive design process and universal design principles to designing HCI systems
4. Make use of HCI design principles, standards and guidelines.
5. Examine and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
6. Categorize and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

COs-POs Mapping

COs	PO2	PO3
1	1	1
2	1	1
3	2	2
4	1	2
5	2	1
6	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**10+5 Hours****Introduction**

Importance of user Interface-definition, importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface-popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user-Interface popularity, characteristics-Principles of user interface.

Unit II**10+3 Hours****Design process**

Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions, Screen Designing:-Design goals-Screen planning and purpose, organizing screen elements, ordering of screen data and content-screen navigation and flow-Visually pleasing composition amount of information-focus and emphasis-presentation information simply and meaningfully-information retrieval on web-statistical graphics-Technological consideration in interface design.

Unit III**12+4 Hours****Windows**

New and Navigation schemes selection of window, selection of devices based and screen based controls, Components-text and messages, Icons and increases-Multimedia, uses problems, choosing colors.

Unit IV**13+3 Hours****Software tools &Interaction Devices**

Specification methods, interface-Building Tools, Keyboard and function keys, pointing devices-speech recognition digitization and generation-image and video displays-drivers.

Total: 45+15 Hours**Textbook (s)**

1. Wilbert O Galitz, Wiley Dream Tech, The essential guide to user interface design,3rd Edition,Wiley Computer Publishing, 2007
2. Ben Shneidermann, Designing the user interface, 3rd Edition, Pearson Education Asia, 2008

Reference (s)

1. Alan Dix, Janet Finckay, Gregory, Abowd, Russell Beaulieu, Human Computer Interaction, 4th Edition, Pearson Education, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define Human Computer Interaction.
2. What is the basic goal of Human Computer Interaction?
3. State the long term goal of HCI
4. List the factors HCI designers must consider for User Interface Design

Understand

1. Demonstrate the HCI importance.
2. Extend the Trouble faced by human with Computers.
3. Illustrate Psychological Responses to Poor Design
4. Interpret Human-factor variables used in Comparison of pointing devices.

Apply

1. Identify the amount of Information need to Present in a page.
2. Organize the different Software tool specification methods.
3. Model out the six types interaction tasks properties of Pointing devices

Analyze

1. Distinguish the Focus and Emphasis of visual elements in web page design.
2. Categorize the Formatting of Menus.
3. Analyze organizational structure of Keyboard layouts

7th Semester

Career Path I (Artificial Intelligence & Machine Learning)

20CSC13 Natural Language Processing

3 1 0 3

Course Outcomes

1. Understand the fundamentals & building blocks of Natural Language Processing
2. Understand different text representations & labelling methods
3. Apply different Natural Language models and named entities
4. Understand Recurrent neural network for NLP
5. Make use of GRUs and LSTM models for translation
6. Understand different applications of NLP

CO-PO Mapping:

CO	PO1	PO4	PO12
1	3	2	1
2	3	3	2
3	3	2	2
4	2	3	1
5	3	3	2
6	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

Introduction to NLP:

11+4 Hours

Definition, History, NLP in the real world, Building blocks of language, Approaches to NLP, NLP Pipeline, NLP Challenges, Deep learning in NLP, Morphology fundamentals;

Objectives of NLP, The applications of NLP.

Unit II

Text Representation and Sequence Labelling

11+4 Hours

Basic Vectorization approaches- One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; Distributed universal text and handcrafted feature Representations, Neural language models, N-gram language model
Sequence labeling for POS and Named Entities: POS tagging, Named Entities tagging, hidden markov models, conditional Random Fields Visualizing Embeddings, Viterbi algorithm.

Evaluation of Named Entity Recognition, Markov chains.

Unit III

Deep learning architectures for NLP:

11+4 Hours

RNN for language model, Sequence Labeling and Sequence Classification, Encoder-Decoder with RNNs and Transformers, GRUs and LSTMs for machine translation, Convolutional neural networks for sentence classification.

Transformers as Autoregressive Language Models, Potential Harms from Language Models.

Unit IV

Case Study on NLP:

12 + 3 Hours

sentiment analysis, machine translation, automated speech recognition systems, question-answering based systems, topic modelling, Text Generation and Summarization.

Semantic Role Labeling Lexicons for Sentiment, Affect, and Connotat.

Total: 45+15 Hours

Textbook (s)

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft)
2. Yoav Goldberg. Neural Network Methods for Natural Language Processing
3. Vajjala, Sowmya, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana. Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems. O'Reilly Media, 2020.

Reference (s)

1. Rajesh Arumugam, Rajalingappaa Shanmugamani :Hands-On Natural Language Processing with Python
2. Manning C.,SchützeH ,Foundations of Statistical Natural Language Processing--.(MITPress)
3. Jacob Eisenstein. Natural Language Processing.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	50	40	--
Understand	30	40	--
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. What is Natural language processing.
2. Define purpose of different building blocks of NLP
3. List any two challenges in NLP.

Understand

1. Explain different Basic Vectorization approaches
2. Explain the role of various Named Entities
3. Explain purpose of Viterbi algorithm

Apply

1. Apply various Deep learning models for NLP
2. Make use of RNN for text translation

Analyze

1. Compare and contrast GRUs and LSTMs for machine translation.
2. Distinguish various methods to Convolutional neural networks for sentence classification.

Evaluate

1. Evaluate the statistics of a sentiment analysis
2. Design an automated speech recognition systems

Open book Question:

1. Design a model to analyse a given sentence is negative, positive or neutral for a given dataset.
2. Design and develop a model to translate a text to speech for a given set of statements.

Career Path II (Full Stack Developer)**20CSC23 Web Application Databases****3 1 0 3****Course Outcomes**

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

1. Understand how web-based client-server applications work.
2. Analyze architecture of various web-based applications.
3. Examine the requirements of structured and un-structured data.
4. Identify the structure of modern-day web applications.
5. Identify the use advanced querying techniques to enable faster data transfer.
6. Analyze the security issues in data transfer via the web.

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₇	PO ₁₂
1	3	3	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	1	2
6	3	1	1	1

3–Strongly linked | 2–Moderately linked | 1–Weakly linked

Syllabus**Unit I****12+4 Hours****Overview of Web databases**

Web application Overview: Basic concepts of web, Web database architectures, Web database gateways, Web-database programming: Client-side and server-side web database programming
Database gateways, CGI, Browser extensions

Unit II**11+4 Hours****Structured and unstructured Web databases**

Structured databases: Structured data, Data models, Relational database management systems, MySQL – Introduction, querying, updating and deleting data, Challenges of structured data.
Unstructured databases: Unstructured data and its usages, NoSQL databases, MongoDB- Introduction, querying, updating and deleting data, Challenges of unstructured data- Cassandra, GraphQL
Structured data, unstructured data, Relational database, Document-based database

Unit III**11+4 Hours****Database connections & data operations**

Connecting to database: Native database APIs, Database-independent APIs, Template-driven database access packages, Third-party class libraries.
CRUD operations: Querying web database, User driven querying, writing to web databases – create, delete and update.
JDBC, ODBC, template parsing.

Unit IV**11+3 Hours****Authentication, Authorization and Communication in web services**

Web requests: Structure of web requests, JavaScript Object Notation (JSON), Request methods – GET, POST, PUT, DELETE, response status codes
State management: Session management, cookies, request and response headers.
Security: User authentication, User authorisation, Proxy servers, Digital signatures, Digital certificates, SSL and HTTPS.
Kafka, RabbitMQ

JSON, User authentication and authorisation

Total: 45+15 Hours**Textbook (s)**

1. Web Database Applications with PHP and MySQL, Hugh E. Williams, David Lane, 2nd Edition, O'Reilly, 2004.
2. NoSQL Distilled, Pramod Sadalage, Martin Fowler, 1st Edition, 2012

Reference (s)

1. Getting Started with NoSQL, Gaurav Vaish, Paperback, Packt, 2013.
2. Fundamentals of Database Systems, Elmasri Navathe Pearson Education.
3. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, 8th Edition.
4. Web Application Security, Andrew Hoffman, O'Reilly, 2020.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	10	--
Apply	30	30	40
Analyze	10	20	30
Evaluate	10	20	30
Create	--	--	--
Total (%)	100	100	100

Sample Question(s)**Remember**

1. List various database architecture layers
2. Define structured and unstructured data
3. List various database connections

Understand

1. Explain Data models
2. Explain the difference between structured and unstructured data
3. Illustrate how state management is achieved for web database requests

Apply

1. When the incoming data varies from request to request, storing and querying it appropriately is a critical problem. Apply the concept of databases to solve this problem.
2. Give an example of a scenario that might benefit from a database that supports authorisation.

Analyze

1. Data needs to be secured from various users using authentication. How can this be achieved?
2. Compare various database connection techniques.
3. Analyze the general strategy behind state management and its importance.

Evaluate

1. Assuming the database has recognised an unusual activity, what can it do to protect the data?
2. Describe how to implement authorisation using SSL.

Open Book Exam Questions

1. Data is to be shared among various people of an organization with various roles. Data can be viewed by anyone with proper authentication whereas only people with certain designation can update or delete data. Write an authorization technique that can help achieve this.
2. Consider a messaging application that is built using a NoSQL database:
 - Suggest a good type of NoSQL storage technique that can help improve performance
 - If we use key-value based approach, what are the pitfalls of it?

