Academic Regulations, Curriculum and Syllabi 2021

B. Tech. CSE Specialization
Artificial Intelligence & Data Science

(Duration of Study: 4 years)

GMRIT
Training Tomorrow's Engineers Today

GMR Institute of Technology
Rajam, Andhra Pradesh
(An Autonomous Institute Affiliated to JNTU-GV Vizianagaram, AP)
NBA Accredited and NAAC Accredited

Academic Rules and Regulations

2021

Undergraduate Programs

GMR Institute of Technology
Rajam 532 127, AndhraPradesh
(An Autonomous Institute, Affiliated to JNTU-GV, Vizianagaram, 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 preferred department of learning for students and teachers alike, with a commitment towards Academics & Research, serving the students in an atmosphere of innovation, critical thinking and making them Industry ready.

Department Mission

M1. To provide adaptable education in a collaborative and innovative environment in skilling the graduates to solve real world problems in the field of Computer Science and Engineering.

M2. To prepare the students as critical thinking professionals with multidisciplinary research orientation and Innovation.

M3. To instil ethical values and nurture the graduates who will be able to contribute to society.

Program Educational Objectives

PEO1: Apply logical and analytical skills in solving complex real-world engineering problems in the areas of computer Science and allied fields

PEO2: Adaptable to emerging technologies with enhanced professional skills and ability towards continuous learning, facilitating higher studies and research

PEO3: Demonstrate professional ethics, leadership qualities and promote inclusive and collaborative growth with human values towards societal interest

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: Implement Principles of Computer Science focusing on the concepts of Artificial Intelligence, Data Science and Machine Learning in developing solutions to the real world problems. (Program Specific)

PSO2: Facilitate Data Driven decision making using Intelligent Systems for process analyzing and visualization in various domains. (Program Specific)

GMR Institute of Technology
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Department of CSE-AI&DS

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

S.no.	Course Code	Course Name	POs	L	T	P	C
First Semester							
1	21HSX01	Communicative English	1,9,10,11,12	2	-	-	2
2	21MAX01	Engineering Mathematics I	1,2,3,4,12	3	-	-	3
3	21PYX01 21CYX01	Engineering Physics / Engineering Chemistry	1,2,12 / 1,2,6,7,12	3/3	-	-	3/3
4	21BEX01 21BEX06	Basics of Engineering / IT Workshop	1,3,6,7,9,11, 12/1,12	3/ -	-	-/ 3	3/1.5
5	21BEX02	Problem Solving and Programming Skills	1,2,3,12	3	-	-	3
6	21BEX03	Problem Solving and Programming Skills Lab	2,3,4,12	-	-	3	1.5
7	21BEX04/ 21BEX05	Engineering Drawing / Engineering Workshop	1,5,10,12/ 1,9,10,12	-	-	3/3	1.5/1.5
8	21PYX02/ 21CYX02	Engineering Physics Lab /Engineering Chemistry Lab	4,9,11/1,6,7, 9,12	-	-	3/3	1.5
9	21HSX02/-	Communicative English Lab/-	1,9,10,11,12	-	-	3/-	1.5/-
			Total	**14/11**	-	**12/12**	**20/17**
Second Semester							
1		Language Elective	10,12	2	-	-	2
2	21MAX02	Engineering Mathematics II	1,2,3,4,12	3	-	-	3
3	21CYX01/ 21PYX01	Engineering Chemistry /Engineering Physics	1,2,6,7,12/1, 2,12	3/3	-	-	3/3
4	21BEX01/ 21BEX06	Basics of Engineering/ IT Workshop	1,12/1,12	-/3	-	3/-	1.5/3
5	21BEX07	Python Programming	1,2,3,12	3	-	-	3
6	21BEX08	Python Programming Lab	2,3,4,5,12	-	-	3	1.5
7	21BEX05/ 21BEX04	Engineering Workshop / Engineering Drawing	1,9,10,12/1,5 ,10,12	-	-	3/3	1.5/1.5
8	21CYX02/ 21PYX02	Engineering Chemistry Lab/Engineering Physics Lab	1,6,7,9,12/4, 9,11	-	-	3/3	1.5/1.5
9	-/21HSX02	-/Communicative English Lab	- /1,9,10,11,12	-	-	-/3	-/1.5
			Total	**11/14**	-	**12/12**	**17/20**
Third Semester							
1	21MA304	Probability and Statistics using Python	1,2,4,10,12	3	-	2	4
2	21ML302	Artificial Intelligence	1,2,3, PSO1, PSO2	3	-	-	3
3	21CS303	Data Structures	1,2,3,12, PSO2	3	-	-	3
4	21CS304	Digital Logic Design	1, 2,3,4,5, PSO1	3	-	2	4
5	21DS305	Mathematical Foundation for Computer Science and Data Science	1,2,3,4,12	3	-	-	3
6	21CS306	Object Oriented Programming with JAVA	1,2,3,12, PSO2	3	-	-	3
7	21CS307	Data Structures Lab	1,2,3,4,12, PSO2	-	-	3	1.5
8	21CS308	JAVA Lab	1,2,3,4,10, 12,PSO2	-	-	3	1.5

9	21BEA01	Environmental Studies	1,7	-	-	-	-
10	21ESX01	Employability Skills I	1,2,3,4,5,9,10 ,11, 12	0	-	2	-
11	21HSX11	CC & EC Activities I	6,7, 9,10	-	-	1	-
			Total	**18**	**-**	**13**	**23**

Fourth Semester							
1	21IT304	Database Management Systems	1,2,3,10,12, PSO2	3	-	-	3
2	21IT403	Operating Systems	1,2,12, PSO1, PSO2	3	-	-	3
3	21CS403	Computer Organization and Architecture	1,2,3,12, PSO1	3	-	-	3
4	21CS404	Design and Analysis of Algorithms	1,2,3,12, PSO1	3	-	2	4
5	21DS405	Foundations of Data Science	1,2,4, PSO1, PSO2	3	-	-	3
6	21IT308	Database Management Systems Lab	1,2,3,4,8,10,12, PSO2	-	-	3	1.5
7	21DS407	Foundations of Data Science Lab	3,4,5, PSO1, PSO2	-	-	3	1.5
8	21ESX01	Employability Skills I	1,2,3,4,5,9,10, 11,12	0	-	2	2
9	21HSX11	CC & EC Activities I	6,7, 9,10	-	-	1	1
			Total	**15**	**-**	**11**	**22**
Fifth Semester							
1	21IT405	Web Technologies (Integrated)	1,2,3,5, PSO1, PSO2	3	-	2	4
2	21DS502	Deep Learning for Data Science	1,2,3,4,5, PSO1	3	-	-	3
3	21DS503	Data Analytics &Visualization Techniques (Integrated)	1,2,3,4,5,12, PSO1,PSO2	3	-	2	4
4	21ML504	Computer Networks	1, 2,4,5,7,12, PSO1	3	-	-	3
5		Elective I (Professional Elective)		3	-	-	3
6		Elective II (Open Elective I)		3	-	-	3
7	21DS507	Deep Learning Lab	4,5,8, PSO1, PSO2	-	-	3	1.5
8	21TPX01	Term Paper	1,2,4,5,6,8,9,10, 12, PSO1,PSO2	-	-	3	1.5
9	21ESX02	Employability Skills II	1,2,3,4,5,9,10, 11,12	0	-	2	-
10	21HSX12	CC & EC Activities II	6,7, 9,10	-	-	1	-
11	21SIX01	Summer Internship I	All POs& PSOs	-	-	-	1
			Total	**18**	-	**13**	**24**
Six Semester							
1	21DS601	Optimization Techniques for ML	1,2,4, PSO1,PSO2	3	-	-	3
2	21ML602	Automata Theory and Language Processors	1,2,3,5,12	3	-	-	3
3	21CS603	Software Engineering	1,2,3,5,8,11, PSO1	3	-	-	3
4		Elective III (Professional Elective)		3	-	2	4
5		Elective IV (Open Elective II)		3	-	-	3
6	21DS606	Optimization Techniques for ML Lab	3,4, 5, PSO1,PSO2	-	-	3	1.5
7	21MPX01	Mini Project	All POs& PSOs	-	-	3	1.5

8	21ESX02	Employability Skills II	1,2,3,4,5,9, 10,11,12	0	-	2	2
9	21HSX12	CC & EC Activities II	6,7,9,10	-	-	1	1
10	21ATX01	Environmental Studies	6,7,9,10	-	-	-	-
11	21ATX02	Professional Ethics and Human Values	1,7	-	-	-	-
12	21ATX---	Audit Course	6,7,8,9,10,12	-	-	-	-
			Total	**15**	-	**11**	**22**
Seventh Semester							
1		Elective V (Professional Elective)		3	-	-	3
2		Elective VI (Professional Elective)		3	-	-	3
3		Elective VII (Open Elective III)		3	-	-	3
4	21SIX02	Summer Internship II	All POs& PSOs	-	-	-	1
5	21PWX01	Project Work	All POs& PSOs	-	-	16	8
			Total	**9**	**-**	**16**	**18**
Eighth Semester							
1		Elective VIII (Professional Elective)		-	-	-	3
2		Elective IX (Open Elective IV)		-	-	-	3
3	21FIX01	Full Semester Internship (FSI)	All POs& PSOs	-	-	-	8
			Total	**6**	**-**	**-**	**14**

List of Electives

Language Electives							
No.	**Course Code**	**Course**	**POs**	**Contact Hours**			
				L	**T**	**P**	**C**
1	21HSX03	Advanced Communicative English	10,12	2	-	-	2
2	21HSX04	Communicative German		2	-	-	2
3	21HSX05	Communicative French		2	-	-	2
4	21HSX06	Communicative Japanese		2	-	-	2
5	21HSX07	Communicative Spanish		2	-	-	2
6	21HSX08	Communicative Korean		2	-	-	2
7	21HSX09	Communicative Hindi		2	-	-	2

Elective I							
Career Path I, II, III							
1	**21MLC11**	**Computer Vision & Pattern Recognition**	1,2,3,12, PSO1	3	-	-	3
2	**21CSC21**	**Web Programming Languages (Full Stack Development)**	1,2,3,5, PSO1, PSO2	3	-	-	3
3	**21MLC31**	**Fundamentals of Cloud Computing**	1,2,3,4,5, PSO1, PSO2	3	-	-	3
Non-Career Path (Core Electives)							
4	21CS004	Principles of Programming Languages	1, 2, 3,4, PSO1	3	-	-	3
5	21CS005	Mobile Computing	1,3,8,10,12, PSO2	3	-	-	3
6	21CS006	Distributed Operating Systems	1,2,3,12, PSO1,PSO2	3	-	-	3
7		MOOCs/Honors		3	-	-	3
Elective II: Open Elective I							
1	21CE001	Disaster Management	2, 7	3	-	-	3
2	21EE001	Electrical Installation and Safety Measures	2,3,6,8	3	-	-	3
3	21DS001	Fundamentals of Data Science	1,3 PSO1,PSO2	3	-	-	3
4	21ME001	Fundamentals of Optimization Techniques	1, 2	3	-	-	3
5	21EC001	Sensors for Engineering Applications	1, 2	3	-	-	3
6	21CS001	Fundamentals of Artificial Intelligence **(Except CSE & IT)**	1, 2, 3	3	-	-	3