Career Path III (Cyber Security)**20ITC33 Cloud Security****3 1 0 3****Course Outcomes**

1. Understand core concepts of the cloud computing paradigm
2. Learn about characteristics, advantages and challenges brought by the various models and services in cloud computing.
3. Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based services.
4. Understand security challenges, threats and risks involved in the cloud application
5. Analyze the Security Requirements for the Architecture in cloud services
6. Understand Data Security and best practices involved in securing the cloud.

CO-PO Mapping

CO	PO1	PO2	PO4
1	3	1	1
2	2	2	2
3	2	1	2
4	3	2	2
5	2	3	3
6	3	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**10+4 Hours**

Cloud Computing Fundamentals and Architecture- Understanding and Roots of Cloud Computing, Essential Characteristics, Cloud Reference Architecture, Cloud Service Models: SaaS, PaaS, IaaS, Cloud Deployment Models, Expected Benefits, Forming Clouds with example.

Unit II**12+4 Hours**

Cloud Computing Software Security Fundamentals- Cloud Information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Security Concerns, Risk Tolerance, Legal and Regulatory Issues

Unit III**12+4 Hours**

Cloud Computing Risk Issues and Security Challenges:

The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure, Data, and Access Control, Cloud Service Provider Risks

Security Challenges- Security Policy Implementation, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.

Unit IV**11+3 Hours**

Securing the cloud: Architecture and Data Security

Security Requirements for the Architecture, Security Patterns and Architectural Elements, Cloud Security Architecture, Planning Key Strategies for Secure Operation .

Overview of Data Security in Cloud Computing, Data Encryption: Applications and Limits, Cloud Data Security: Sensitive Data Categorization, Cloud Data Storage, Cloud Lock-in, Key strategies to secure the cloud, Best practices for cloud computing, security monitoring

Total: 45+15 Hours**Textbook (s)**

1. Russell Dean Vines and Ronald L. Krutz, Cloud Security: A Comprehensive Guide To Secure Cloud Computing, Wiley India Pvt Ltd, 2010
2. Vic Winkler (J.R.), Securing The Cloud: Cloud Computing Security Techniques and Tactics, Syngress/Elsevier, 2011

Reference (s)

1. Thomas Erl, Cloud Computing Design Patterns, Prentice Hall, 2015
2. Barrie Sosinsky, Cloud Computing Bible, Wiley India, 2011
3. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Remember

1. Define Cloud Computing.
2. List Cloud Service Models
3. List Cloud Information Security Objectives
4. What is cloud foundry?

Understand

1. Identify Cloud Computing Risk Issues and Security Challenges
2. Explain the Data Security
3. Explain all session management techniques
4. Explain different cloud service models

Apply

1. Demonstrate the process for war file deployment in the cloud.
2. How does Sensitive Data Categorization happens in Cloud?

Analyze

1. Justify your answer which technique is used for Session management.
2. Deploy Security Challenges

20IT010 Social Network Analysis (Elective V)**3 1 0 3****Course Outcomes**

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

1. Acquire Knowledge to analyze Social Networks
2. Model, Aggregate and Represent Knowledge for Semantic Web
3. Use Extraction and Mining tools for Social Networks
4. Apply Reality Mining to Predict Human Behaviors for Social Communities
5. Apply various Algorithms for Evolution and Opinion Mining in Social Networks
6. Write algorithms and systems for expert location in social networks

CO – PO Mapping

COs	PO ₁	PO ₂	PO ₇	PO ₁₂
1	2	2	3	2
2	2	2	3	2
3	2	1	3	3
4	2	1	2	2
5	2	2	3	2
6	2	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****9+3****Hours****Introduction**

Introduction to Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Statistical Properties of Social Networks, Network analysis, Development of Social Network Analysis-Key concepts and measures in network analysis, Discussion networks-Blogs and online communities-Web-based networks

Case Studies of Social Network sites like Facebook-Twitter-Linkedin etc.

Unit II**12+4****Hours****Evolution**

Evolution in Social Networks- Framework, Tracing Smoothly Evolving Communities, Models and Algorithms for Social Influence Analysis, Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing, Link Prediction in Social Networks, Feature based Link Prediction
Neurons & Social Actor-Advanced techniques in Link Prediction

Unit III**12+4****Hours****Mining Communities and Opinion Mining**

Applications of Community Mining Algorithms, Node Classification in Social Networks
Opinion Extraction-Sentiment Classification and Clustering, Temporal Sentiment Analysis-Irony Detection in Opinion Mining-Wish Analysis-Product Review Mining-Review Classification
Tracking Sentiments towards Topics over Time

Unit IV**12+4****Hours****Modelling and Visualization**

Visualizing Online Social Networks, A Taxonomy of Visualizations, Graph Representation-Centrality-Clustering-Node-Edge Diagrams-Visualizing Social Networks with Matrix-Based Representations-Node-Link Diagrams, Hybrid Representations, Modelling and Aggregating Social Network Data, Random Walks and their Applications, Ontological representation of Social Individuals and Relationships.

Use of Hadoop and MapReduce-Gephi

Total: 45+15 Hours**Textbook (s)**

1. Charu C. Aggarwal, Social Network Data Analytics, Springer, 2011
2. Peter Mika, Social Networks and the Semantic Web, Springer, 1st Edition, 2007.

Reference (s)

1. BorkoFurht, Handbook of Social Network Technologies and Applications, Springer, 1st Edition, 2010.
2. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking, Techniques and applications, Springer, 1st Edition, 2011.
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis, Springer, 2010.
4. Ajith Abraham, Aboul Ella Hassanien, VáclavSnášel, Computational Social Network Analysis: Trends, Tools and Research Advances, Springer, 2009.

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Comprehensive Test1 (%)
Remember	35	20	-
Understand	35	30	-
Apply	20	40	70
Analyze	10	10	20
Evaluate	--	-	10
Create	--	-	-
Total (%)	100	100	100

Sample Question (S)

Remember

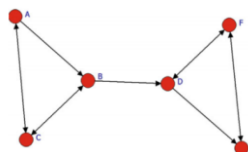
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

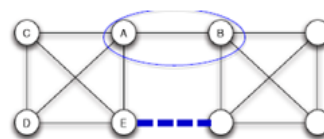
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for expert location in social networks.
6. Outline the models and algorithms for social influence analysis.

Apply

1. Make use of the following graph to solve Degree Centrality, Between-ness Centrality and Cliques.



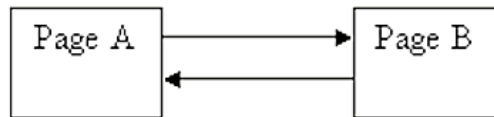
2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using Erdos Reini Model
5. Solve Weak Ties, Traidic closure for the following graph.



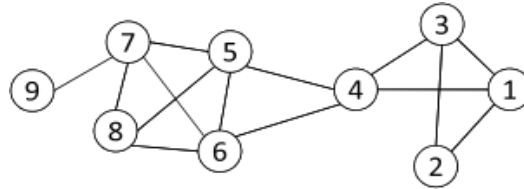
Analyse

1. Compute PageRank for the following figure.

¹Comprehensive test should contain only questions related to Higher Order Thinking (HOT) Skills Pertaining to this course



2. Discover Spectral Clustering steps for the following graph.



3. Examine the ways to visualize community's hubs and node centrality measures using sna package.
4. Analyze positive, moderate and negative feeds using sentiment analysis on twitter data.

Open Book Exam Questions

1. Visualization of team data in Gephi-What should be my considerations?
2. How do we calculate data processing time using cloud analyst?

20CS011 Optimization Techniques (Elective V)**4 0 0 4****Course Outcomes**

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

1. Explain the need of optimization of engineering systems.
2. Formulate and solve linear programming problems.
3. Solve the problems on network models such as transportation and assignment.
4. Analyze the complexity of solutions to an optimization problem.
5. Apply unconstrained optimization and constrained non-linear programming
6. Illustrate about dynamic programming and modern optimization techniques.

CO-PO Mapping

CO	PO11	PO12
1	2	2
2	2	1
3	3	2
4	2	1
5	1	3
6	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11+3 Hours****Introduction to Optimization & Classical Optimization Techniques:**

Engineering Applications of Optimization, Statement of Optimization Problem.

Classical Optimization Techniques: Single variable optimization, multivariable optimization with no constraints, multivariable optimization with equality constraints, multivariable optimization with inequality constraints, convex programming problem.

*Optimization techniques, Engineering Optimization Literature.***Unit II****11 + 4****Hours****Linear Programming & Transportation Problems:**

Applications of Linear Programming, Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – simplex algorithm.

Introduction to Transportation problems, various methods of Transportation problem, Variations in Transportation problem,

*Two phases of simplex method***Unit III****12 + 4****Hours****Assignment Problems & Unconstrained Nonlinear Programming:**

Introduction to Assignment problems, variations in Assignment problems. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

Introduction, Random Search Methods, Grid Search method, Univariate method, Powell's Method, Simplex Method, Gradient of a Function, Steepest descent method. Newton's Method.

*Marquardt Method, Quasi-Newton Methods***Unit IV****11 + 4****Hours****Dynamic Programming & Modern methods of Optimization:**

Multistage decision process, Concept of suboptimization and principle of optimality, computational procedure in dynamic programming, Examples of calculus and tabular method of solutions.

Modern methods of optimization: Genetic Algorithms, particle swarm optimization and Ant colony optimization.

*Simulated Annealing, neural network-based optimization***Total: 45+15 Hours****Textbook (s)**

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice, Wiley, 4th edition, 2009.

Reference (s)

1. Deb K. - Optimization for Engineering Design Algorithms and Examples, PHI - 2000
2. George Bernard Dantzig, Mukund Narain Thapa, Linear programming, Springer series in operations research 3rd edition, 2003.
3. H.A. Taha, Operations Research: An Introduction, 8th Edition, Pearson/Prentice Hall, 2007.
4. Kalyanmoy Deb, Optimization for Engineering Design-Algorithms and Examples, PHI Learning Pvt. Ltd., New Delhi, 2005.
5. Arora J, Introduction to Optimization Design, Elsevier Academic Press, New Delhi, 2004
6. Saravanan R, Manufacturing Optimization through Intelligent Techniques, Taylor & Francis (CRC Press), 2006
7. Hardley G., Linear Programming, Narosa Book Distributors Private Ltd., 2002

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	30	30	--
Understand	30	30	30
Apply	40	40	50
Analyze	--	--	20
Evaluate	--	--	---
Create	--	--	--
Total (%)	100	100	100

Understand

1. Explain about soft computing?
2. Classify supervised learning and unsupervised learning?
3. Summaise the difference between conventional control system and Fuzzy control

Apply

1. Demonstratre the application of Fuzzy logic in Indusrtial manufacturing?
2. Show the differences between Traditional Algorithms and Genetic Algorithm
3. A genetic algorithm is to be used to evolve a binary string of length n containing only 1s. The initial population is a randomly generated set of binary strings of length n. Give a suitable fitness function for this problem.

Analyze

1. If the population size in a genetic algorithm is restricted to 1, what search algorithm does it correspond to? Justify your answer.
2. Consider two fuzzy sets X and Y with the following membership functions: $X = \{(x1/0.4), (x2/0.7), (x3/0.8), (x4/1)\}$ $Y = \{(x1/0.3), (x2/0.6), (x3/0.5), (x4/.9)\}$ Resolve: $X \cup Y, X \cap Y, X - Y, X + Y, X * Y$

Open Book Examination Question

Evaluate

1. Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: $f(x) = (a + b) - (c + d) + (e + f) - (g + h)$ and let the initial population consist of four individuals with the following chromosomes: $x1 = 65413532$ $x2 = 87126601$ $x3 = 23921285$ $x4 = 41852094$. Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last.
2. Suggest a suitable evolutionary computing technique for finding optimized Economic Load Dispatch. Support your answer by providing detailed analysis
3. Consider four travel packages offered by Thomas Cook, Club Mahindra, World around, and Himalaya Travels. We want to choose one. Their costs are INR 100,000, INR 200,000, INR 150,000 and INR 175,000. Their trave time in hours are 1 | 50, 200, 100, and 125 respectively. They are viewed as interesting with degrees 0.4, 0.3, 0.6, 0.5. Define your own fuzzy set of acceptable travel times. Then determine the fuzzy set of interesting travel packages. whose cost and travel times are acceptable and use this set to choose one of your own packages

20CS012 Wireless Adhoc Network (Elective V)**3 1 0 3****Course Outcomes**

1. Understand the various challenging issues of wireless Ad hoc networks
2. Apply the MAC protocols using reservation and scheduling mechanism
3. Apply the routing protocols and transport layer protocol using various TCS mechanism in wireless Ad hoc networks
4. Understand the issues of MAC and network layer solution to provide quality of service
5. Understand the significances of various battery management schemes for wireless Ad hoc networks
6. Analyze the security requirements and secure routing in wireless Ad hoc networks

COs-POs Mapping

COs	PO3	PO5	PO6
1	2	3	1
2	3	2	2
3	3	3	2
4	2	3	1
5	1	3	1
6	2	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I**11+4 Hours**

Wireless Ad Hoc Networks: Introduction, Properties, applications, limitations, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet. **MAC Protocols:** Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms.
Contention - Based MAC Protocols with Scheduling Mechanisms

UNIT II**12+4 Hours**

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Proactive/ Table-Driven Routing Protocols, Reactive/ On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power - Aware Routing Protocols. **Transport Layer:** Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks.
Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT III**11+3 Hours**

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. **Energy Management:** Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes.
System Power Management Schemes.

UNIT IV**11+4 Hours**

Security Protocols: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, Location Discovery.

Quality of a Sensor Network, Evolving Standards, Other Issues

Total: 45+15 Hours**Textbook (s)**

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press

Reference(s)

1. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
2. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,First ed. Pearson Education

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE (%)
Remember	40	50	20
Understand	35	30	20
Apply	25	20	60
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. Find out the major significance of cellular wireless networks and Ad hoc wireless networks.
2. List few latest application systems of Ad hoc wireless networks.
3. Identify the challenging issues in Ad hoc network configuration and maintenance.
4. Show the proactive steps to solve the hidden terminal problem.
5. List the transmission impediments of wireless channel.
6. List the issues that affect the design deployment and performance of ad hoc wireless system.
7. List the benefits when deployment of a commercial ad hoc wireless networks compared to wired network
8. Write the advantages of hybrid wireless networks.
9. Define Scalability.
10. Write the design goals of MAC protocol for ad- hoc networks.
11. Describe the issues of MAC protocol for ad hoc networks in brief.
12. Show the classifications of MAC protocol.
13. Identify the effects of exposed terminal problem in wireless networks.
14. Relate the advantages of directional antennas of MMAC over MACAW.
15. Name the mechanisms used in MAC layer.

Understand

1. Summarize the issues that affect the deployment and performance of ad hoc wireless system.
2. Outline the benefits when deployment of a commercial ad hoc wireless networks compared to wirednetwork.
3. Compare Ad-hoc Networks and Wireless LAN.
4. Compare the efficiency of the packet queuing mechanism adopted in MACA and MACAW.
5. Relate contention-based protocols with reservation mechanism and contention based protocols withscheduling mechanism by means of packet delivery, reception and acknowledgement ratio.
6. Describe the design strategies of MACAW protocol.
7. Illustrate various steps involved in five phase reservation protocol with its frame format.
8. Compare the differences of Ad hoc on demand Distance vector routing protocol (AODV) and dynamicsequence routing protocol (DSRP).
9. Identify any four reasons that lead to the quick power drain of nodes in mobile ad hoc network.
10. Explain the sensor network architecture with a suitable illustration.

Apply

1. Calculate the maximum achievable data rate over a 9 KHz channel whose signal to noise ratio is 20dB.
2. Think of four scenarios where wireless networks can replace wired networks in order to improve the efficiency of people at their workplace. Briefly describe how in each case a wireless network will fit the role better than a wired network.
3. Determine the transfer time of a 22 KB file with a mobile data network (a) with a transmission rate of 10 Kbps and (b) repeat the same for 802.11 WLAN operating at 2 Mbps. (c) What is the length of the file that WLAN can carry in the time that mobile data service carried a 20 KB file? (d) Whatdo you infer from the answers to the above questions?
4. Assume that in one slot in Bluetooth 256 bits of payload could be transmitted. How many slots are needed if the payload size is (a) 512 bits, (b) 728 bits, and (c) 1,024 bits. Assume that the non-payload portions do not change.

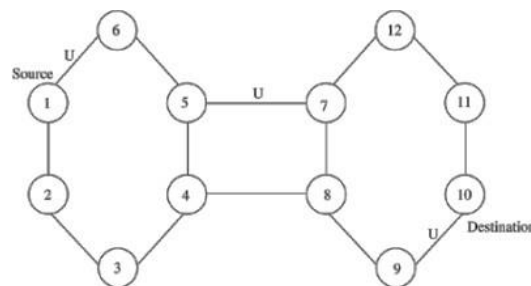
- With reference to the discussion on scatternets, illustrate the trade-off of synchronization and bandwidth using a timing diagram. (Hint: Consider the case when a Bluetooth device acts as a master in one piconet and as a slave in another.)

Analyze

- Discuss the deployment scenarios for various HIPERLAN standards in the ETSI BRAN system.
- Compare the EY-NPMA and the CSMA/CA mechanisms.
- In the serial communications, the baud rate of transmission is specified. Legacy applications on Bluetooth devices specify the baud rate. In the case of the old serial communications, the data rate is the specified baud rate, but in the case of Bluetooth serial communications, it is not so. Why?
- Identify and elaborate some of the important issues in pricing for multi-hop wireless communication.
- Channel quality estimation can be done both at the sender and the receiver. Which is more advantageous? Why?
- Compare an ad hoc network and a cellular network with respect to bandwidth usage and cost effectiveness.
- Compare the pros and cons of using scheduling-based MAC protocols over reservation-based MAC protocols.

Evaluate

- Consider the topology given in below to simulate DSR, SSA, and ABR protocols for path establishment from node 1 to node 10, find the paths found and the ratio of the number of *Route Request* packets sent in the network. (Links labeled "U" refer to unstable ones.)