7	21IT001	Fundamentals of Multimedia	1, 5, 7	3	-	-	3
Elective III							
Career Path I, II, III							
1	**21MLC12**	**Machine Learning for Business Intelligence**	1,2,3,4, PSO1,PSO2	3	-	2	4
2	**21CSC22**	**Web Application Developments Framework (Full Stack Development)**	1,2,3,5, PSO1,PSO2	3	-	2	4
3	**21MLC32**	**Cloud Services using AWS**	1,2,3,4,5, PSO1	3	-	2	4
Non-Career Path (Core Electives)							
4	21CS007	Cloud Computing Essentials	1,3,6,7,8,9	3	-	2	4
5	21CS008	Cryptography and Network Security	1,2,3,6,8,12	3	-	2	4
Elective IV: Open Elective II							
1	21CE002	Air Pollution and Environmental Impact Assessment	6, 7,12	3	-	-	3
2	21EE002	Renewable Energy Sources	2, 7	3	-	-	3
3	21ME002	Principles of Entrepreneurship	1,11	3	-	-	3
4	21EC002	Electronics for Agriculture	1, 2	3	-	-	3
5	21CS002	Fundamentals of Machine Learning	2, 3	3	-	-	3
6	21CH002	Industrial Safety and Hazard Management	2, 6, 7,8	3	-	-	3
7	21IT002	Fundamentals of Cloud Computing	1, 7	3	-	-	3
8	21BS002	Advanced Numerical Techniques	1, 2	3	-	-	3
9	21BS003	Functional Materials and Applications	1, 2	3	-	-	3
Elective V							
Career Path I, II, III							
1	**21MLC13**	**Conversational AI**	1,2,4,12, PSO1	3	-	-	3
2	**21CSC23**	**Web Application Databases (Full Stack Development)**	1,3,5, PSO2	3	-	-	3
3	**21MLC33**	**Cloud Security Essentials**	1,2,3,4,5, PSO1	3	-	-	3
Non-Career Path (Core Electives)							
4	21IT010	Social Network Analysis	1,2,4,5	3	-	-	3
5	21ML001	Human Computer Interaction	1,2, 3,12, PSO1	3	-	-	3
6	21CS012	Wireless Adhoc Networks	1,2,3,6,7,10	3	-	-	3
7		MOOCs/Honors		3	-	-	3
Elective VI							
1	21DS002	Data Visualization with Power BI	1,2,3,4,5,12, PSO1,PSO2	3	-	-	3
2	21CS015	Software Project Management	1,2,3,11,12, PSO2	3	-	-	3
3	21ML003	Reinforcement Learning	1,2,3, PSO1,PSO2	3	-	-	3
4		MOOCs/Honors		3	-	-	3
Elective VII: Open Elective III							
1	21CE003	Solid Waste Management	2,3,12	3	-	-	3
2	21EE003	Fundamentals of Electrical Vehicle Technology	2,3,12	3	-	-	3
3	21ME003	Industrial Engineering and Management	1,11	3	-	-	3
4	21EC003	Interfacing and Programming with Arduino	1,2	3	-	-	3
5	21CS003	Data Science for Engineering Applications	2,3,4	3	-	-	3
6	21CH003	Industrial Ecology for Sustainable Development	2,6,7	3	-	-	3
7	21IT003	Fundamentals of Mobile Computing	1,7	3	-	-	3
8	21BS004	Advanced Materials of Renewable Energy	1,7	3	-	-	3
9	21BS005	Applied Linear Algebra for Engineers	1,12	3	-	-	3

Elective VIII: Professional Elective							
1	21CS018	Information Retrieval Systems	1,2,3,4,10, PSO2	-	-	-	3

2	21CS019	Fundamentals of Devops	1,2,3,11, PS02	-	-	-	3
3	21DS003	Cyber Security	1,3,4,5, PSO1				3
4		MOOCs/Honors		-	-	-	3

Elective IX: Open Elective IV							
1	21CE019	Green Buildings	2,3,4,5,7	-	-	-	3
2	21EE017	Sustainable Energy	1,2,12	-	-	-	3
3	21ME004	Total Quality Management	1,11	-	-	-	3
4	21EC011	Communication Technologies	1,2	-	-	-	3
5	21CS020	Applications of Artificial Intelligence	2,3,6,7	-	-	-	3
6	21CH016	Green Technologies	1,6,7	-	-	-	3
7	21IT015	Human Computer Interaction	1,7	-	-	-	3
8	21BS006	Handling of Industrial Waste and Wastewater	1,7	-	-	-	3

Audit Course							
1	21AT001	Communication Etiquette in Workplaces	-	-	-	-	-
2	21AT002	Contemporary India: Economy, Policy and Society	-	-	-	-	-
3	21AT003	Design The Thinking	-	-	-	-	-
4	21AT004	Ethics and Integrity	-	-	-	-	-
5	21AT005	Indian Heritage and Culture	-	-	-	-	-
6	21AT007	Intellectual Property Rights and Patents	-	-	-	-	-
7	21AT008	Introduction to Journalism	-	-	-	-	-
8	21AT009	Mass Media Communication	-	-	-	-	-
9	21AT010	Science, Technology and Development	-	-	-	-	-
10	21AT011	Social Responsibility	-	-	-	-	-
11	21AT012	The Art of Photography and Film Making	-	-	-	-	-
12	21AT013	Gender Equality for Sustainability	-	-	-	-	-
13	21AT014	Women in Leadership	-	-	-	-	-
14	21AT015	Introduction to Research Methodology	-	-	-	-	-
15	21AT016	Climate Change and Circular Economy	-	-	-	-	-

B. Tech. (Honors)							
Domain I (Data Engineering)							
01	21CSH11	Advanced Data Structures	2,3,4	4	-	-	4
02	21CSH12	Advanced Databases	2,3,4	4	-	-	4
03	21CSH13	Programming, Data Structures and Algorithms Using Python	2,3,4,5	4	-	-	4
04	21CSH14	Bioinformatics	2,3	4	-	-	4
Domain II (Modern Software Engineering)							
01	21CSH21	DevOps	1,3,5,8,10	4	-	-	4
02	21CSH22	Design Patterns	2,3	4	-	-	4
03	21CSH23	Advanced Software Engineering	1,3,4, PSO1	4	-	-	4
04	21CSH24	Robotic Process Automation	3,5, 8, PSO2	4	-	-	4
Domain III (Security)							
01	21CSH31	Computer Systems Security	1,2	4	-	-	4
02	21CSH32	Python Programming for Security	2,3,4	4	-	-	4
03	21CSH33	Management of Information Security	3,6,7	4	-	-	4
04	21CSH34	Computer Forensics	2,3	4	-	-	4
Domain IV (User Interface Design)							
01	21CSH41	Computer Graphics	1,2,3,4	4	-	-	4
02	21CSH42	Multimedia Systems	3,4	4	-	-	4
03	21CSH43	Human Computer Interaction	2,3	4	-	-	4
04	21CSH44	Mobile Programming	3,4	4	-	-	4

B. Tech. (Minors)							
Energy Science & Technology							
01	21CHM11	Foundation of Energy Science and Technology	1,2,3,5,7,12	4	-	-	4
02	21CHM12	Energy Generation from Waste	1,2,3,4,5	4	-	-	4
03	21CHM13	Energy Storage Systems	1,2,3,6,7	4	-	-	4
04	21CHM14	Hydrogen Energy and Fuel Cells	1,2,3,7	4	-	-	4
Nano Science & Technology							
01	21CHM21	Introduction and Characterization of Nano Materials	1,2,3,7	4	-	-	4
02	21CHM22	Carbon Nanostructures and Applications	1,3,4,5	4	-	-	4
03	21CHM23	Energy, Environment & Biomedical Nanotechnology	1,2,3,7	4	-	-	4
04	21CHM24	Industrial Applications of Nano Technology	2,3,5,,7	4	-	-	4
Environmental Engineering							
01	21CEM11	Watershed Management	6,7	4	-	-	4
02	21CEM12	Industrial Pollution Control and Engineering	3,6,7,12	4	-	-	4
03	21CEM13	Solid and Hazardous Waste Management	1,3,6,7	4	-	-	4
04	21CEM14	Ecology and Environmental Assessment	1,3,6,7	4	-	-	4
Artificial Intelligence & Machine Learning							
01	21CSM11	Fundamentals of AI & Machine Learning	1,12	4	-	-	4
02	21CSM12	Feature Engineering for Machine Learning	1,2,3	4	-	-	4
03	21CSM13	Exploratory Data Analytics	1,4	4	-	-	4
04	21CSM14	Foundations of Deep Learning	1,2, 4	4	-	-	4
Cyber Security							
01	21CSM21	Fundamentals of Security	1,2	4	-	-	4
02	21CSM22	Management of Information Security	3,6,7	4	-	-	4
03	21CSM23	Cyber Security	1,3,4	4	-	-	4
04	21CSM24	Fundamentals of Cloud Security	2,3	4	-	-	4
Data Science & Analytics							
01	21CSM31	Data Cleaning	2,3,4	4	-	-	4
02	21CSM32	Data Engineering	1,2,3,4	4	-	-	4
03	21CSM33	Text Analytics	1,2,4	4	-	-	4
04	21CSM34	Social Network and Semantic Analysis	2, 4	4	-	-	4
Computer Systems Programming							
01	21CSM41	Programming Fundamentals	1,2,3	4	-	-	4
02	21CSM41	Data Structures & Algorithms	1,2,3,4	4	-	-	4
03	21CSM41	Fundamentals of Databases	1,4	4	-	-	4
04	21CSM41	Fundamentals of Computer Networks & Operating Systems	1,2,3	4	-	-	4
Digital IC Design							
01	21ECM11	Fundamentals of VLSI Design	1,2,3	4	-	-	4
02	21ECM12	Digital Design using HDL	1,2,3	4	-	-	4
03	21ECM13	FPGA Technology	1,2	4	-	-	4
04	21ECM14	Analog and Mixed Signal Design	1,2	4	-	-	4
Industrial Automation							
01	21ECM21	Microcontrollers and Interfacing	1,2,3	4	-	-	4
02	21ECM22	Sensors and Data Acquisition System	1,2	4	-	-	4
03	21ECM23	Fundamentals of Labview	1,2	4	-	-	4
04	21ECM24	Medical Robotics	1,2,3	4	-	-	4
Communications and Networking							
01	21ECM31	Principles of Communications	1,2	4	-	-	4
02	21ECM32	Coding Theory and Practice	1,2	4	-	-	4
03	21ECM33	Ad-hoc and Wireless Sensor Networks	1,2,3	4	-	-	4
04	21ECM34	Fundamentals of Multimedia Networking	1,2,3	4	-	-	4
Avionics							
01	21ECM41	Principles of Aerodynamics	1,2	4	-	-	4
02	21ECM42	Aircraft Electrical Systems	1,2	4	-	-	4
03	21ECM43	Aircraft Instrument Systems	1,2	4	-	-	4
04	21ECM44	Aircraft Communication and Navigational Systems	1,2	4	-	-	4
Geographic Information System							

01	21ECM51	Sensors and Sensing Technology	1,2	4	-	-	4
02	21ECM52	Geographic Information Systems	1,2	4	-	-	4
03	21ECM53	Digital Image Processing	1,2	4	-	-	4
04	21ECM54	Lidar Systems	1,2	4	-	-	4
Electric Vehicles Technology							
01	21EEM11	Introduction to Electric Vehicles Technologies	2,3	4	-	-	4
02	21EEM12	Electrical Drives and Controllers for Electric Vehicles	2,3	4	-	-	4
03	21EEM13	Charging Technology in Electric Vehicles	2,3	4	-	-	4
04	21EEM14	Computer Vision in Electric Vehicles	2,3	4	-	-	4
Electric Vehicles Technology							
01	21EEM21	Fundamentals of Smart City	2,3	4	-	-	4
02	21EEM22	Smart City Infrastructure	2,3	4	-	-	4
03	21EEM23	Computational Methods for Smart City Management	2,3	4	-	-	4
04	21EEM24	Communication Technologies and Mobility for Smart City	2,3	4	-	-	4
Electric Vehicles Technology							
01	21EEM31	Modelling and Simulations of Industrial Applications	2,3	4	-	-	4
02	21EEM32	Industrial Sensors and Actuators	2,3	4	-	-	4
03	21EEM33	Programmable Logic Controllers	2,3	4	-	-	4
04	21EEM34	Control Design for Industrial Applications	2,3	4	-	-	4
Cloud Application Development							
01	21ITM11	Introduction to Cloud Computing	6, 7, 12	4	-	-	4
02	21ITM12	Introduction to Web Development with HTML, CSS, JavaScript	1, 2, 3, 9, 12	4	-	-	4
03	21ITM13	Developing Cloud Native Applications	5, 8, 10	4	-	-	4
04	21ITM14	Developing Cloud Apps with Node.js and React	5, 8, 10	4	-	-	4
Robotics and Automation							
01	21MEM11	Introduction to Robotics	1,2,3	4	-	-	4
02	21MEM12	Drives and Sensors	1,2,3,4	4	-	-	4
03	21MEM13	Control Systems for Robotics	1,2,3,4	4	-	-	4
04	21MEM14	Machine Learning for Robotics	2,5	4	-	-	4
Industrial Systems Engineering							
01	21MEM21	Industrial Management	1,10,11,12	4	-	-	4
02	21MEM22	Fundamentals of Operations Research	1,2,3,5	4	-	-	4
03	21MEM23	Enterprise Resource Planning	1,2,3,5,11,12	4	-	-	4
04	21MEM24	Production Planning and Control	1,2,3,5,11,12	4	-	-	4

21HSX01 Communicative English

(Common to all B Tech Programmes)

2 0 0 2

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. Understand 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. Chose and use the appropriate vocabulary, phrases in different contexts

COs – POs Mapping

COs	PO1	PO9	PO10	PO11	PO12
l	1	1	3	1	2
2	1	1	3	1	2
3	1	1	3	1	1
4	1	1	3	1	2
5	1	1	3	1	1
6	1	1	3	1	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, 2019

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) MacmillanEducational.
3. Hewings, Martin.*Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
4. Bailey, Stephen. *Academicwriting: 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

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	25	25	
Understand	25	25	
Application	50	50	40
Analysis	-	-	30
Evaluate	-	-	
Create	-	-	30
Total (%)	100	100	100

Sample question (s)

Remember

1. Write plural forms of the following nouns**.**
   i. ox ii. radius
2. Find an adjective form of the following verbs
   i. Interact ii. communicate

Understand

1. What do you understand by skimming and scanning?
2. Differentiate summarizing and paraphrasing.

Apply

1. Construct a dialogue between students about organizing music club activities in their college.
2. Punctuate the following sentences.
   a. does he speak english well
   b. mount everest is the highest peak in the world
   c. rama a son of dasaradha is a great king of ayodhya
3. A) Imagine that you are Jack Ma and you are going to speak to the students of first semester B.Tech. students of GMR Institute of Technology about your life and future course of action. Use the information given in the passage below to create a 3-minute speech. You must answer all the questions in the order as follows:
   a. Identify 8 keywords from the passage below.
   b. Mention minimum 4 headings under which you will organize your speech. Refer to page No. 17 of English All Round to identify the prompts you need. You can also create your own prompts.
   c. Introduce Jack Ma in a single sentence of not more than 12 words.
   d. Refer to page no 39 to use signpost language to write a speech imagining that you are Jack Ma speaking to the students of first semester B.Tech. students of GMR Institute of Technology about your life and future course of action.

1. B) Which title given below is the best in your view? Justify your decision. You may suggest a new title and justify that your choice is better than the given options. (For Open Book Examination and not for semester end examination)

21MAX01 Engineering Mathematics I

(Common to all B. Tech. Programmes)

3 0 0 3

Course Outcomes

1. Find the solution of system of linear equations, eigen values 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	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	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

15 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}, $\sin ax$, $\cos ax$ polynomials in x, $e^{ax}V(x)$, $x^mV(x)$

Problems related to LCR circuits

15 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

15 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

15 Hours

Total: 60 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
3. R. K. Jain, S. R. K.Iyengar, Advanced Engineering Mathematics, 4th Ed., Narosa Publishing House, New Delhi, 2014

Reference (s)

1. B. V. Ramana, Engineering Mathematics, 4th Ed., Tata McGraw Hill, New Delhi, 2009
2. D. S. Chandrashekharaiah, Engineering Mathematics, Volume 1, Prism Publishers, 2010
3. 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
4. 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 (%)	Int. Test 3[1] (%)
Remember	10	10	-
Understand	30	30	25
Apply	60	60	75
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

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

Understand

1. Represent $x^2y + 3y - z$ in powers of $(x - 1)$ using Taylor's theorem.
2. Show that $3y^4z^2\hat{\imath} + 4x^3z^2\hat{\jmath} + 3x^2y^2\hat{k}$ is solenoidal.

Apply

1. Make use of the properties, to compute the sum and the product of the Eigen values of $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 5 & 1 \\ 0 & 0 & 2 \end{pmatrix}$.
2. Solve $(D^3 - 3D^2 + 4)y = e^{2x} + 6 + 80\cos 2x$
3. Gowtham invests a total of Rs. 10,000 in three accounts, one paying 5% interest, another paying 8% interest, and the third paying 9% interest. The annual interest earned on the three investments last year was Rs. 770. The amount invested at 9% was twice the amount invested at 5%. (For Open Book Examination and not for semester end examination)
   a) Express the given data in system of equations. (U/C)
   b) Use the knowledge of matrices to evaluate the amounts invested in three accounts. Justify your method. (An/P)
   c) If the amount invested at 9% was Rs. 200 more than that of the twice the amount invested at 8%. How much amounts would be gowtham invested in this case. (An/P)

21PYX01 Engineering Physics

(Common to all B.Tech. Programmes)

3 0 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	PO_1	PO_2	PO_{12}
1	3	2	1
2	3	2	1
3	3	2	1
4	3	2	1
5	3	2	1
6	3	2	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

17 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 - Polariods - Rayleigh criterion in resolution

14 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

17 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.

12 Hours

Total: 60 Hours

Textbook (s)

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

Reference (s)

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

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Int. Test 3 [i](%)
Remember	40	40	-
Understand	40	40	25
Apply	20	20	75
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

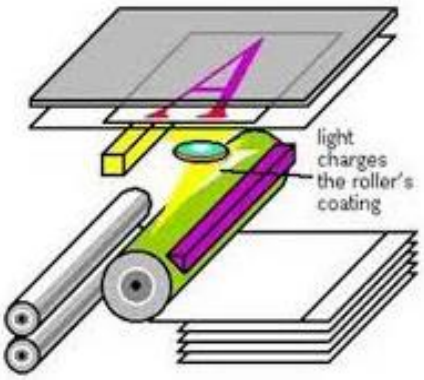
1. Define Principle of Superposition.
2. State Faraday's law of electromagnetic induction and Lenz's law.
3. Recall vector and scalar fields.

Understand

1. Explain the construction and working principle of Nicole's prism.
2. Illustrate Ruby laser and explain its working principle with energy level diagram.
3. Outline fermi dirac distribution function.

Apply

1. Demonstrate any four applications of lasers with reference to their characteristics**.**
2. 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.
3. Calculate electric field intensity due to infinite line of charge by applying Gauss law**)**
4. Electric field just above the surface of the charged drum of a photocopying machine as a magnitude of E = 2.3 x 10^5 N/Coulomb. **(For Open Book Examination and not for semester end examination)**



a) What is the surface charge density on the drum if it is a conductor?
b) Calculate the total charge on the drum if it has a length of 42 cm and diameter of 12 cm.
c) The manufacturer wishes to produce a desktop version of the machine, this requires reducing the size of the drum to a length of 28 cm and diameter of 8 cm. The electric field at the drum surface must remain unchanged. What must be charge on this new drum?

21CYX01 Engineering Chemistry

(Common to all B.Tech. Programmes)

3 0 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	PO2	PO6	PO7	PO12
1	3	1	1	3	1
2	3	1	1	2	1
3	3	1	1	3	1
4	3	1	1	2	1
5	3	1	1	3	1
6	3	1	1	2	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 hydrohy alkanoates (PHA), Poly caprolactum (PCL)

Molecular imprinting polymers (MIP)

15 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

15 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

15 Hours

Unit IV

Structure and Bonding Models

Molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2, N_2, 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)

15 Hours

Total: 60 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, 1994

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Int. Test 3[1] (%)
Remember	20	20	-
Understand	60	60	25
Apply	20	20	75
Analyze	-	-	-
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.
3. When a metal X (of reduction potential = 0.337V at 25^0C) is connected to another metal Y (of reduction potential = -0.140V at 25^0C) and this structure is exposed continuously to sea water, which type of corrosion would take place? Explain with suitable mechanism
4. Starch is digested by humans as well as animals but cellulose is digested by animals only. (For Open Book Examination and not for semester end examination)
   a) Draw and identify the differences in structures of starch and cellulose
   b) Comment on the bio-degradability of them, giving possible by products if bio degradable
   c) Is it possible to make plates with starch so that they can be eaten too at the end? What precautions should be taken while making plates with starch so that they have all the necessary properties like cellulose plate?
   d) List few suitable/bio-compatible/edible ingredients to such a 'starch' plate
   e) What would be the situation if humans were given the ability to digest cellulose as well, by God?

21BEX01 Basics of Engineering

(Common to all B.Tech. Programmes)

3 0 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	PO3	PO6	PO7	PO9	PO11	PO12
1	3	2	1	1	1	1	1
2	3	2	1	1	1	1	1
3	3	2	1	1	1	1	1
4	3	2	1	1	1	1	1
5	3	2	1	1	1	1	1
6	3	2	1	1	1	1	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)

15 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

15 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.

15 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

15 Hours

Total: 60 Hours

Textbook(s):

1. G. Shanmugam and M.S. Palanichamy, Basic Civil and Mechanical Engineering, 3rd Ed., Tata. McGraw. Hill Publishing Co., New Delhi, 2000.
2. Ramamrutham S., Basic Civil Engineering, 3rd Ed., Dhanpat Rai 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, 3rd Ed., 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, 1st Ed., S. Chand & Company Ltd., 2018
9. D. Patranabhis, Sensors and transducers, 2nd Ed., PHI publication, 2013.
10. Principles of Electrical Engineering by V. K. Mehta and Rohit Mehta, S Chand and company Ltd, 5th Edition, 2012
11. 11. Basic Electrical Engineering Theory and Problems by D.P. Kothari and I.J. Nagrath, Prentice Hall, India, 4 th Edition, 2013.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Int. Test 3[1] (%)
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. Lable 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 magmetic sensor.
19. State the purpose of a sensor?
20. List any two applications of a capacitive sensor.
21. Define Slew rate of sensor.

Understand

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. Explan 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 avo9iding 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

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) Simpsons rule.
3. The following figure shows the typical cross section of a Flexible Pavement or Bituminous Pavement:

City A Municipal Corporation intends to use the following cross section detailed in Figure No. 2 for preparation of pavement which is spanning 20 km in length and 14 m wide. Camber slope (transverse slope) provided on top of the pavement surface is 1 in 45. Cost of excavation of Earthwork based on Standard Scheduled Rate (SSR) report prepared by governing body of city is ₹ 252.20/1 m^3. Traditional Materials that can be used in flexible pavement construction include: Bitumen (Viscous substance), Granular Soil, Binders (limited use only), Crushed Stone and Bricks. Amount of traffic expected to ply on the road surface after it is finished and open to service is 30 commercial vehicles/4 hours. Each commercial vehicle is approximately weighing 8 tonnes to 12 tonnes. Flexible pavement is expected to serve 7.50 msa (million standard axle) load repetitions throughout its 15 years (design life or minimum serviceability life). 1 standard axle is equal to 80 kN. Alternative road construction forms: Plain Cement Concrete (PCC), Reinforced Cement Concrete (RCC). Alternative road construction materials: Dressed Stone Blocks (Igneous Type), Pre-casted Paver Blocks (with Concrete), Plastic Lamina.

a) Calculate the cross-section area of the pavement in m^2 if pavement sections are constructed:
   - To preserve economy
   - To use abundant materials
   - To use average quantity of resources
b) Calculate the following details based on traffic data provided:
   - Earliest time of failure of pavement (in years)
   - Time gap between earliest failure of pavement and design life (in years)
c) What is the cost incurred in excavation of earth work for preparing road cross section, for a mentioned length; if cross section is prepared with abundant pavement material resources?
d) Apex council of city A have relaxed the choice of materials used in pavement construction w. r. t. traditional materials; what are the different materials that you suggest for each layer of the pavement among alternative materials mentioned in question statement. Justify your preferences made for each layer of the pavement.

Mention significant pavement damage causing elements other than traffic plying on it. Create a pavement design strategy (in the form of flow chart) which can be tested in laboratory before it is implemented in form of full-scale construction. **(For Open Book Examination and not for semester end examination)**

21BEX02 Problem Solving and Programming Skills

(Common to all B.Tech. Programmes)

3 0 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	PO2	PO3	PO12
1	3	2	2	2
2	3	2	2	2
3	3	2	2	2
4	3	2	2	2
5	2	2	2	2
6	2	2	2	2

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

19 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*

15 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

14 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.

12 Hours

Total: 60 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 (%)	Assignment Test [5] (%)
Remember	25	20	-
Understand	35	40	25
Apply	40	40	75
Analyze	-	-	-
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
4. Compare structure and union
5. Differentiate logical and relational operators
6. Distinguish between Recursive and non-recursive functions

In a class of 50 students of 30 boys and 20 girls, develop programs that help a teacher to

a) to enroll their names to a particular course according to an alphabetical order

b) different ways to form a team of 17 students for coding sessions that consists of 7 boys and 10 girls

c) wants to know the no. of groups in which the students are grouped according to their length of names

d) wants students to form 2 groups: a palindromic group and a non-palindromic group

21BEX03 Problem Solving and Programming Skills Lab

(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	PO2	PO3	PO4	PO12
1	2	2	3	2
2	2	2	3	2
3	2	2	3	2
4	2	2	3	2
5	2	2	3	2
6	2	2	3	2

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<=R<=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<=H<=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>=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 19 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>=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 pthFactor 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 ≤ n ≤ 1015
    - 1 ≤ p ≤ 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 = 3rd 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 = 1st 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
    aabba aa bb a

aabba 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

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

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 $0 \le i < h$) 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
bbba bbb a
abba bb a a
acaa a aa c
aaac aaa 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 ∈ {01}.
1 ≤ |binString| ≤ 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
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.