- Justify whether the LCC algorithm (when run consistently with node degrees or node IDs) give a deterministic result? If so, prove the above fact. Otherwise, give a counter-example.
- Critique on how content-based multicasting (CBM) could be advantageous or disadvantageous as far as the bandwidth utilization of the network is concerned.
- Discuss how network security requirements vary in the following application scenarios of ad hoc wireless networks:
 - Home Network
 - Classroom Network
 - Military Network
 - Emergency Search and Rescue Network
- Discuss how security provisioning in ad hoc wireless networks differs from that in infrastructure-based networks?

20CS014 Green Computing (Elective VI)**3 1 0 3****Course Outcomes**

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

1. Understand green IT with its different dimensions and strategies.
2. Analyze green devices and hardware along with its green software methodologies.
3. Examine the green IT standards for enhancing environmental sustainability.
4. Analyze the various green enterprise activities, functions and their role with IT.
5. Identify the various laws, standards and protocols for regulating green IT.
6. Identify the various key sustainability and green IT trends.

CO – PO Mapping

COs	PO ₆	PO ₇	PO ₈
1	3	3	2
2	3	3	2
3	3	3	2
4	3	3	2
5	3	3	1
6	3	2	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Syllabus**Unit I****11+4 Hours****Fundamentals**

Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green IT, Holistic Approach to Greening IT, Greening IT, Applying IT for enhancing Environmental Sustainability, Green IT Standards and Eco-Labeling of IT.

Enterprise Green IT strategy, Green IT: Burden or Opportunity?

Unit II**11+3 Hours****Green Devices and Hardware with Green Software**

Green Devices and Hardware: Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and measuring software Impact to platform power.

Research the sustainability of paper use in an organization.

Unit III**11+4 Hours****Green Enterprises and the Role of IT**

Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.

Analyze an organization's IT sustainability.

Unit IV**12+4 Hours****Managing and Regulating Green IT**

Introduction, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social media.

Laws, Standards and Protocols : Introduction, The regulatory environment and IT manufacturers, Non regulatory government initiatives, Industry associations and standards bodies.

Green building standards, Green data centers, Social movements and Greenpeace.

Total: 45+15 Hours**Textbook (s)**

1. Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan, Wiley Publication, ISBN:9788126539680,2012.

Reference (s)

1. Foundation of Green IT, Marty Poniatowski, Prentice Hall Publication, ISBN:9780137043750,2009.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	40	--
Understand	30	30	--
Apply	30	30	50
Analyze			50
Evaluate			--
Create	--	--	--
Total (%)	100	100	100

Sample Question (S)**Remember**

1. Define Green IT
2. Define Green Software

Understand

1. Explain the Life Cycle of a Green device or hardware.
2. Illustrate the concept of process re-engineering in a simple way from a green perspective.

Apply

1. Identify the several key standards for process and product of Green IT.
2. Apply ERP system with modules and relationships in any recent trend.

Analyze

1. Analyze and give recommendations on how green strategies can be implemented in Homes to make a greener world. Explain about the same in your perspective.
2. Classify the major categories of information systems within an organization? Provide examples of greening enterprise activities at each level.

Evaluate

1. Recommend with a case study to depict the ways in which a green enterprise transformation (GET) can be applied for a service organization. For the selected service organization, briefly explain the following:
 - i) the practical aspects of a preliminary green IT audit.
 - ii) the green business objectives.
 - iii) a high-level SWOT analysis from a GET perspective.
2. Choose the UML diagrams to present the following models of green information systems:
 - i) use case diagram for "emissions benchmark maintenance".
 - ii) state machine diagram for "class-emission report".

Open Book Exam Questions

1. What is the meaning of Green Computing, gather statistics, or develop a list of ways to practice green computing; now expand the discussion to determine if Green Computing is possible, if it can make a difference, or if it is a marketing term used by large organizations in today's environmentally friendly society.
2. "Green computing or green IT is the study and practice of environmentally sustainable computing or IT"
 - i. In your own words, explain the term Green IT.
 - ii. Summarise the challenges in making Green IT a reality. Consider environmental factors such as political, economic, social, technological, legal and ecological in your answer.
 - iii. Cite 2 examples of success stories on Green IT. Evaluate if the same effort is achievable in your origin country.

20CS015 SOFTWARE PROJECT MANAGEMENT (Elective VI)**3 1 0 3****Course Outcomes**

1. Explain the concepts and issues of Software Project Management
2. Illustrate various Software Architectures
3. Classify Software Risks and Risk Management Strategies
4. Design effective software development model to meet organizational needs
5. Experiment with appropriate methodologies to develop a project schedule
6. Experiment with appropriate techniques to assess ongoing project performance

CO-PO Mapping

COs	PO3	PO5	PO6	PSO2
1	1	1	2	1
2	2	2	2	2
3	1	1	1	3
4	3	3	1	2
5	3	3	1	3
6	3	3	1	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**12+4 Hours**

Conventional Software Management: The Waterfall Model, Conventional Software Management Performance.
Transition: The principles of conventional software Engineering, Principles of Modern software management, transitioning to an iterative process.

Evolution of Software Economics: Software Economics, Software Cost Estimation. **Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.
Software Development Phases, Procedural vs Object Oriented Paradigm.

Unit II**11+4 Hours**

Life Cycle Phases: Engineering and Production Stages, Inception, Elaboration, Construction, Transition Phases.
Artifacts of Software Process: The Artifact Sets, Types of Artifacts.

Software Architectures: A Management Perspective and Technical Perspective,

Workflows of the process: Software Process Workflows, Iteration Workflows.

Off-the-Shelf Components, Requirement Specification Document, Methods of Specification.

Unit III**11+4 Hours**

Checkpoints of the Process: Major Milestones, Minor Milestones, Periodic Status Assessments.

Iterative Process Planning: Work breakdown Structures, Planning Guidelines, Cost and Schedule Estimating process, Iteration Planning Process.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, Evolution of Organizations.

Process Automation: Automation Building Blocks, The Project Environment.

CASE Tools for Requirements Specification, Planning and Estimation, Pragmatic Planning.

Unit IV**11+3 Hours**

Project control and Process Instrumentation: The Seven Core Metrics, Management Indicators, Quality Indicators, Life Cycle Expectations, Pragmatic Software Metrics, Metrics Automation, Tailoring the Process.

Future Software Project Management: Modern Project Profiles, Next Generation Software Economics, The COCOMO Cost Estimation Model: Basic COCOMO

Bugs of testing, Bug tracking tools

Textbook (s)

1. Walker Royce, "Software Project Management – A Unified Framework", 1stEdition, Pearson Education, 2005.
2. Pankaj Jalote, "Software Project Management in Practice", 1stEdition, Pearson Education, 2002.

Reference (s)

1. Bob Hughes, “Mike Cotterell, Rajib Mall, Software Project Management”, 5thEdition, McGraw-Hill Higher Education, 2011.
2. Joel Henry, “Software Project Management”, 1st Edition, Pearson Education, 2004.
3. Norman E. Fenton, Shari Lawrence Pfleeger, “Software Metrics: A Rigorous and Practical Approach “, 1st Edition, PWS Publishing Company, 1997.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	40	30	--
Understand	40	40	--
Apply	20	30	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Software Process
2. List the phases of Software Development.
3. What is an Artifact?
4. What is Process Automation?

Understand

1. Explain various formal methods of specification.
2. Explain COCOMO II Model.
3. Explain Critical Path Methods to schedule a software project.

Apply

1. Identify the amount of Information need to present in a page.
2. Organize the different Software tool specification methods.
3. Assume that the size of an organic type software product has been estimated to be 32,000 lines of source code. Assume that the average salary of software engineers be Rest. 15,000/- per month. Determine the effort required to develop the software product and the nominal development time.

Open Book Questions

1. Calculate the effort and development time for the model related to your mini-project which was developed in previous semester using COCOMO basic cost estimation model. (Take your mini-project size in KLOC)[Apply]
2. Analyze your mini-project with respect to changes using Type 0, Type 1, Type 2, Type 3 & Type 4 categories. [Apply]

20CS016 Soft Computing (Elective VI)**3 1 0 3****Course Outcomes**

1. Identify an appropriate soft computing technique to build an Intelligent Machine
2. Understand supervised learning methods for neural network models for pattern classification and regression problems
3. Demonstrate the use of various Associative Memory Networks
4. Understand unsupervised learning methods for neural network models for storing and pattern classification
5. Determine the solutions of modeled networks using soft computing approaches for a given problem
6. Explain fuzzy logic and Genetic Algorithm to handle uncertainty

COs - POs Mapping

COs	PO ₁	PO ₂	PO ₃	PO ₄	PO ₉
1	3	3	2	2	2
2	2	3	2	2	2
3	2	2	3	3	3
4	3	3	2	2	3
5	3	3	2	2	2
6	3	2	3	3	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11+3 Hours**

Basic elements of Soft Computing: Difference between Hard Computing & Soft Computing - Introduction to Neural Networks - Fuzzy Logic - Genetic Algorithms - Hybrid Systems.

Artificial Neural Networks: Introduction to Artificial Neural Networks - Evolution of Neural Networks - Basic Models of Neural Networks - McCulloch-Pitts Neuron - Hebb Network.

Basics of Artificial Intelligence and Computational Intelligence.

Unit II**11+4 Hours**

Supervised Learning Network: Artificial Neural Networks: Introduction - Perceptron Networks - Back Propagation Network. Radial Basis Function Network.