List of Augmented Experiments

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, 2019

21HSX02 Communicative English Lab

(Common to all B Tech Programmes)

0 0 3 1.5

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. Understand 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. Chose and use the appropriate vocabulary, phrases in different contexts

COs – POs Mapping

COs	PO1	PO9	PO10	PO11	PO12
l	1	1	3	1	2
2	1	1	3	1	2
3	1	1	3	1	1
4	1	1	3	1	2
5	1	1	3	1	1
6	1	1	3	1	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:
Silent letters, Plural markers and past tense markers **(1) session**

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 Experiments

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, 1981
6. K. Mohan and M. Raman, Effective English Communication, 1st Ed., Tata McGraHills, 2000
7. R. K. Bansal and J. B. Harrison, Spoken English, 3rd Ed., Orient Black Swan, Hyderabad, 1983

21BEX04 Engineering Drawing

(Common to all B.Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Apply the Principles of engineering drawing for the construction of various geometric shapes
2. Construct various curves which include ellipse, parabola and hyperbola
3. Develop Orthographic projections of Points, Lines and Planes
4. Develop 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

CO	PO1	PO5	PO10	PO12
1	3	-	3	3
2	3	-	3	3
3	3	-	3	3
4	3	3	3	3
5	3	3	3	3
6	3	3	3	3

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 Experiments

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)

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

21BEX05 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 prototypes using carpentry practice
3. Develop simple house hold items using sheet metal
4. Develop different mild steel joints using Fitting practice
5. Understand simple house wiring circuits
6. Create various prototypes using the basic principles of all workshop trades

COs – POs Mapping

CO	PO1	PO9	PO10	PO12
1	3	2	2	2
2	3	3	2	2
3	3	3	2	2
4	3	3	2	2
5	3	3	2	2
6	3	3	2	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 Experiments

1. Prepare Tee–bridle joint
2. Prepare Corner dovetail joint
3. Make Corner bridge joint
4. Make Dovetail lap joint
5. Prepare 90^0 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 wring
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.

21BEX06 IT Workshop

(Common to all B.Tech. Programmes)

0 0 3 1.5

Course Outcomes

1. Apply knowledge for computer assembling and Operating System installation
2. Understand trouble shooting of various problems of Hardware
3. Construct residential wiring and various types of wiring schemes
4. Demonstrate the working and troubleshooting of various electrical gadgets
5. Understand the applications of various sensors and transducers
6. Demonstrate the working principle of top loaded washing machine

CO-PO Mapping

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

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

List of Experiments

1. Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral.
2. Disassemble and assemble the PC back to working condition.
3. Installation of MS Windows (2010 or Latest Version) on the personal computer.Word Orientation: Introduction to MS Word, Accessing, overview of toolbars, saving files, Using help and resources, rulers, Font, Colors, format painter, creating custom tabs.
4. Creating a Scheduler: Introduction to MS Excel, Gridlines, Format Cells, Summation, auto fill, FormattingText, is creating custom tabs.
5. Creating Power Point Slides: Basic power point utilities and tools, PPT Orientation, Slide Layouts, InsertingText, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Master Layouts,Types of views.
6. Interactive Presentations: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts, Rehearsals.
   Two lamps control using two 2-way switches: Design of electrical circuit to control two lamps connected in series and parallel using two two-way switches.
7. Wiring of living room: Development of socket connections consisting one-way and two-way switches forliving room.
8. Tube-light wiring: To do the installation and connection of tub-light wiring.
9. Electrical wiring circuit incorporated with fuse cut-out, energy meter and main switch.
10. Godown wiring: Preparing a godown wiring circuit with PVC conduit system.
11. Resistance, Current and Voltage Measurements using Digital Multimeter.
12. Temperature measurement using thermocouple sensors and understand the working principle of relay.
13. Detection of smoke using smoke sensor and measuring the speed of DC motor using Speed sensor.
14. Distance measurement using Linear Voltage Differential Transducer.
15. Identification of Fault detection in top loaded / front loaded washing machine

Reference Books

1. Faithe Wempen & Rosemary Hattersley & Richard Millett & Kate Shoup , Computing fundamentals:digital literacy edition, Wiley, 2014.
2. Clements & Alan, Principles of Computer Hardware, Oxford press, fourth edition,2006.

1PYX02 Engineering Physics Lab

(Common to all B.Tech. Programs)

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	PO9	PO11
1	3	2	2
2	3	2	2
3	3	2	2
4	3	2	2
5	3	2	2
6	3	2	2

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 Experiments

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, GMRIT, Rajam, 2019
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

21CYX02 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	PO1	PO6	PO7	PO9	PO12
1	3	1	3	1	1
2	3	1	3	1	1
3	3	1	3	1	1
4	3	1	2	1	1
5	3	1	3	1	1
6	3	1	3	1	1

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 - ε 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 Experiments

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

21HSX03 Advanced Communicative English

(Language Elective for all B Tech Programmes)

2 0 0 2

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. Understand 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. Chose and use the appropriate vocabulary, phrases in different contexts

COs – POs Mapping

COs	PO1	PO9	PO10	PO11	PO12
l	1	1	3	1	2
2	1	1	3	1	2
3	1	1	3	1	1
4	1	1	3	1	2
5	1	1	3	1	1
6	1	1	3	1	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.

Grammarand Vocabulary: Formal/academic words and phrases; Phrasalprepositions; 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: Hayavadana by Girlish karnad

15 Hours

Unit III

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

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/Resumeand cover letter.

Grammarand **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.

Grammarand 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, 2019.

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) MacmillanEducational.
3. Hewings, Martin.*Cambridge Academic English (B2)*. CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)
4. Bailey, Stephen. *Academicwriting: 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

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test (%)
Remember	25	25	
Understand	25	25	
Application	50	50	40
Analysis	-	-	30
Evaluate	-	-	
Create	-	-	30
Total (%)	100	100	100

Sample question (s)

Remember

1. Write the meanings for the following phrasal verbs**.**
   i. look for ii. Break down
2. Use the following verbs in your own sentences
   i. Assess ii. Instruct

Understand

1. What are the steps that one should follow while preparing a PPT presentation.

2. Discuss the role of body language in group discussion.

Apply

1. Convert the following sentence into passive voice:
   a. The result surprises me. b. People speak English all over the world
2. Correct the following sentence:
   a. the tree is cut by man by an axe. b. he discussed about phonetics at length.
3. Write a formal letter to the Chief District Medical Officer of your district requesting him to utilize the NSS units of colleges to carry out public campaign to help people to stay safe from Covid-19. Use the clues below to write your letter:
   (For Open Book Examination and not for semester end examination)
   a) Stay home
   (b) Face mask
   (c) Sanitizer
   (d) Social distancing
   (e) Wash hands
   (f) Do not shake hands
   (g) Get medical check-ups

21MAX02 Engineering Mathematics II

(Common to all B. Tech. Programmes)

3 0 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	PO2	PO3	PO4	PO12
1	3	3	2	2	1
2	3	2	3	3	1
3	3	3	3	2	1
4	3	2	2	1	1
5	3	3	2	1	1
6	3	3	3	2	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 toordinary differential equations with constant coefficients

Laplace transforms of Periodic functions

15 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

15 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

15 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

15 Hours

Total: 60 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. Iyengar*et.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.Chandrashekharaiah, 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 (%)	Int. Test 3[1] (%)
Remember	10	10	-
Understand	30	30	25
Apply	60	60	75
Analyze	-	-	-
Evaluate	-	-	-
Create	-	-	-
Total (%)	100	100	100

Sample question (s)

Remember

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

Understand

1. Interpret Laplace transform technique $y^{11}-3y^1+2y=e^{3t}$ given $y(0)=1 \ \ and \ y^1(0)=0$.
2. Show that the vector $(x^2-yz)I-(y^2-zx)\,J-(z^2-xy)\,K$ is Irrotational.

Apply

1. Verify Gauss divergence theorem $F=(x^3-yz)I-2x^2y\,J-z\,K$taken over the surface of the cube formed by the planes $x=y=z=a$ and coordinate planes.
2. A tightly stretched string with fixed end points $x=0\ and\ x=l$is initially in a position given by $y=y_0 sin^3\frac{\pi x}{l}$.If it is released from rest from this position, find the displacement $y(x,t)$.
3. Using Laplace transform to evaluate $\int_0^\infty \frac{\cos at-\cos bt}{t}\,dt$
4. Evaluate $f(x)=x^2$as a fourier series in $-\pi<x<\pi$.
5. Examine whether $F=(y^2cosx+z^3)I+(2ysinx-4)J+(3xz^2+2)K$ is a conservative vector field ? If so find the scalar potential?
6. The population of a city grows at a rate proportional to the number of people presently living in the city. After two years, the population has doubled, and after three years the population is twenty thousands.
   a) State the suitable law to construct the differential equation
   b) Apply Transform techniques to solve the equation
   c) Estimate the number of people initially living in the city and interpret your result
   d) Justify the advantage of Laplace transform technique over conventional techniques

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

21BEX07 PYTHON PROGRAMMING

3 0 0 3

Course Outcomes

1. Understand the fundamentals of Python , syntax and semantics
2. Understand the concepts of control flow statements
3. Understand and apply the concepts of strings, dictionaries, sets, list, and tuples.
4. Demonstrate and apply the concepts of Functions and Modules
5. Understand and apply the concepts of searching and sorting
6. Understand exception handling in Python and standard library

CO – PO Mapping

COs	PO1	PO2	PO3	PO12
1	3	2	2	2
2	3	2	2	2
3	3	2	2	2
4	3	2	2	2
5	2	2	2	2
6	2	2	2	2

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

Unit I **16 Hours**

Introduction: History of Python, Need of Python Programming, Running Python Scripts, Identifiers, Statements, Variables, Keywords, Input-Output statements, Indentation, command line arguments

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators-Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Precedence and Associativity

Control Flow Statements: if Statement, if…else Statement, elif Statement, Nested if Statement, while Loop, for Loop, continue and break Statements.

Applications of Python, REPL

Unit II **15 Hours**

Strings: initialization, modifying, concatenation, slicing, formatting and string methods, lists with strings.

Python Data structures:

Lists: Creating Lists, Basic List Operations, List Methods.

Introduction to Tuple: Tuple Operations and methods, Dictionary, dictionary operations and dictionary methods, Sets, set operations.

Comprehension on list, tuple and dictionary

Unit III **15 Hours**

Functions- Defining Functions, Calling Functions, Types of Arguments, Anonymous Functions, Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from. Import statement.

Object Oriented Programming OOP in Python: Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Encapsulation, Inheritance, Polymorphism.

Filters, Lambda function

Unit IV **14 Hours**

Files: Creating files, operations on files (open, close, read, write)

Searching and Sorting: Searching techniques-linear search and binary search. Sorting techniques-bubble sort, selection sort, insertion sort, merge sort.

Exception Handling: Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exception.

Regular Expressions

Total: 60 Hours

Textbook (s)

1. Fundamentals of Python Programming ,Richard L. Halterman 2019
2. Kenneth A. Lambert. "Fundamentals of Python: First Programs", 2nd Edition, Publisher: Cengage Learning 2018 3. Python Programming: A Modern Approach, VamsiKurama, Pearson 2017 Learning Python, Mark Lutz, Orielly, 5th Edition.

Reference(s)

1. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

Internal Assessment Pattern

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

Remember

1. What are the benefits of using Python?
2. What is an Interpreted language?

Understand

1. List any four string handling functions
2. What are lists and tuples? What is the key difference 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

21BEX08 PYTHON PROGRAMMING LABORATORY

0 0 3 1.5

Course Outcomes

1. Understand various programming platforms available for problem solving
2. Understand mathematical and logical methods which improve critical thinking
3. Understand and apply Python programs with conditionals and loops.
4. Understand and develop Python programs step-wise by defining functions and calling them.
5. Understand and apply Python lists, tuples, and dictionaries for representing compound data.
6. Analyze various searching and sorting techniques using python and apply exception handling.

Co-Po Mapping

COs	PO2	PO3	PO4	PO5	PO12
1	2	2	3	3	2
2	2	2	3	3	2
3	2	2	3	3	2
4	2	2	3	3	2
5	2	2	3	3	2
6	2	2	3	3	2

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

List of Experiments

1. a) Write a python program to add two numbers.
   b) Write a python program to print a number is positive/negative using if-else.
   c) Write a python program to find largest number among three numbers.
2. a) Write a python program to check whether the given string is palindrome or not.
   b) Write a python program to check whether the given number is even or odd.
   c) Write a python program using while loop that asks the user for a number and prints a countdown from that number to 0
3. a) Write a python program that takes two numbers as command line arguments and prints its sum.
   b) Write a python program to implement various operators available in python language.
4. a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure
   b) Write a Python function that takes two lists and returns true if they are equal otherwise false
5. a) Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear()
   b) Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len()
6. a) Write a python program to find factorial of a given number using functions
   b) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.
7. a) Write a program to double a given number and add two numbers using lambda()?
   b) Write a program for filter() to filter only even numbers from a given list
8. a) Write a python program to display a particular month of a year using calendar module
   b) Write a program to find sum of two numbers using class and methods.
9. Write a program to read 3 subject marks and display pass or failed using class and object.
10. a) Write a python program to open and write "hello world" into a file?
    b) Write a python program to write the content "hi python programming" for the existing file.
11. Write a python program to compute 5/0 and use try/except to catch the exceptions.
12. Write a python program for binary search to search an item in a sorted list and to return the index of element to be searched in the list.