Associative Memory Networks: Auto-associative Memory Network - Hetero auto-associative Memory Network - Bidirectional Associative Memory (BAM) - Hopfield Networks.

Functional Link Neural Network.

Unit III**11+4 Hours**

Unsupervised Learning Network: Introduction - Fixed Weight Competitive Nets -Kohonen Self-Organizing Feature Maps - Learning Vector Quantization - Counter Propagation Networks – Basic Concepts on Adaptive Resonance Theory Networks (ART-1 & ART-2).

Support Vector Machines and their applications for Classification.

Unit IV**12+4 Hours**

Introduction to Fuzzy Sets: Difference between Classical Sets & Fuzzy Sets – Properties.

Classical Relations and Fuzzy Relations: Cartesian product of Relations - Classical Relations - Fuzzy Relations Membership Functions: Features of Membership Functions -Fuzzification - and Defuzzification

Genetic Algorithm: Basic Concepts on Genetic Operators.

Concepts on Fuzzy Controller and its applications - a Simple Application of Genetic Algorithm for function Optimization.

Total: 45+15 Hours**Textbook (s)**

1. S. N. Sivanandam, S N Deepa, Principles of Soft Computing, 2nd Edition, Wiley India, 2007
2. V. Kecman, Learning and Soft Computing, Pearson Education, India, 2006

Reference(s)

1. J-S R Jung, C-T Sun and E. Mizutani, Neuro Fuzzy and Soft Computing, Pearson Education, India, 2015
2. G. J. Klir and Bo Yuan, Fuzzy sets and Fuzzy Logic, Prentice Hall, USA, 1995
3. D. E. Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley, N.Y, 1989
4. S. Haykins, Neural networks: a comprehensive foundation Pearson Education, India, 2002
5. A. P. Engelbrecht, Computational Intelligence: An Introduction, John Wiley & Sons, 2007.
6. X. Yu and M. Gen, Introduction to Evolutionary Algorithms, Springer Verlag, 2010.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE# (%)
Remember	25	15	--
Understand	35	15	--
Apply	20	20	40
Analyze	20	30	40
Evaluate	--	20	20
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Define Chromosome
2. List two methods in which the information flows in a nervous system
3. List five unsupervised learning algorithms
4. List the difference between classical logic and fuzzy logic
5. List the computational units of ART

Understand

1. Explain the components of Soft Computing
2. Explain the role of activation function in exhibiting the output from a neuron
3. Construct the 5 node pattern {0,1,1,0,1} by Hopfield network and explain the procedure for recalling and storing
4. Explain Adaptive Resonance Theory and its type
5. Explain CPN and illustrate the steps involved in training algorithm of full CPN

Apply

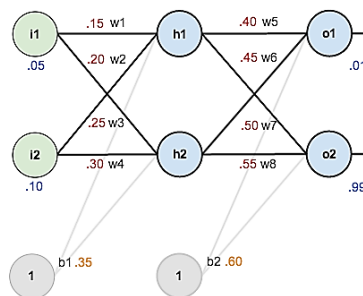
1. Construct a ANN circuit which makes the flow of data using multilayered and multilevel networks
2. Apply clusters of various datasets maintained by learning approach considering live example
3. Draw the neat architecture of hamming network and trace the inhibitory and excitatory neurons by considering an inconsistent vector
4. Find the Max-min and Max Product composition of the fuzzy relation matrices $R=\{0.6,0.3,0.2,0.9\}_{(2 \times 2)}$
 $S=\{1,0.5,0.3,0.8,0.4,0.7\}_{(2 \times 3)}$
5. Find the cardinality for the matrices $R=\{1,4,6,7\}_{(2 \times 2)}$ $S=\{5,2,3,7\}_{(2 \times 2)}$

Analyze

1. Differentiate between learning and training algorithms considering multilayer perceptron network and trace the different types of networks obtained.
2. Differentiate between Counter Propagation Network and Adaptive Resonance Theory

Evaluate

1. Evaluate using Back Propagation algorithm for the below map considering weights , inputs and outputs



2. Evaluate the instance , that the 2 dimensional input vector X is presented to the three-neuron Kohonen network, $x=[0.52 \ 0.12]$. The initial weight vectors, W_j are given by
 $W_1=[0.27, 0.81]$
 $W_2=[0.42, 0.70]$
 $W_3=[0.43, 0.21]$
 in a form of 2 X 1 matrix. Find the winning neuron using the Euclidean distance and apply kernel self-organization map. State the differences between register machines and stack machine?

20CS003 Data Science for Engineering Applications (Open Elective III)**3 1 0 3****Course Outcomes:**

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

1. Understand the fundamentals of data science.
2. Explain how data is collected, managed, and stored for data science.
3. Analyze the data by applying various techniques.
4. Explore data visualization techniques.
5. Explore the technologies for data visualization
6. Investigate several applications in data science.

COs-POs Mapping

CO	PO2	PO3	PO4
1	1	2	2
2	3	2	2
3	3	1	2
4	3	2	2
5	3	2	2
6	2	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit-I: Fundamentals of Data science**11+4 Hours**

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources.

Unit-II: Data analysis**12+4 Hours**

Basics of Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT.

Algorithms: Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Unit-III: Data visualization**11+4 Hours**

Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Unit-IV: Data Science-Applications**11+3 Hours**

Applications of Data Science, Technologies for visualisation, Bokeh (Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Total 45+15 = 60 Hours**Textbook:**

1. Jeffrey S. Saltz, Jeffrey M. Stanton, "An Introduction to Data Science", SAGE Publications, 2018.
2. Anil K. Maheshwari, "Data Analytics Made Accessible", 2015 (Online)
3. Laura Igual, Santi Seguí, "Introduction to Data Science A Python Approach to Concepts, Techniques and Applications", Springer Publications, 2014

Reference(s)

1. Glenn J. Myatt, Wayne P. Johnson: Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, 2nd Edition, Wiley, 2014
2. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination² (%)
Remember	40	30	--
Understand	40	20	--
Apply	20	30	80
Analyze	--	20	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. What is data science.
2. Define purpose of different data visualtion aids
3. List any two steps involved in EDA.

Understand

1. Explain different data representation
2. Explain the role of various data grouping methods
3. Explain purpose of hypothesis testing in detail

Apply

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data nanlysis
3. Examine data with various distribution function

Analyze

1. Comapre and contrast varius data grouping methods.
2. Distinguish various methods to address problems with dummy variables
3. Examine various string handling methods

Evaluate

1. Evaluate the statistics of a given dataset
2. Justify the importance of data skewness
3. Measure data dispersion methods on a dataset

Open Book Exam Questions**Question 1:**

Perform below analysis on a house price prediction dataset.

- a. Univariate Analysis
 - i. Analysis of a numerical feature
 - ii. Analysis of a categorical feature
- b. Bivariate Analysis
 - i. Relationship of a numerical feature with another numerical feature
 - ii. Relationship of a numerical feature with a categorical feature

Question 2:

Perform below analysis on weather prediction dataset.

- a. Correlation Analysis
 - i. Correlation Heat Map
 - ii. Zoomed Heat Map
 - b. Investgation of missing values
 - i. What's missing? to what extent?
 - ii. Visualizing missing values in a dataframe
-

20SIX02 Summer Internship II**0 0 0 1.5****Course Outcomes**

At the end of the summer internship students will be able to

1. Demonstrate communication skills to meet the requirement of industry
2. Develop logical thinking and analytical skills to thrive in competitive examinations
3. Use mathematical concepts to solve technical quizzes
4. Develop technical skills to work out real time problems
5. Develop algorithms for different applications
6. Solve industry defined problems using appropriate programming skills

CO-PO Mapping

COs	PO1	PO2	PO5	PO6	PO10	PO12
C01	-	-	-	-	3	-
C02	3	1	-	-	-	-
C03	3	-	3	-	-	2
C04	3	1	-	-	-	-
C05	3	1	3	3	-	1
C06	3	1	3	-	-	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

20PWX01 Project Work**0 0 16 8****Course Outcomes**

At the end of the project work the students will be able to

1. Identify a contemporary engineering application to serve the society at large
2. Use engineering concepts and computational tools to get the desired solution
3. Justify the assembled/fabricated/developed products intended.
4. Organize documents and present the project report articulating the applications of the concepts and ideas coherently
5. Demonstrate ethical and professional attributes during the project implementation.
6. Execute the project in a collaborative environment.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	-	-	-	3	2	-	-	-	-	-
C02	3	3	-	-	3	-	-	-	-	-	-	-
C03	3	3	3	2	-	-	-	-	-	-	2	-
C04	-	-	-	-	-	-	-	-	-	3	-	2
C05	-	-	-	-	-	-	-	3	-	-	-	-
C06	-	-	-	-	-	-	-	-	3	-	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

8th Semester**20CS017 Fundamentals of Social Networks Analysis (Elective VIII)****0 0 3****Course Outcomes**

1. Explain the fundamental principles of social networking
2. Identify the architectures and challenges in building social networks
3. Interpret the capabilities and limitations of the existing network analysis methods
4. Model the knowledge to analyze real-world networks
5. Demonstrates the knowledge of basic mathematical models used in the analysis of social networks
6. Understand human behaviour in social web and related communities.

CO-PO Mapping

CO	PO2	PO4
1	3	1
2	3	1
3	1	3
4	3	1
5	1	3
6	1	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**10+4 Hours**

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient.

Frequent patterns. Network motifs. Cliques and k-cores.

Unit II**12+4 Hours**

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length.

Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.

Unit III**11+4 Hours**

Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering.

Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems

Unit IV**12+3 Hours**

Predicting human behaviour and privacy issues: Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

Applications of SNA: covert networks , community welfare, collaborative networks, co-citation networks

Total: 45+15 Hours**Textbook (s)**

1. David Easley and John Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press 2010.
2. Stanley Wasserman and Katherine Faust, Social Network Analysis. Methods and Applications, Cambridge University Press, 1994

Reference (s)

1. Matthew O. Jackson, Social and Economic Networks, Princeton University Press, 2010.
2. Eric Kolaczyk, Gabor Csardi, Statistical Analysis of Network Data with R, Springer, 2014.
3. Mark Newman, Networks: An Introduction, Oxford University Press, 2010.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE
Remember	50	40	-
Understand	30	40	-
Apply	20	20	50
Analyze	--	--	50
Evaluate	--	--	-
Create	--	--	-
Total (%)	100	100	100

Remember

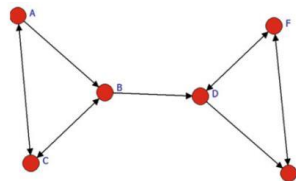
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

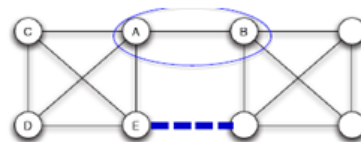
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for expert location in social networks.
6. Outline the models and algorithms for social influence analysis.

Apply

1. Make use of the following graph to solve Degree Centrality, Between-ness Centrality and Cliques.

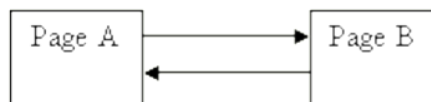


2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using Erdos Reini Model
5. Solve Weak Ties, Traidic closure for the following graph.

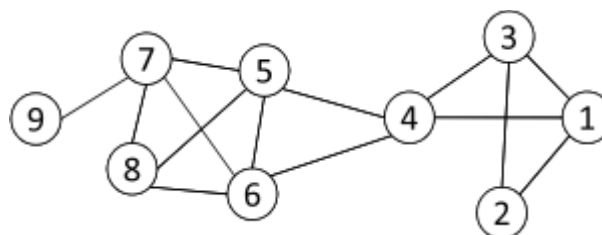


Analyze

1. Compute PageRank for the following figure.



2. Discover Spectral Clustering steps for the following graph.



3. Examine the ways to visualize community’s hubs and node centrality measures using sna package.
4. Analyze positive, moderate and negative feeds using sentiment analysis on twitter data.

20CS018 Information Retrieval Systems (Elective VIII)**0 0 0 3****Course Outcomes**

1. Explain the Objectives of Information Retrieval Systems and its relation to Digital Libraries and Data warehouse
2. Illustrate various System Search Browse and Miscellaneous Capabilities
3. Explain Automatic Indexing, Information Extraction methods
4. Demonstrate Inverted file structures, N-gram data structure, and PAT data structure
5. Interpret Classical techniques of Information Retrieval, and additional techniques employed by Web search engines
6. Learn to develop a small information retrieval system by using user search techniques and text search Algorithms

CO-PO Mapping

COs	PO3	PO6	PO8
1	3	2	2
2	3	2	2
3	2	3	1
4	2	3	1
5	2	3	1
6	3	3	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I**11+4 Hours**

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.

Information Retrieval System Capabilities: Search, Browse, Miscellaneous. *Miscellaneous capabilities.*

Unit II**11+4 Hours**

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction.

Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure. *Signature file structure, Hypertext data structure.*

Unit III**12+3 Hours**

Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters. *Measurement Example-TREC Results.*

Unit IV**11+4 Hours**

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Searching the Internet and hypertext, Information Visualization

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems. *Hardware text search systems*

Textbook (s)

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. <http://nlp.stanford.edu/IR-book/html/htmledition/evaluation-in-information-retrieval-1.html>

Reference (s)

1. Frakes, W.B. and RicardoBaeza Yates, Information Retrieval Data Structures and Algorithms, 1st Edition Prentice Hall, 1992.
2. Robert Korfhage, Information Storage & Retrieval, 1st Edition, John Wiley & Sons, 2005

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	30	30	--
Understand	40	40	--
Apply	10	20	80
Analyze	20	10	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)**Remember**

1. Define measures for IRS
2. Define PAT
3. State Browse capabilities
4. List automatic indexing
5. Recall term clustering algorithms

Understand

1. Explain Functional Overview
2. Explain Stemming algorithms
3. Summarize Brute force algorithms
4. Illustrate S/w text search Algorithms
5. Interpret standard test collection
6. Classify S/w & H/w text search system

Apply

1. Demonstrate Precision
2. Design a hybrid Indexing Data Structure
3. Use stemming Algorithms for IRS

Analyze

1. Analyze s/w and h/w indexing methods
2. Analyze search and Browse capabilities
3. Compare Pat and Stemming algorithms
4. Analyze Term clustering Algorithms

Evaluate

1. Determine Which of the indexing algorithm is efficient
2. Check all automatic indexing methods for its efficiency
3. Compare S/w text search and H/w text search algorithms

20CS019 Fundamentals of DevOps (Elective VIII)**0 0 0 3****Course Outcomes:**

1. Illustrate the need of Improvement and value of DevOps
2. Outline the Value Stream using DevOps
3. Describe the Organizational Change and transformation
4. Illustrate the Concept and Goal of Accelerate Flow
5. Outline Feedback Loops and its usage
6. Demonstrate the Concept and Goal of Learning

CO-PO Mapping:

COs	PO1	PO3	PO5	PO8	PO10
1	3	3	3	3	3
2	2	2	2	2	2
3	1	2	1	1	2
4	3	2	2	1	2
5	3	3	3	3	2
6	2	3	2	1	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I**11+4 Hours**

Introduction to DevOps: Understanding Improvement, The Convergence, History, and Value of DevOps;
Understanding the Value Stream using DevOps: Analyzing the technology Value Stream; The ways of DevOps: Flow, Feedback Loops, Culture of Continual Experimentation and Learning;

UNIT II**11+4 Hours**

Value Stream in DevOps: Concept and Goals of Streams, Picking a Value Stream, Understanding Organizational Change, Enabling Transformation;

UNIT III**12+4 Hours**

Accelerate Flow: Concept and Goal of Accelerate Flow, Continuous Delivery Patterns and Practices, the Deployment Pipeline, Creating Consistency in the Pipeline, Automated Testing, Deployment Strategies;
Amplifying the Feedback Loops: Concept and Goals of Feedback Loops, Creating a Service Reliability Culture, Fast Feedback, Understanding Monitoring, Understanding Complexity

UNIT IV**11+3 Hours**

Learning Acceleration with DevOps: Concept and Goal of Learning, Learning Organizations, Communication, Blameless Culture;

Total: 45+15 Hours**Text Books:**

1. Kim, G., Behr, K., and Spafford, G. (2013). The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win. IT Revolution Press
2. Kim, G., Humble, J., Debois, P., and Willis, J. (2016). The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations. IT Revolution Press

Reference Books:

1. Julian Fish, The Practical Guide to Enterprise DevOps and Continuous Delivery

Internal Marks Assessment:

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	OBE Test (%)
Remember	25	25	
Understand	40	30	40
Apply	20	20	30
Analyze	15	20	30
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample Questions

Remember

- 1) What is DevOps
- 2) Define Value Stream
- 3) What is **Accelerate Flow**

Understand

- 1) Explain about Ways of DevOps
- 2) Explain Picking Value Stream min DevOps
- 3) Describe Feedback Loops

Apply

- 1) Give Some Real Time Applications of DevOps

20CS020 Applications of Artificial Intelligence (Open Elective IV)**0 0 0 3****Course Outcomes**

1. Illustrate the scope of Artificial Intelligence (AI) in gaming and expert systems.
2. Demonstrate various applications of AI related to perception and biometrics.
3. Summarize and learn different case studies in classification and recognition systems.
4. Describe and apply natural language processing techniques for designing AI Bots,
5. Illustrate the role of AI in robotics.
6. Demonstrate the state of AI in solving human labor problems for social equity.

CO-PO Mapping:

COs	PO2	PO3	PO6	PO7
1	3	3	3	1
2	3	3	3	1
3	3	3	2	1
4	2	2	2	2
5	2	1	1	2
6	1	1	1	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit -I**10+4 Hours****AI for Everyone, Gaming and Expert Systems**

AI for Everyone- What is AI? AI Explosion, AI at work, AI at Society, Applications of AI. **Gaming** – Games as search problems- Mini Max Search, Alpha Beta Cutt-Offs, State of the Art Games- Chess & Checkers Problem.

Expert Systems- Representing and using domain knowledge, Expert System Shells, Explanation and Knowledge Acquisition. **Case Study:** MYCIN expert system using AI to identify bacteria causing Infections.