List of Augmented Experiments

1. Flames Game
2. 2048 Game
3. Automated Trading
4. GUI Applications

21HSX04 Communicative German

(Language Elective for all B Tech Programmes)

2 0 0 2

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) Hobby4) 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 1) How to introduce oneself4) How to talk about the weather5) 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) Greetings2) Etiquettes3) Facts about Germany4) German customs and traditions5) 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

21HSX05 Communicative French

(Language Elective for all B Tech Programmes)

2 0 0 2

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	PO_{10}	PO_{12}
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) Nouns2)Indefinite articles3) Definite articles4) Prepositions5) Negation6) Interrogatives7) Irregular verbs (Present tense) : être8) 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) Days4) Months5) Colours 6) Numbers 0 to 100 (Ordinal, cardinal) 7) Parts of the face and body

15 Hours

Unit-3

Communicative skills: 1) How to greet2) Locating objects and places3) How to ask and answer questions4) How to introduce oneself 5) How to talk about the weather6) 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) Etiquettes3) Facts about France4) French customs and traditions5) 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

21HSX09 Communicative Hindi

(Language Elective for all B Tech Programmes)

2 0 0 2

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: 60hours

Recommended Study material:

1.MeenuKaturia. *Saral Hindi Vyakaran tatha Rachana. Kumar publications Delhi.*
2. N.RajeshRakhade & G.kanaka Durga*. Hindi Speaking course,* Mudra Books. 2014

3rd Semester

21MA304 - Probability and Statistics using Python

3 0 2 4

Course Outcomes:

1. List the basic data structures of Python and 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. Examine given dataset based on descriptive statistics.
5. Compare the null or alternative hypotheses using the suitable test statistic.
6. Choose appropriate curve fitting and correlation methods for a given data

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	1	-	-	-	-	-	2	-	2	-	-
CO2	3	2	-	3	-	-	-	-	-	3	-	2	-	-
CO3	3	2	-	3	-	-	-	-	-	3	-	1	-	-
CO4	3	1	-	3	-	-	-	-	-	3	-	3	-	-
CO5	3	1	-	2	-	-	-	-	-	3	-	1	-	-
CO6	3	1	-	3	-	-	-	-	-	3	-	3	-	-

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

Unit I **12+8 Hours**

Fundamental of Python Programming

Strings, Files, Lists, Dictionaries, Tuples**. Introduction to NumPy:** Creating Numpy Arrays, Numpy Data Objects, dtype, Numerical Operations. Numpy Arrays: Concatenating, Flatten, reshape, adding Dimensions, Vector Stacking,Pandas DataFrame, Accessing and Changing values of DataFrames, Pandas Pivot, groupby **Introduction to Pandas:** Reading and Writing Data in Pandas, Multi-level Indexing, Data Visualization in Pandas

Objects and Classes

Practical Components

1. Experiments on Basic experiments on fundamentals on python

Exploratory Data Analysis using NumPy
Exploratory Data Analysis using Pandas
Exploratory Data Analysis using Matplotlib

Unit II 12+6 **Hours**

Random Variables and Probability Distributions

Introduction to Probability: Events, Axioms of Probability and Probabilities of events; Conditional Probability, Bayes Theorem. Discrete and Continuous random variables; Expectation and Variance, Distribution of a Random Variables: **Discrete and Continuous Distributions**- Bernoulli, Binomial, Poison and Normal Distributions (without proofs); Central Limit Theorem (without proof).

Gaussian distribution

Practical Components

1. Simulation of random experiments and plot the empirical probability of each event, alongside the theoretical probability.

Python script to find conditional probability of a given event.
Simulation of various probability distributions

Unit III **12+10 Hours**

Sampling Theory and Testing of Hypothesis

Sampling: Population and sample, parameter and statistic, standard error. Parameter estimations, Confidence Intervals, Unknown Standard Deviation. **Hypothesis Testing**: Null and alternative hypothesis, level of significance, Type I and Type II errors, one tail and two-tail tests. 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.

One-way ANOVA

Practical Components

1. Python Modules for Descriptive Statistics

Write a python program to perform z-test, t- test for testing the Null hypothesis for single mean
Write a python program to perform z-test, t- test for testing the Null hypothesis for difference of means

Write a python program to 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 **12+8 Hours**

Curve Fitting, Correlation & Regression

Curve Fitting: Introduction-fitting a straight line-second degree curve-exponential curve by method of least squares. **Correlation:** Simple correlation, Karl Pearson's Correlation coefficient and Spearman's rank correlation. Simple regression, multiple regression.

Covariance

Practical Components

1. Develop a straight line curve to fit some real world observations

Develop a exponential curve to fit some real world observations
Explore problems in Correlation with sample data
Explore problems in Regression with sample data

Total: 48+32 **Hours**

Text Books:

1. 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:

1. 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/OBE (%)
Remember	10	10	--
Understand	50	30	--
Apply	40	60	--
Analyze	--	--	--
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	--

SAMPLE QUESTION (S)

Remember

1. Define variable in python.

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

Understand

1. Explain use of probability and statistics in real world.

Illustrate about random variables in python.

Apply

1. Find different real time applications which use Markov process

Implement a queuing theory to handle multiple processes.

21ML302 Artificial Intelligence

3 0 0 3

Course Outcomes

1. Summarize the fundamental concepts of Artificial Intelligence.
2. Understand the control strategies and production systems.
3. Illustrate the Concepts of Heuristic Search Techniques.
4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
5. Make use of concept of Game Playing Algorithms.
6. Outline the concept of Planning System

CO–PO Mapping

CO	PO1	PO2	PO3	PSO1	PSO2
1	2	1	2	2	2
2	2	2	3	3	3
3	3	1	1	3	3
4	2	2	2	3	3
5	1	3	2	3	3
6	1	2	2	3	3

3. Strongly linked | 2-Moderately linked | 1-Weaklylinked

Unit I 12 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 12 Hours

Heuristic Search Techniques

Generate-and-test, Hill climbing, Best-first-search – OR Graphs – A* Algorithm, Problem reduction – AND-ORGraphs – AO* Algorithm, constraint satisfaction - cryptarithmetic problem.

Depth-first search – Breadth-first search- Data abstraction

Unit III 12 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 12 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 : 48 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 Recogonition.
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.

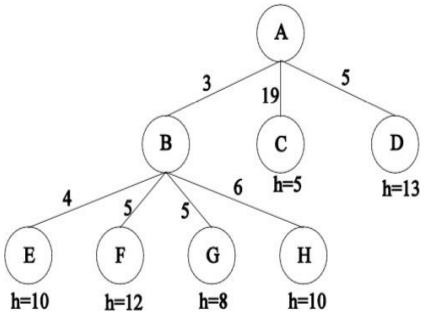
Analyze

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

21CS303 Data Structures

3 0 0 3

Course Outcomes

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

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO12	PSO2
1	3	2	1	2	2
2	3	2	1	2	2
3	3	2	1	2	2
4	3	2	1	1	2
5	3	2	1	2	2
6	3	2	1	2	2

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

Unit I

Linear Data Structures–List **12 Hours**

AbstractDataTypes(ADTs)–ListADT–Array-basedimplementation–Linkedlistimplementation–Singly linked lists- Circularly linked lists- Doubly-linked lists – Applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal) - Searching - Linear Search – BinarySearch

Doubly linked Circular list

Unit II

Linear Data Structures – Stack and Queue **12 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 – Ticketcounter

Circular Queue

Unit III

Sorting, Hashing Techniques and Trees **12 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 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: 48 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 datatypes?
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 andP2

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. Selectappropriatedatastructuretosimulatetheoperationsofa MusicPlayer–Songsinmusic playerarelinkedtopreviousandnextsong.youcanplaysongseitherfromstartingorending of the list.

[3]Open 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 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 in to 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 in to 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).

21CS304 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.
2. Classify logic circuits using basic Logic gates and simplify logic expressions using theorems, K-map.
3. Design and implement logical devices using combinational circuits.
4. Demonstrate and compare the construction of programmable logic devices and different types of ROM.
5. Understand and Analyze Sequential circuits like latches and flip-flops.
6. Analyze and Design sequential circuits like Registers and Counters.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	1	1	1	-	-	-	-	-	-	-	2	-
CO3	3	1	3	2	2	-	-	-	-	-	-	-	3	-
CO4	2	3	3	2	2	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	3	-
CO6	3	3	3	2	2	-	-	-	-	-	-	-	3	-

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

Unit I **12+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 (NOR)
3. Realization of basic gates using Universal gates (NAND)

Unit II **12+12Hours**

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
2. Implementation of Full Adder
3. Implementation and verification of Encoder
4. Implementation and verification of Decoder
5. Implementation and verification of MUX
6. Implementation and verification of DE-MUX

Unit III **12+6Hours**

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 (SR Flip Flop)
2. Realization of Flip-Flops using ICs (JK Flip Flop)
3. Realization of Flip-Flops using ICs (D and T Flip Flop)

Unit IV **12+8 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 SISO and SIPO Shift Registers
2. Verification of PIPO and PISO Shift Registers
3. Implementation of Synchronous Counter
4. Implementation of Asynchronous Counter

Total: 48+32 Hours

Textbook (s)

1. Digital Design 6th Edition by M Morris Mano, PEARSONINDIA,2018.
2. Charles H. Roth, Fundamentals of Logic Design,3rd Edition, ThomsonPublications,2014
3. John F. Wakerly, Digital Design Principles & Practices, 4th Edition, PHI/ Pearson EducationAsia,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 number0.1011
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 Programable 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) = ∑ m (0,1,2,4,5,7,8,9,12,13) by using 8 to1mux.
4. Illustrate a half adder using NAND –NAND
5. Represent a T flip flop using JK flipflop.
6. Differentiate between Bi-directional and Universal Shift-Registers.

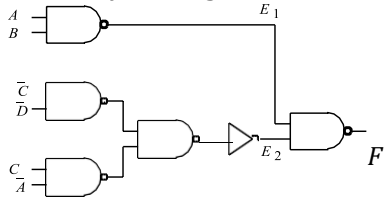
[4]Assignment test should contain only questions related to Higher Order Thinking (HOT) Skills

Apply

1. Find a circuit that has no static hazards and implements the Boolean function F(A,B,C,D) = Σ (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-3code.
5. Implement a combinational logic circuit, which can compare two bits binary numbers.

Analyze

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 in not used and floating format issued
4. What happens when an electric signal is grounded?
5. Design a Sequence detector to detect10111001

21DS305 Mathematical Foundation for Computer Science and Data Science

3 0 0 3

Course Outcomes

After undergoing this course, the learners are enabled to

1. Demonstrate Vector Spaces , Inner product spaces and their applications.
2. Solve Problems involving Recurrence Relations and Generating Functions
3. Apply Eigenvalues in Singular value decomposition and Principal component analysis.
4. Derive statements using the rules of inference for Mathematical logic.
5. Understand the basic knowledge of Graph theory and applications.
6. Construct the minimum spanning tree using different algorithms.

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO6	3	3	3	2	-	-	-	-	-	-	-	1	-	-

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

Unit-I

Vector Spaces and Inner Product Spaces **12 Hours**

Vector Spaces: Definition, Properties of Vector Spaces, Subspaces, Algebra of Subspaces, Basis and Dimension, Linear Span, Linear Independence and Dependence of vectors, Linear Transformations, Range and Null Spaces, Rank-Nullity theorem, Matrices of Transformations. (All theorems without Proof)

Inner Product Spaces: Definition, Properties of Inner Product Spaces, Norm of a vector, Cauchy Schwarz's Inequality, Complete orthonormal set, Gram-Schmidt Orthogonalization process.

Bessel's inequality

Unit-II

Recurrence Relations and Advanced Linear Algebra **12 Hours**

Recurrence Relations: Generating Functions – Calculating Coefficient of Generating Functions – Recurrence Relations – Solving Recurrence Relations by Substitution method, Solving Recurrence Relations by generating functions.

Advanced Linear Algebra: Hermitian, Skew-Hermitian, Unitary Matrices, Eigenvalues and Eigenvectors of complex matrices, Singular Value Decomposition (SVD), Principal Component Analysis (PCA)

Method of Characteristic roots

Unit-III

Mathematical Logic **12 Hours**

Propositional Logic: 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.

Relations in Databases

Unit-IV

Graph Theory **12 Hours**

Basics of Graph Theory: Representation of Graphs – Degree of a Graph –Complete Graphs – Regular Graphs – Bipartite Graphs –Walk – Path – Circuit – Cycle – Planar Graphs – Euler's Formula – Isomorphism – Euler Circuit and Hamilton Cycle – Chromatic Number.
Trees: Definition and properties of tree, Spanning Tree, Breadth First Search (BFS) algorithm, Depth First Search (DFS) algorithm, Minimum Spanning Tree, Kruskal algorithm, Prim's algorithms.
Applications of Graphs and Trees, Ternary Tree

Textbook(s)

1. Gilbert Strang, "Linear Algebra and Learning from Data", Wellesley, Cambridge Press, 2019.
2. Kenneth H. Rosen, Discrete Mathematics and Applications, 7th Edition, Tata McGraw Hill, 2015.
3. 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. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, 2015.
3. K Hoffman and R Kunze, Linear Algebra, Pearson Education, 2017.