AI in fashion, Ethics and Laws for Holding AI,

Unit -II**11+4 Hours****Perceptions and Biometrics**

Perceptions-Image formation, Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D world, Object recognition from structural information. Using Vision for manipulation and navigation.

Biometrics- Understanding the Biometric fingerprints, facials, voice, iris, palm, and finger vein patterns Identifies Challenges in Biometric Systems. **Case Study I:** Text Classification System **Case Study II:** Face Recognition System.

AI in Health Care, Medical Imaging, Role, Benefits and Tools of AI

Unit -III**12+4 Hours****Natural Language Processing and Natural Language Communication**

Natural Language Processing- Language Models, Text Classification, Information Retrieval and Information Extraction. **Natural Language Communication-** Phrase Structure Grammars, Syntactic Analysis, Augmented Grammars and Semantic Analysis, Machine Translation and Speech Recognition. Case Study: Automatic Speech Recognition System. **Case Study I:** Understand the development and deployment of AI Chat Bots.

Question and Answer Problem, Information extraction and Translation, Corpus,

Unit -IV**12+3 Hours****Robotics and Impact of AI on Human Labor and Social Equity**

Robotics- Robot Hardware- Robot Perception- Planning to Move- Planning Uncertain Movements- Planning Moves- Robotic Software Architectures and Domains. **Impact of AI on Human Labor and Social Equity** - Benefits on this Technological Revolution- Need and Necessity of Labor based Economy and Society- Distribute future assets more equitably-Support for Unemployed.

Future Impacts of AI, Fault Detection, Diagnosis and Optimization.

Total: 45+15 Hours

Text Book (s)

1. Russel and Norvig, Artificial Intelligence A Modern Approach, 4th Edition, Pearson Education 2021.
2. Stevan Finaly, Artificial Intelligence for Everyone, Relativistic Publications, Great Britan,2020.
3. E. Rich K. Knight and B.Nair – Artificial Intelligence– Third Edition – Tata McGraw Hill, 2017.
4. Jerry Kaplan, Artificial Intelligence- What everyone needs to know, Oxford University Press,2016.

Reference (s)

1. Artificial intelligence: a very short introduction; Margaret A. Boden; Oxford University Press; 2018.
2. Artificial Intelligence and Social Work; Milind Tambe, Eric Rice; Cambridge University Press; 2018.
3. Artificial Unintelligence; Meredith Broussard; The MIT Press; 2018.
4. Tom M. Mitchell, –Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam ⁵ (%)
Remember	25	20	-
Understand	35	40	30
Apply	40	40	40
Analyze	-	-	30
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

1. Define AI.
2. List any five AI applications.
3. Define a curve matrix.

Understand

1. What is an Expert System??
2. How perception and biometrics differ w.r.tAI?
3. Explain confusion matrix with an example

Apply

1. Write a program to convert text to speech.
2. Develop a robot using an AI simulating software.
3. Write a program to demonstrate the working of the expert system to trace its decision.

Analyze

1. Implement a fake product monitoring system using biometrics.
2. Develop and Automatic Attendance Monitoring System.
3. Design and AI BOT to pay Snake game between two players.

Open Book Question(s)

1. Mr Neerukonda is a famous real estate agent and always busy with uplift of houses in the nearby villages and small cities. He one day popped with his busy schedule, came into a decision to build a model to predict House prices by taking a coder help called Mr Trevedhi, who was a gem in Artificial Intelligence. Mr Neerukonda, started off by collecting data on the houses in the areas which he is most interested and

nearby too. Assuming that thousands of sample houses data is collected, where each sample contained information on a given house's properties and handed over the details to Mr Trivedhi. Among these properties include the number of bedrooms, number of bathrooms and square footage. Common sense would lead anyone to believe that there is relationship between the number of bedrooms, the number of bathrooms and the square footage of the house. In other words, anyone can easily suspect that the higher the square footage of a house, the more bedrooms, and bathrooms it contains. If the properties are highly correlated, is it necessary that should we have three individuals for the same underlying property in size, do explain and help Mr Trivedhi to resolve this and provide a solution to Mr Neerukondas Query. Apply relevant common-sense reasoning and help Mr Trivedhi to determine which of the variables accounts for the most variance in house price, suggesting him an algorithm for solving the same representing with both procedure and pictorial model.

2. Vamsi and Tirumalesh are two best friends, who does all the activities in parallel either in college or in their room. It might depend on various factors like whether or not these two get free from the college on time and able to leave on time, whether they can reach room before 7 pm in the evening depending upon traffic or whether their roommates have some other activity already scheduled that day; in all the cases, their decision to go out to play a game, tennis with their roommates depends mainly upon the particular day and its endure. If everything is fine, and if they are free from college and reach the room in time and if their roommates doesn't have any other class, may want to go out to the tennis court with them. If they reach on time but already has some other activity scheduled that day, they might want to just relax at room, writing the record. Determine and suggest the best algorithm for solving the same.

20FIX01 Full Semester Internship (FSI)**0 0 0 9****Course Outcomes**

At the end of the Full Semester Internship the students are able to

1. Use the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. Select appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
4. Use ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
5. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
6. 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

COs-POs Mapping:

COs	PO1	PO2	PO5	PO8	PO9	PO10	PSO1	PSO2
C01	3	-	-	-	-	-	3	3
C02	-	3	-	-	-	-	3	3
C03	-	-	3	-	-	-	3	3
C04	-	-	-	3	-	-	-	-
C05	-	-	-	-	3	-	-	-
C06	-	-	-	-	-	3	-	-

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

B. Tech. (Honors)**Domain I (Data Engineering)****20CSH14 Bioinformatics****4 0 0 4****Course Outcomes:**

1. Understand different types of bioinformatics data (gene, protein, disease, etc.), including their biological characteristics and relationships
2. Understand the differences between genomics and proteomics
3. Analyze processed data with the support of analytical and visualization tools
4. Apply advisement, including systems biology, structural bioinformatics and proteomics
5. Understand and analyse how to solve the biological problems using computational approach
6. Understand and analyse internet packages of bioinformatics.

CO-PO Mapping

COs	PO3	PO7	PSO1
1	3	3	1
2	2	2	1
3	1	2	2
4	3	2	2
5	3	3	2
6	2	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT -I**11+3 Hours**

Introduction: Definitions, Sequencing, Biological sequence/structure, Genome Projects, Pattern recognition and prediction, Folding problem, Sequence Analysis, Homology and Analogy.

Protein Information Resources:

Biological databases, Primary sequence databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases.

DNA sequence databases, specialized genomic resources

Unit-II**11+4 Hours****Genome Information Resources: DNA Sequence Analysis:**

Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases

Unit-III**12+4 Hours****Pairwise Alignment Techniques:**

Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, subsequence's, Identity and similarity, The Dot plot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

Multiple Sequence Alignment:

Definition and Goal, the consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching

Unit-IV**11+4 Hours****Secondary Database Searching:**

Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

Analysis Packages:

Analysis package structure, commercial databases, commercial software, comprehensive packages, packages specializing in DNA analysis, Intranet Packages, Internet Packages.

Total: 45 + 15 Hours

Text Books:

1. Introduction to Bioinformatics, by T K Attwood & D J Parry-Smith Addison Wesley Longman, 1999. ISBN: 0-582-32788-1
2. Bioinformatics a Beginner's Guide Paperback, by Jean Michael Claverie, Cerdic Notredame, Wiley India Private Limited, 2003 ISBN-13: 978-8126503803

Reference Books:

1. Introduction to Bioinformatics by Arthur M. Lesk, Third Edition, Oxford University Press, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Examination (%)
Remember	30	30	--
Understand	35	35	--
Apply	35	35	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

Sample question (s)

Remember

1. Which of the tools are used for the identification of motifs?
2. Define Bioinformatics.
3. List the gene in Bioinformatics.

Understand

1. Explain the DNA sequence
2. Differentiate Primary sequence databases and Secondary databases.
3. Explain the Importance and need of secondary database searches.