Internal Assessment Pattern

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

Remember

1. Define Vector Space.
2. State Hand shaking theorem.

Understand

1. Prove that "if n^2 is odd then n is odd" by the method of contradiction.
2. Explain about Euler circuit and Hamiltonian cycle with suitable examples.

Apply

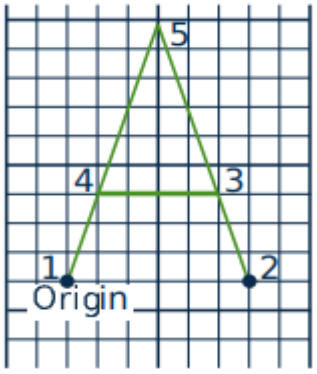
1. Find rank of the transformation $T: R^2 \rightarrow R^3$ defined by $T(x, y) = (x + y, x - y, y)$ using Rank-Nullity Theorem.
2. Obtain the matrices U, V and S such that $A = USV^T$, where $A = \begin{bmatrix} 3 & 3 & 2 \\ 2 & 3 & -2 \end{bmatrix}$ using Singular Value Decomposition.

Analyze

1. Prove the validity of the following argument: "If I study, then I will pass in exam. If I do not go to cinema, then I will study. But I failed in exam. Therefore, I went to cinema."
2. Draw a graph which contains an Eulerian circuit but not an Hamiltonian cycle with justification

Open Book Exam

1. Construct an AVL tree by inserting the following elements in the order given: {10, 6, 9, 4, 8, 7, 2, 11, 12, 3, 5, 1}, and balancing as necessary. Delete the elements in the following order {9, 6, 2, 5, 10, 3, 1, 4, 7, 8, 12, 11} balancing as necessary. Show the intermediate steps of deletion when re-balance (rotation) is used and end result of the insertion.
2. Model the matrix for the figure given below.
   i. Draw the image corresponding to the matrix obtained by multiplying $\begin{bmatrix}1 & 0.2\\0 & 1\end{bmatrix}$ with obtained matrix in (i)
   ii. Sketch the image and write the corresponding matrix by rotating the following figure through the angle $\frac{\pi}{6}$ about the point $\begin{bmatrix}4\\5\end{bmatrix}$.



21CS306 Object Oriented Programming with JAVA

3 0 0 3

Course Outcomes

At the end of the course, students will be able to
1. Understand the object oriented programming concepts
2. Develop applications using different types of inheritances
3. Understand the creation of user defined packages
4. Analyze and recover runtime exceptions arise in the applications
5. Develop multithreaded applications with synchronization
6. Develop interactive applications for standalone and Internet

COs–POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO2	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO3	3	3	1	-	-	-	-	-	-	-	-	2	-	1
CO4	2	2	2	-	-	-	-	-	-	-	-	2	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	2
CO6	3	2	2	-	-	-	-	-	-	-	-	2	-	2

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

Unit I **13 Hours**

Introduction to Java

Overview of Object Oriented Programming principles, Importance of Java to the Internet, Byte code, Methods, classes and instances, Data types, arrays, control statements, simple java program, Classes and Objects– constructors, methods, access control, this keyword, overloading methods and constructors, garbage collection, java.lang – String, StringBuffer, StringBuilder, Type wrappers – Integer, Character, Float, Double, Boolean

Features of object oriented programming–Java History–Computer Programming Hierarchy–Role of Java Programmer in Industry

Unit II **11 Hours**

Inheritance, Packages & Interface

Inheritance: Basics, Using super, Multilevel Hierarchy, Method overriding, Dynamic Method Despatch, Using Abstract classes, Using final with inheritance, Sealed Classes

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, Member access rules, Java Collections – Arrays, ArrayList, Hashtable, StringTokenizer, Vector

Interface: Defining an interface, differences between classes and interfaces, implementing interface, variables in interface and extending interfaces, Default Methods in Interfaces, Static Methods in Interface

Nested–Inner Class & Anonymous Classes–Generic Class Types

Unit III **12 Hours**

Exception Handling & Multithreading

Exception handling: Concepts and benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built-in and User Defined Exceptions

Multithreading: Definition thread, thread life cycle, creating threads, synchronizing threads, daemon threads

Control Flow In Exceptions– JVM reaction to Exceptions– Inter Communication of Threads– Critical Factor in Thread–Deadlock

Unit IV **12 Hours**

Applets & Event Handling

Applets: Concepts of Applets, life cycle of an applet, types of applets, creating applets, passing parameters to applets, The AWT class hierarchy, user interface components labels, button, Text components

Event Handling: Events, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes, Compare basic AWT components with swing components, More user interface components-canvas, scrollbars, check box, choices, lists panels–scroll pane, dialogs, menu bar, layout managers.

Applet Security Policies–Anonymous Inner classes a Short–cut to Event Handling–Java Utilities (java.util Package)

Total: 48 Hours

Textbook (s)

1. H. Schildt, Java: The complete reference, 7th Edition, TMH, 2006
2. T. A. Budd, An Introduction to Object–Oriented Programming, 3rd Edition, Addison Wesley Longman, 2002

Reference (s)

1. Dietal&Dietal, Java: How to Program, 8th Edition, PHI, 2010
2. C. S. Horstmann and G. Cornell, Core Java, Vol 1. Fundamentals, 7th Edition, Pearson Education, 2004
3. C. Horstmann, BIG JAVA Compatible with Java 5 & 6, 3rd Edition, Wiley Publishers, 2008

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Assignment Test[1] (%)
Remember	25	15	10
Understand	30	15	30
Apply	25	40	30
Analyze	20	20	30
Evaluate	--	10	--
Create	--	--	--
Total (%)	100	100	100

Remember

1. List all OOPs principles
2. Define class and object
3. Illustrate various data types supported by JAVA
4. State various access controls available in JAVA
5. Define inheritance
6. Define thread

Understand

1. Explain byte code
2. Explain the use of super, static and final keywords
3. Illustrate the use of try, catch, throw and throws
4. Java is purely object oriented programming language. Explain
5. Explain types of polymorphism with Example

Apply

1. Write statements that perform the following one-dimensional-array operations:
   a) Set the 10 elements of integer array counts to zero
   b) Add one to each of the 15 elements of integer array bonus
   c) Display the five values of integer array best Scores in column format
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. Write a java program to implements final variable, Method and classes
4. Explain the reason for the following code giving compiling errors.

```
abstractclassAbstractClass
{
  abstractvoidabstractMethod()
  {
    System.out.println("First Method");
  }
}
```

5. Write a java program to implement the following techniques
   a) Method Overloading
   b) Method Overriding

6. Write a Java program to implement Virtual function technique

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

21CS307 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	PO1	PO2	PO3	PO4	PO12	PSO2
1	2	2	3	1	2	2
2	2	2	3	2	2	2
3	2	3	3	3	2	2
4	2	2	3	1	2	1
5	2	3	2	2	2	2
6	2	2	2	2	2	2

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

List of Experiments

1. Arrays

Implement list using an array and perform the following operations on it.

- **Insert(pos, element):** It should insert the given element into the list at the specified position pos. If pos is out of range (less than 0 or greater than the current list size), display an error message.
- **Delete(pos, element):** This function should delete the given element from the list at the specified position pos, if it exists. If pos is out of range or the element is not found at the given position, print an appropriate message.
- **Search(element):** This function should check if the given element is present in the list. If the element is found, return True; otherwise, return False.
- **Running Sum of 1D Array()**: This function return a new array containing the running sum of input array 'num'. The running sum of an array is defined as
  Running Sum[i] = sum(nums[0]…nums[i]).
- **Display():** This function should display the current elements present in the list.

Examples:

Initial list: []
Insert(0, 5): [5]
Insert(1, 10): [5, 10]
Insert(5, 15): Invalid position, element not inserted
Display: [5, 10]

Initial list: [1, 2, 3, 4]
Delete(1, 2): [1, 3, 4]
Delete(0, 5): Element not found at position 0
Display: [1, 3, 4]

List: [1, 2, 3, 4]
Search(3): True
Search(5): False

Given array: [1, 2, 3, 4]
Running Sum: [1, 3, 6, 10]

Given array: [2, 4, 6, 8]
Running Sum: [2, 6, 12, 20]

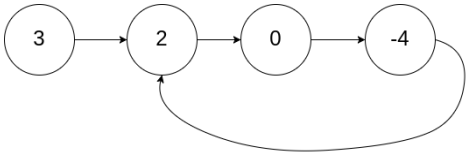
2. Singly linked list

Implement a singly linked list with the following functions: insert, delete, display and detect_cycle.

Node Structure:
Each node should have two attributes: val to store the value of the node and next to point to the next node in the list.

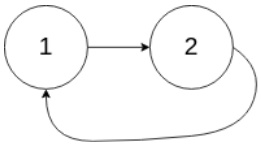
- **insert(val)**: This function should take an integer val as input and insert a new node with the given value at the end of the linked list.
- **delete(val)**: This function should take an integer val as input and remove the first occurrence of the specified value from the linked list. If the value is not found in the list, print an appropriate message.
- **display():** This function should display all the elements present in the linked list, starting from the head to the tail.
- **detect_cycle():** This function should detect if there is a cycle in the linked list. It should return True if a cycle is found and False otherwise. There is a cycle in a linked list if there is some node in the list that can be reached again by continuously following the next pointer.

Example 1: detect_cycle()



Input: head = [3,2,0,-4],
Output: true
Explanation: There is a cycle in the linked list, where the tail connects to the 1st node (0-indexed).

Example 2: detect_cycle()



Input: head = [1,2]
Output: true
Explanation: There is a cycle in the linked list, where the tail connects to the 0th node.
Example 3: detect_cycle()

Input: head = [1], pos = -1
Output: false
Explanation: There is no cycle in the linked list.

3. Doubly linked list

Implement a doubly linked list with the following functions: insert, delete, display, and middle_node.

Node Structure:
Each node should have three attributes: val to store the value of the node, prev to point to the previous node, and next to point to the next node in the list.

- **insert(val):** This function should take an integer val as input and insert a new node with the given value at the end of the doubly linked list.

- **delete(val):** This function should take an integer val as input and remove the first occurrence of the specified value from the doubly linked list. If the value is not found in the list, print an appropriate message.
- **display():** This function should display all the elements present in the doubly linked list, starting from the head to the tail.
- **middle_node():** This function should find and return the middle node of the doubly linked list. If the list has an even number of nodes, return the first middle node.

Example 1: middle_node(
Input: head = [1,2,3,4,5]
Output: [3,4,5]
Explanation: The middle node of the list is node 3.

Example 2: middle_node(
Input: head = [1,2,3,4,5,6]
Output: [4,5,6]
Explanation: Since the list has two middle nodes with values 3 and 4, we return the first one.

4. Linear search and Binary search

Linear search

You are given an m x n integer matrix with the following two properties:

- Each row is sorted in non-decreasing order.
- The first integer of each row is greater than the last integer of the previous row.
- Given an integer target, return true if target is in matrix or false otherwise.

Example 1:

1	3	5	7
10	11	16	20
23	30	34	60

Input: matrix = [[1,3,5,7],[10,11,16,20],[23,30,34,60]], target = 3
Output: true

Binary Search:

Given an array nums containing n distinct numbers in the range [0, n], return the only number in the range that is missing from the array.

Example 1:

Input: nums = [3,0,1]
Output: 2
Explanation: n = 3 since there are 3 numbers, so all numbers are in the range [0,3]. 2 is the missing number in the range since it does not appear in nums.

Example 2:

Input: nums = [0,1]
Output: 2
Explanation: n = 2 since there are 2 numbers, so all numbers are in the range [0,2]. 2 is the missing number in the range since it does not appear in nums.

Example 3:

Input: nums = [9,6,4,2,3,5,7,0,1]
Output: 8
Explanation: n = 9 since there are 9 numbers, so all numbers are in the range [0,9]. 8 is the missing number in the range since it does not appear in nums.

Constraints:
All the numbers of nums are unique.

5. Stack

Remove All Adjacent Duplicates in String using stack
Implement a stack Abstract Data Type (ADT) that supports the following operations:

- push(element): Add the given element to the top of the stack.
- pop() -> element: Remove and return the top element from the stack. If the stack is empty, return None.
- peek() -> element: Return the top element of the stack without removing it. If the stack is empty, return None.

Implement a function that removes all adjacent duplicates in the string using a stack-based approach. A duplicate removal operation consists of selecting two adjacent and equal letters and eliminating them from the string. You should repeatedly apply these duplicate removals on the string s until no further duplicates can be removed.

- Input: A string s (1 ≤ |s| ≤ 10^5) consisting of lowercase English letters.
- Output: Return a string representing the final string after all adjacent duplicates have been removed.

Example 1:
Input: s = "abbaca"
Output: "ca"
Explanation:
For example, in "abbaca" we could remove "bb" since the letters are adjacent and equal, and this is the only possible move. The result of this move is that the string is "aaca", of which only "aa" is possible, so the final string is "ca".
Example 2:
Input: s = "azxxzy"
Output: "ay"

6. Stack applications: Infix to postfix conversion

Implement function to convert infix expression to its postfix notation using a stack.

Infix notation is the commonly used notation to represent mathematical expressions, where operators are written between the operands. For example, 2 + 3 * 4 is an infix expression.Postfix notation (also known as Reverse Polish Notation) is a way to represent mathematical expressions where each operator follows its operands. For example, the postfix equivalent of 2 + 3 * 4 is 2 3 4 * +.

- Input:A string infix_expr containing the infix expression. The expression will only contain the following characters: digits (0-9), operators (+, -, *, /), and parentheses (,).
- Output:A string representing the postfix expression obtained after converting the infix expression.

Example 1:
Input: infix_expr = "2 + 3 * 4"
Output: "2 3 4 * +"

7. Stack applications: Evaluation of postfix expressions.
Postfix expression as input and evaluates it to obtain the result using a stack.

- Input: A string postfix_expr containing the postfix expression. The expression will only contain the following characters: digits (0-9) and operators (+, -, *, /).
- Output: An integer representing the result of the evaluated postfix expression.

Examples:
Input: postfix_expr = "2 3 4 * +"
Output: 14
Explanation: The postfix expression is evaluated as 2 + (3 * 4) = 2 + 12 = 14.

8. Queue

Implement the queue Abstract Data Type (ADT) and use it to calculate the time needed to buy tickets.
Problem Statement: **Time Needed to Buy Tickets**

- There are n people in a line queuing to buy tickets, where the 0th person is at the front of the line and the (n - 1)th person is at the back of the line.
- You are given a 0-indexed integer array tickets of length n where the number of tickets that the ith person would like to buy is tickets[i].
- Each person takes exactly 1 second to buy a ticket. A person can only buy 1 ticket at a time and has to go back to the end of the line (which happens instantaneously) in order to buy more tickets. If a person does not have any tickets left to buy, the person will leave the line.
- Return the time taken for the person at position k (0-indexed) to finish buying tickets.

Example 1:
Input: tickets = [2,3,2], k = 2
Output: 6
Explanation:
- In the first pass, everyone in the line buys a ticket and the line becomes [1, 2, 1].
- In the second pass, everyone in the line buys a ticket and the line becomes [0, 1, 0].
The person at position 2 has successfully bought 2 tickets and it took 3 + 3 = 6 seconds.

Example 2:
Input: tickets = [5,1,1,1], k = 0
Output: 8
Explanation:
- In the first pass, everyone in the line buys a ticket and the line becomes [4, 0, 0, 0].
- In the next 4 passes, only the person in position 0 is buying tickets.
The person at position 0 has successfully bought 5 tickets and it took 4 + 1 + 1 + 1 + 1 = 8 seconds.

9. Insertion sort

Sort the array using insertion sort, and then find the **majority element** is the element that appears more than ⌊n / 2⌋ times. You may assume that the majority element always exists in the array.

Example 1:
Input: nums = [3,2,3]
Output: 3
Example 2:
Input: nums = [2,2,1,1,1,2,2]
Output: 2

10. Merge sort

Given an array of integers nums, sort the array in ascending order and return it.
Solve the problem without using any built-in functions in O(nlog(n)) time complexity and with the smallest space complexity possible.

Example 1:
Input: nums = [5,2,3,1]
Output: [1,2,3,5]
Explanation: After sorting the array, the positions of some numbers are not changed (for example, 2 and 3), while the positions of other numbers are changed (for example, 1 and 5).
Example 2:
Input: nums = [5,1,1,2,0,0]
Output: [0,0,1,1,2,5]
Explanation: Note that the values of nums are not necessairly unique.

11. Hash Table

Find the first non-repeating character in a string using hash table,Given a string s, find the first non-repeating character in it and return its index. If it does not exist, return -1.

Example 1:
Input: s = "leetcode"
Output: 0

Example 2:
Input: s = "loveleetcode"
Output: 2
Example 3:
Input: s = "aabb"
Output: -1

12. Open hashing

Implement the Open Hashing data structure that supports the following operations:

- **insert(key, value)**: Insert a key-value pair into the hash table.
- **get(key)** -> value: Retrieve the value associated with a given key from the hash table.
- **remove(key)**: Remove the key-value pair with the given key from the hash table.

Constraints:

- Use an appropriate hash function to convert keys into valid indices for the hash table.
- If a collision occurs during insertion (i.e., multiple keys map to the same index), use separate chaining to handle it by creating a linked list at that index.

13. Tree traversal algorithms

You are given a binary tree. Your task is to implement three tree traversal algorithms: Preorder Traversal, Inorder Traversal, and Postorder Traversal.

- Preorder Traversal: Visit the root node first, then traverse the left subtree, and finally traverse the right subtree.
- Inorder Traversal: Traverse the left subtree first, then visit the root node, and finally traverse the right subtree.
- Postorder Traversal: Traverse the left subtree first, then traverse the right subtree, and finally visit the root node.

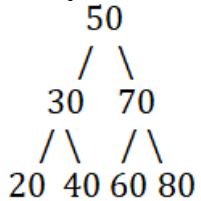
Example :
Input: root = [1,2,3,4,5,null,null]
Output:
Preorder: [1, 2, 4, 5, 3]
Inorder: [4, 2, 5, 1, 3]
Postorder: [4, 5, 2, 3, 1]

14. Binary Search Tree (BST)

The Binary Search Tree must maintain its BST property at all times. For every node in the BST, the keys in its left subtree are less than its key, and the keys in its right subtree are greater than its key. Implement the Binary Search Tree data structure that supports the following operations:

- **insert(key):** Insert a new key into the BST while maintaining its BST property.
- **delete(key):** Delete a key from the BST while preserving its BST property.
- **search(key)** -> bool: Check whether a given key is present in the BST.

Example:
Insertion of elements (50, 30, 20, 40, 70, 60, 80) into the BST.



Constraints:
The BST property is maintained throughout the insertions and deletions.

15. Balanced Binary Tree

Given a binary tree, determine if it is height-balanced. A binary tree is height-balanced if the difference in heights between its left and right subtrees is at most 1 for every node in the tree.Write a function called is_balanced that takes the root of the binary tree as input and returns a boolean value indicating whether the binary tree is height-balanced or not.

Example 1:
Input: root = [3,9,20,null,null,15,7]
Output: true
Example 2:
Input: root = [1,2,2,3,3,null,null,4,4]
Output: false
Example 3:
Input: root = []
Output: true

16. Graph traversal algorithm

Implement the Depth First Search (DFS) algorithm to traverse the graph starting from a given source vertex. It that takes the adjacency matrix representation of a graph and the source vertex as inputs and returns a list of vertices visited during the DFS traversal.
Example
adj_matrix = [[0, 1, 0, 1, 0], [1, 0, 1, 0, 1], [0, 1, 0, 1, 0], [1, 0, 1, 0, 1], [0, 1, 0, 1, 0]]
source = 2
DFS traversal order is [2, 1, 0, 3, 4]
Source =0
DFS traversal order is [0, 1, 2, 3, 4]

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.
   Exa
   mple
   :
   Inpu
   t:
   2
   5 2
   1 2 3 4 5
   10 3
   2 4 6 8 10 12 14 16 18 20
   Output:
   3 4 5 1 2
   8 10 12 14 16 18 20 2 4 6
3. Given a singly linked list, the task is to find the length of the linked list, where the length is defined as the number of nodes in the linked list.
   Input:
   FirstlineofinputcontainsnumberoftestcasesT.Toreachtestcase,firstlineofinputcontainsnumber of nodes N, to be inserted into the linked list and next line contains data of Nnodes.
   Output:
   There will be a single line of output for each test case, which contains length of the linked list.
4. Given a doubly linked list, rotate the linked list counter-clockwise by P nodes. Here, P is a given positive integer and is smaller than the count of nodes (N) in the linked list.
   Input:

The first line of input contains an integer **T** denoting the no of test cases. For each test case, the first line of input contains two integers **N and P** denoting the number of nodes in Linked List and the number of nodes to be rotated respectively.

Output:

For each test case, output the final linked list after the P rotations in it**.**

5. Given a stack with **push(),pop(),empty()**operations,delete**middle**ofitwithoutusinganyadditional data structure.

   Middle: ceil(size_of_stack/2.0)

   Input Format:

   The first line contains an integer **T**, the number of test cases. For each test case, the first line contains an integer **sizeOfStack** denoting the stacksize. Nextline contains space separated integers that will be pushed into the stack.

   Output Format:

   For each test case, in a new line, print the stack elements. **If stack size if 1 then just print**
6. Given a Queue **Q** containing **N** elements. The task is to reverse the Queue. Your task is to complete the function **rev(),** that reverses the **N** elements of the queue.

   Input Format:

   The first line of input contains an integer **T** denoting the Test cases. Then **T** test cases follow. The first line contains N which is the number of elements which will be reversed. Second line contains N space separated elements.

   Output Format:

   For each test case, in a new line, print the reversed queue.
7. Given a Binary Search Tree, find the sum of all leaf nodes. BST has the following property (duplicate nodesarepossible):The**leftsubtree**ofanodecontainsonlynodeswith**keysless**thanthenode'skey;

   The **right sub tree** of a node contains only nodes with **keys greater than** or **equal** to the node's key. **Input:**

   The first line of input contains a single integer **T** denoting the number of test cases. Then T test cases follow.Eachtestcaseconsistsoftwolines.Thefirstlineofeachtestcaseconsistsofinteger**N**,denoting the number of elements in the BST. The second line of each test case consists of N space-separated integers denoting the elements in the BST.

   Output:

   For each test case, in a new line, print the sum of leaf nodes.

Reading Material (s)

1. Data Structures Lab manual, Department of CSE, GMRIT, Rajam

21CS308 JAVA Lab

0 0 3 1.5

Course Outcomes

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

1. Make use of JAVA SDK environment to create - debug and run java programs
2. Create applications based on code reusability
3. Develop programs using threads
4. Develop and debug real time problems using exception handling
5. Create interactive applications using event handling mechanisms
6. Design Graphical User Interface using AWT components

CO-PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	2	-	2	-	2
CO2	3	3	2	1	-	-	-	-	-	2	-	2	-	2
CO3	3	3	2	2	-	-	-	-	-	2	-	2	-	2
CO4	3	3	2	3	-	-	-	-	-	2	-	3	-	3
CO5	3	3	3	2	-	-	-	-	-	2	-	2	-	3
CO6	3	3	3	2	-	-	-	-	-	2	-	3	-	3

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

List of Experiments

1. Case Study: Permutations and Combinations Calculator

User Input:

- The program should prompt the user to enter the total number of elements (n) and the number of elements to be selected (r).
- Validate the input to ensure that both n and r are positive integers, and r is less than or equal to n.

Functional Description:

- Create a method **calculate Permutations** that takes two integers n and r as input and returns the number of permutations.

Formula *nPr = n! / (n - r)!, where "!" denotes factorial*.

- Create a method **calculate Combinations** that takes two integers n and r as input and returns the number of combinations.

Formula *nCr = n! / (r! * (n - r)!).*

- Implement a separate method to calculate the factorial of a given integer.

Sample Output:

Enter the total number of elements (n): 5
Enter the number of elements to be selected (r): 3
Permutations (nPr): 60
Combinations (nCr): 10

2. Conversion Utility that allows users to convert measurements between different units.

User Input:

- The program should prompt the user to enter positive integer value for conversion type.
- The program should prompt the user to enter the positive input (feet/ meters/ miles/ kilometers) based on user option.

Functional Description:

- utilize method overloading to handle conversions between various units, such as feet to meters, miles to kilometers, and vice versa.

formula:feet to meters - feet * 0.3048
miles to kilometers - miles * 1.60934

Sample Output:

Measurement Conversion Utility
1. Feet to Meters
2. Meters to Feet
3. Miles to Kilometers
4. Kilometers to Miles
5. Exit
Enter your choice: 3

Enter the distance in miles: 5
5 miles is approximately 8.046 kilometers.

3. Case Study: **BankAccount** Class with Constructor Overloading

Functional Description:

- Create a **BankAccount** class to represent a bank account. The class should have private attributes such as **accountNumber** (a unique identifier for the account), **accountHolderName**, and **balance** (representing the current account balance).
- The class should have the following constructors:
  - **BankAccount(String accountNumber, String accountHolderName)**: Create an account with a zero balance.
  - **BankAccount(String accountNumber, String accountHolderName, double initialBalance)**: Create an account with the specified initial balance.
- Implement methods to:
  - **deposit(double amount):** Add the given amount to the account balance.
  - **withdraw(double amount):** Subtract the given amount from the account balance if sufficient funds are available.