Apply

1. Make use of Dynamic Programming to Pair wise database searching.
2. Model an Algorithm to Comparing two sequences

Analyze

1. Analysis the various package structures used in DNA structure.

Domain II (Modern Software Engineering)

20CSH24 Robotic Process Automation

4 0 0 4

Course Outcomes

1. Outline the Robotic Process Automation technology
2. Illustrate the usage of Recording and advance UI Interaction
3. Identify UiPath programming techniques to deploy robot configurations
4. Summarize various data extraction techniques and perform integrations with various popular applications
5. Develop a programmed robot that includes logging and exception handling
6. Inspect Deploy and control Bots with UiPath Orchestrator

CO-PO Mapping

COs	PO3	PO7	PSO1
1	3	3	1
2	2	2	1
3	1	2	2
4	3	2	2
5	3	3	2
6	2	3	1

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

11+4 Hours

Introduction to Robotic Process Automation (RPA)

Introduction: What is Robotic Process Automation (RPA), Scope & techniques of Automation, Benefits of RPA, Components of RPA,UiPath Studio, Installation of UiPath Studio, Learning UiPath Studio, **Sequence, Flowchart & Control Flow**: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations
Applications of RPA,RPA platforms

Unit II

11+4 Hours

Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events **Recording and advanced UI Interaction** Basic recording, Desktop recording, Web recording, Citrix, Screen Scraping, When to use OCR, How to use OCR Avoiding typical failure points, **Plugins and Extensions**: Terminal plugin, Java plugin, Java plugin with UiPath Studio, Citrix automation, Citrix environment, Mail plugin, , Web integration, Excel and Word plugins, Credential management Extensions
Types of OCR available, PDF plugin

Unit III

11+4 Hours

Handling User Events and Assistant Bots: What are assistant bots, Monitoring system event triggers: Hotkey trigger, Mouse trigger, Monitoring image and element triggers, Launching an assistant bot on a keyboard event, **Exception Handling, Debugging, and Logging**: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots Debugging techniques, Setting breakpoints, Slow step, Highlighting, Break, Collecting crash dumps: Enabling crash dumps, Disabling crash dumps, Error reporting: Enterprise Edition customers, Community Edition users.
Exception Handling, System trigger

Unit IV

12 + 3 Hours

Managing and Maintaining the Code: Project organization, Picking an appropriate layout for each workflow, Breaking the process into smaller parts, Using exception handling, Making your workflow readable, Keeping it clean, Nesting workflows, Reusability of workflows, Templates, Commenting techniques, State Machine, When to use Flowcharts State Machines or Sequences.
Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots,Activating and uploading a license to Orchestrator, Publishing and managing updates, Packages, Managing packages
Reusability of workflows, License management

Total: 45+15 Hours

Textbook (s)

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: OReilly Publishing, 2018, ISBN: 9781788470940.
2. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

Reference (s)

1. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, 1st Edition, Consulting Opportunity Holdings LLC, 2018
3. <https://www.uipath.com/rpa/robotic-process-automation>
4. <https://www.udemy.com/robotic-process-automation>

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Test (%)
Remember	40	40	--
Understand	30	40	--
Apply	30	20	50
Analyze	--	--	50
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List any four application of RPA
2. Define Control flow
3. List RPA platforms

Understand

2. Explain Data manipulation with suitable example
3. Explain the Control flow for Decision making
4. Illustrate the techniques of Automation

Apply

1. How to use OCR Avoiding typical failure points
2. Give some real-world applications of Recotding and Advance UI
3. Create how to Launching an assistant bot on a keyboard event,

Domain III (Security)

20CSH34 Computer Forensics

4 0 0 4

Course Outcomes

1. Understand the real time computer forensic issue.
2. Understand data recovery, forensics lab certification and physical requirements.
3. Identify different storage formats for data acquisition.
4. Analyze various data acquisition tools for collecting digital evidence.
5. Apply various strategies to secure digital evidences.
6. Identify and apply various computer forensics tools to solve the computer forensic cases.

CO-PO Mapping:

COs	PO2	PO3	PO5
1	1	1	2
2	2	1	2
3	2	1	2
4	2	2	2
5	2	2	3
6	2	2	3

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

UNIT I

11+4 Hours

Computer Forensics and Investigations & Investor’s Office and Laboratory

Understanding Computer Forensics, Preparing for Computer Investigations, Taking A Systematic Approach, Procedure for Corporate High-Tech Investigations, Understanding Data Recovery Workstations and Software, Understanding Forensics Lab Certification Requirements, Determining the Physical Requirements for a Computer Forensics Lab, Selecting a Basic Forensic Workstation.

Nature and scope of cybercrime-categories of cybercrime, social engineering

UNIT II

11+4 Hours

Data Acquisition& Processing Crime and Incident Scenes

Understanding Storage Formats for Digital Evidence, Determining the Best Acquisition Method, Contingency Planning for Image Acquisitions, Using Acquisition Tools, Validating Data Acquisition, Performing RAID Data Acquisition, Using Remote Network Acquisition Tools, Using Other Forensics Acquisition Tools.

Open source data acquisition tools

UNIT III

12+3 Hours

Digital Evidence

Identifying Digital Evidence, Collecting the Evidence in Private-Sector Incident Scenes, Processing law, Enforcement Crime Scenes, Preparing for a Search, Securing a Computer Incident or Crime Scene, Sizing Digital evidence at the Scene, Storing Digital evidence, obtaining a Digital Hash.

Selecting a basic forensic work station, methodologies to store digital evidence

UNIT IV

11+4 Hours

Current Computer Forensics Tools

Evaluating Computer Forensics Toll Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.; Computer Forensics Analysis and Validation: Determining What Data to Collect and Analyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing Remote Acquisition.

Digital evidence handling procedures, Linux system forensics, windows system forensics

Total: 45+15 Hours

Textbook (s)

1. Nelson, Phillips Eninger, Steuart, Computer Forensics and Investigations, Cengage Learning, 4th Edition, 2009
2. Man Young Rhee, Internet Security: Cryptographic Principles, Algorithms and Protocols, Wiley Publications, 2003

Reference (s)

1. John R. Vacca, Computer Forensics, Cengage Learning, 2005
2. MarjieT. Britz, Computer Forensics and Cyber Crime: An Introduction, 3rdEd, Prentice Hall, 2013

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test4 (%)
Remember	30	20	-
Understand	35	30	-
Apply	30	30	-
Analyze	15	20	50
Evaluate	--	--	50
Create	--	--	-
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. List the various disk storage formats
2. List some digital evidences
3. List some tools used for digital evidences
4. List different type of compression methods.

Understand

1. Explain RAID Data Acquisition
2. Explain Identification of Digital Evidence,
3. Write about Locating and Recovering Graphics
4. Discuss about Mobile Device Forensics

Apply

1. Apply any different digital forensics tool to create OS image.
2. Apply different networking tools to collect evidences.

Analyze

1. Compare different digital forensic open-source tools to select a suitable tool which identifies hidden data.

Evaluate

1. Evaluate the performance of dd and dfcldd LINUX commands
2. Evaluate the performance of Widows based tools when compared with LINUX

Create

1. Use any open-source tool to create ISO image of a disk

Domain IV (User Interface Design)

20CSH44 MOBILE PROGRAMMING

4 0 0 4

Course outcomes:

1. Understand the basic concepts and principles in Mobile Computing
2. Demonstrate the use of various frameworks of Mobile Programming
3. Understand the basic OS architecture and building Applications
4. Explain the Mobile application frameworks and handling the Power Management
5. Apply the Augmented Reality for Mobile Applications
6. Understand the security issues in Mobile Applications

COs-POs Mapping

COs	PO3	PO4
1	1	1
2	1	1
3	2	2
4	1	2
5	2	1
6	2	2

3-Strongly linked | 2-Moderately linked | 1-Weakly linked

Unit I

11+4 Hours

Introduction to Mobile Devices:

Mobile vs. desktop devices and architecture -Power Management-Screen resolution -Touch interfaces - Application deployment -App Store, Google Play, Windows Store -Development environments-XCode- Eclipse - VS2012-PhoneGAP-Native vs. web applications

HTML5/JS/CSS3

Quick recap of technologies -Mobile-specific enhancements -Browser- detection-Touch interfaces - Geolocation - Screen Orientation-Mobile browser “interpretations”(Chrome/Safari/Gecko/IE)- Case studies.

Unit II

12+3 Hours

Mobile OS Architecture

Comparing and Contrasting architectures of all three – Android, iOS and Windows-Underlying OS (Darwin vs. Linux vs. Win 8) -Kernel structure and native level programming -Runtime (Objective-C vs. Dalvik vsWinRT) - Approaches to power management - Security

Android/iOS/Win 8 Survival and basic

Building Application(iOS, Window, Android).- App structure, built-in Controls, file access, basic graphics Android/iOS/Win8 inbuilt APP- DB access, network access, contacts/photos

Unit III

11+4 Hours

Underneath the frameworks:

Native level programming on Android -Low-level programming on (jailbroken) iOS-Windows low level APIs

Power Management:

Wake locks and assertions -Low-level OS support -Writing power-smart applications

Unit IV

11+4 Hours

Augmented Reality (AR) and Mobile Security:

Web and AR-User interface-Mobile AR-evaluation of AR- standardization-GPS-Accelerometer - Camera -Mobile malware -Device protections - Mobile Security - overview of the current mobile threat landscape-An assessment of your current mobile security solution- complete analysis of your current risks- Recommendations on how to secure your company’s mobile devices from advanced threats and targeted attacks

Total: 45+15 Hours**Text Book(s):**

1. Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK3 for Dummies,Wiley, 2011.

Reference Books

1. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.
2. Brian Fling, Mobile Design and Development O'Reilly Media,2009
3. Maximiliano Firtman, Programming the Mobile Web, O'Reilly Media, 2010.
4. Christian Crumlish and Erin Malone, Designing Social Interfaces, O'Reilly Media, 2009

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test4 (%)
Remember	30	20	-
Understand	35	30	-
Apply	30	30	-
Analyze	15	20	50
Evaluate	--	--	50
Create	--	--	-
Total (%)	100	100	100

Remember

1. Why XML is used for frontend development in Android?
2. What's Activity in Android?
3. Define AR.

Understand

1. Explain the components of the Android Application?
2. Explain the working structure of Android App.
3. Illustrated the Service in android?
4. Explain the various security issues of Mobile Programming.

Apply

1. Utilize the Android Kernel structure for your program.
2. Select the best language among HTML5/JS/CSS3 to design mobile applications and give the benefits.

Analyse

1. Examine the various current mobile security solutions.