Sample Output:

Welcome to the Bank Account System
Creating a new account...
Enter the account holder's name: John Doe
Enter the initial balance: 500.0
Account created successfully.
Account Number: ACCT123456
Account Holder: John Doe
Balance: $500.00
What would you like to do?
1. Deposit
2. Withdraw
3. Exit
Enter your choice: 1
Enter the amount to deposit: 250.0
$250.00 deposited successfully.
Updated Balance: $750.00

4. Implement inheritance concept for below case study:

Note: class **FictionBook** extends class **LibraryBook**, class **ClassicBook** and class **ScienceFictionBook** extends from **FictionBook**

- **LibraryBook**: Represents a general library book with attributes like title, author, and year, along with a method **displayBookInfo()** to display book details.
- **FictionBook**: Extends **LibraryBook** and adds an additional attribute genre.
- **ClassicBook**: Extends **FictionBook** and adds an additional attribute publisher.
- **ScienceFictionBook**: Extends **FictionBook** and adds an additional attribute edition

5. Case Study: Abstract Class for Finding Areas of Different Shapes

User Input:

- The program should prompt the user to enter positive integer value to calculate type of area.
- The program should prompt the user to enter the input based on user option.
  - **Circle**: Requires the radius as an input parameter
  - **Rectangle**: Requires the length and width as input parameters.
  - **Triangle**: Requires the base and height as input parameters.
  - **Square**: Requires the side length as an input parameter.

Functional Description:

- Create an abstract class **Shape** that will serve as the base class for different shapes. Include an abstract method **calculateArea()**
- Create concrete subclasses that extend the **Shape** class for different shapes like **Circle**, **Rectangle**, **Triangle** and **Square**.

Sample Output:

Select a shape:
1. Circle
2. Rectangle
3. Triangle
4. Square

5. Exit
Enter your choice: 1

Enter the radius of the circle: 5
The area of the selected shape is: 78.53981633974483

6. Implement Dynamic Method Dispatch in Java.
7. i. Create an **ArrayList** of integers to store a collection of numbers. Implement methods to add elements to the list, remove elements, update elements, and search for elements in the list.
   ii. Create a Java program that accepts a string input from the user. Use the **StringTokenizer** class to tokenize the input string into separate tokens based on specified delimiters (e.g., space, comma, etc.).
8. Demonstrating Mutability Differences between **String**, **StringBuilder**, and **StringBuffer** in Java
   - Explain the Concept in 100 words.
   - Perform string manipulation operation concatenation on each class
   - Print the results of each class after modification operation
9. Demonstrate multiple inheritance-like behavior achieved through interface implementation.
10. Case Study: Java Program Illustrating Multiple Catch Clauses with Finally Block
    Functional Description:
    - Implement exception handling for possible exceptions that may occur during the division, such as **ArithmeticException** and **NumberFormatException**.
    - Use multiple catch clauses to handle **ArithmeticException** and **NumberFormatException** separately.
    - Use a **finally** block to execute code that should be performed regardless of whether an exception occurred or not

    Sample Output:
    Enter the dividend: 10
    Enter the divisor: 0
    Division by zero is not allowed.
    Execution completed.
11. Create your own custom exception classes to handle specific situations or errors that are not covered by the built-in exception classes.
    Functional Description:
    - Create a custom exception class that extends the **Exception** class (or any other appropriate superclass, depending on your requirements).
    - Define the custom exception class to represent a specific error situation, such as **InvalidAgeException**, which is thrown when an invalid age is provided.
    - Use the custom exception class in a method to throw the exception when a certain condition is met, such as when the age is less than zero or exceeds a specific limit.

    Constraints:
    The program should prompt the user to enter age integer value. Here, age<0 or age>120

    Sample Output:
    Enter age:-5
    Exception: Invalid age. Age must be between 0 and 120.
12. Creates three threads by extending the **Thread** class. Each thread will display a specific message at a regular interval. The messages to be displayed are as follows:
    First thread: "**Good Morning**" every 1 second
    Second thread: "**Hello**" every 2 seconds
    Third thread: "**Welcome**" every 3 seconds
    Note: implement the same by using **Runnable** interface.
13. Case Study: Java Program for Producer-Consumer Problem
    User Input:
    - The program should prompt the user to enter positive integer valuesfor **bufferSize**
    - The program should prompt the user to enter positive integer values to **produceCount** and **consumeCount**

    Functional Description:
    - Buffer Implementation:
      - Create a shared buffer with a limited size (e.g., an array or an ArrayList) to hold the produced items.
    - Producer & Consumer Implementation:
      - Create a Producer class & Consumer class that implements the Runnable interface.
      - The Producer class should produce items and put them into the buffer.
      - The Consumer class should consume items from the buffer.

- Implement synchronization to avoid race conditions when accessing the buffer.

Sample Output:

```
Enter Buffer Size:5

Enter Procedure Count:5
Enter Consumer Count:5
Produced: 0
Consumed: 0
Produced: 1
Consumed: 1
Produced: 2
Consumed: 2
Produced: 3
Consumed: 3
Produced: 4
Consumed: 4
```

14. Case Study: Java Program for a Basic Calculator using AWT

In this case study, we'll implement a Java program to create a basic calculator using AWT. The calculator will have a simple graphical user interface (GUI) with buttons for numbers, arithmetic operations, and a display to show the result of calculations.

AWT Implementation:

- Create a Java AWT to implement the calculator GUI.
- The AWT should have buttons for digits (0 to 9), arithmetic operations (addition, subtraction, multiplication, division), and an equal (=) button to perform calculations.

Display and Input:

- Implement a display area where the user can see the entered numbers and the result of calculations.
- Provide a way for users to input numbers and arithmetic operations using the GUI buttons.

Basic Calculations:

- Implement methods to handle basic arithmetic calculations (addition, subtraction, multiplication, division).
- Perform calculations based on the user's input and display the result in the GUI.

User Interface:

- Design a user-friendly GUI with appropriate labels, buttons, and display areas.
- Use layout managers to organize the components effectively.

15. Case Study: Java Program for Temperature Converter using AWT

In this case study, we'll implement a Java AWT to create a Temperature Converter. The AWT will allow users to convert temperatures between Celsius and Fahrenheit. The user will input a temperature value in one unit, and the AWT will display the converted temperature in the other unit.

AWT Implementation:

- Create a Java AWTpplet to implement the temperature converter GUI.
- The AWT should have input fields for the temperature value and buttons to select the source and target temperature units (Celsius or Fahrenheit).
- Use appropriate layout managers to organize the components effectively.

Conversion Logic:

- Implement methods to handle temperature conversions between Celsius and Fahrenheit.
- The temperature conversion formulas are:
  - Fahrenheit to Celsius: C = (F - 32) * 5 / 9
  - Celsius to Fahrenheit: F = (C * 9 / 5) + 32

User Interface:

- Design a user-friendly GUI with appropriate labels, input fields, and buttons.
- Display the converted temperature in the GUI after the conversion is performed.

16. Case Study: Java Swing Application for Job Application Form

In this case study, we'll implement a Java Swing application with a JFrame that contains fields for name, age, email, and qualifications. The application will validate the form data when the user clicks the "Submit" button. If all fields are filled, the data will be written to a file named "application_form.txt."

Swing Application:

- Create a Java Swing application with a JFrame to display the job application form.
- Design the form with labels for each field (name, age, email, qualifications) and corresponding input fields (text fields or other appropriate components).
- Add a "Submit" button to the form to allow users to submit their job application.

Data Validation:

- Implement validation for the form data to ensure that all fields are filled before submission.
- Display error messages for missing fields or invalid data.

Data Writing:

- Create a method to write the validated form data to a file named "application_form.txt."
- The file should be created in the current working directory.
- Use appropriate file handling techniques to write the data.

User Interaction:

- Allow users to input their name, age, email, and qualifications using the form fields.
- Trigger the form data validation when the user clicks the "Submit" button.
- Display appropriate messages to inform the user about the success or failure of form submission.

List of Augmented Experiments

1. New Patient Registry Management System
2. Restaurant Billing Management System
3. Library Management System
4. ATM Management System
5. Bus Ticket Booking Management System
6. Movie Ticket Booking Management System
7. Queuing Management System
8. Attendance Management System
9. Medical Store Billing Management System
10. Text Editor Projects in Java
11. Google Search Engine Filter
12. Electronic voting System
13. Day Planner
14. Library management System
15. Personal Finance Management System

Reading Material (s)

1. JAVA Lab manual, Department of CSE and IT, GMRIT, Rajam

21ESX01 Employability Skills I

0 0 2 0

Course Outcomes

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

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs –POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	3	2	-	-	-	2	2	2	3	-	-
CO2	3	2	3	2	3	-	-	-	2	2	2	3	-	-
CO3	3	2	3	2	3	-	-	-	2	2	2	3	-	-
CO4	3	2	3	2	2	-	-	-	3	3	3	3	-	-
CO5	3	2	3	2	2	-	-	-	3	3	3	3	-	-
CO6	2	1	2	3	2	-	-	-	3	3	3	3	-	-

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

Unit-I

Communication Skills **16 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 **16 hours**

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

Unit-II

Module-1:

No of Hours: 16 Hours

Introduction: Importance of Competitive Programming, Conditional Statements, Loops, Nested Loops. Strings: Declaration of strings, Accessing strings elements, operations

Practice Problems:

Week	Topic	Practice Problem Links
1	Introduction to Competitive Programming	**Codechef, Hackerrank,Codeforces, Leetcode, interviewbit…etc**
2	Conditional Statements-I	https://www.codechef.com/practice/tags/basic-programming-concepts
		https://www.codechef.com/practice/tags/conditional-statements
3	Conditional Statements-II	https://www.codechef.com/practice/tags/basic-programming-concepts
		https://www.codechef.com/practice/tags/conditional-statements
4	Loops-I	https://www.codechef.com/practice/tags/loops
		https://leetcode.com/tag/math/
		https://www.interviewbit.com/practice/#topics[]=math
		https://www.codechef.com/practice/tags/basic-maths
5	Loops-II	https://www.codechef.com/practice/tags/loops
		https://leetcode.com/tag/math/
		https://www.interviewbit.com/practice/#topics[]=math
		https://www.codechef.com/practice/tags/basic-maths
6	Nested Loops-I	https://www.codechef.com/practice/topics/math
		https://www.interviewbit.com/practice/#topics[]=math

		https://leetcode.com/tag/math/
7	Nested Loops-II	https://www.codechef.com/practice/topics/math
		https://www.interviewbit.com/practice/#topics[]=math
		https://leetcode.com/tag/math/
8	Strings-I	https://www.codechef.com/practice/topics/strings
		https://leetcode.com/tag/string/
		https://www.interviewbit.com/practice/#topics[]=strings
9	Strings-II	https://www.codechef.com/practice/topics/strings
		https://leetcode.com/tag/string/
		https://www.interviewbit.com/practice/#topics[]=strings
10	String Matching Algorithms	https://www.codechef.com/practice/topics/strings
		https://leetcode.com/tag/string/
		https://leetcode.com/tag/string-matching/
		https://www.interviewbit.com/practice/#topics[]=strings

Module-2:

No of Hours: 16 Hours

Arrays: Basics on Arrays: Creating elements, converting a string into array of characters, converting a number into array of character, accessing array elements **Recursion:** Definition, examples and how recursion differs from iteration.

Practice Problems:

Week	Topic	Practice Problem Links
11	Arrays - I	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=arrays
		https://leetcode.com/tag/array/
		https://www.codechef.com/practice/topics/arrays
		https://www.interviewbit.com/practice/#topics[]=arrays
12	Arrays - II	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=arrays
		https://leetcode.com/tag/array/
		https://www.codechef.com/practice/topics/arrays
		https://www.interviewbit.com/practice/#topics[]=arrays
13	2D Arrays & Matrix	https://www.interviewbit.com/practice/#topics[]=two-pointers
		https://leetcode.com/tag/two-pointers/
		https://leetcode.com/tag/matrix/
		https://www.codechef.com/practice/tags/matrices
14	Recursion - I	https://leetcode.com/tag/recursion/
		https://www.codechef.com/practice/tags/recursion
15	Recursion - II & Assessment	https://leetcode.com/tag/recursion/
		https://www.codechef.com/practice/tags/recursion
		https://www.hackerearth.com/practice/basic-programming/recursion/recursion-and-backtracking/practice-problems/
16	Recursion - III & Assessment - II	https://leetcode.com/tag/recursion/
		https://www.codechef.com/practice/tags/recursion

Total: 32 Hours

References:

1. https://leetcode.com
2. https://www.codechef.com
3. https://www.hackerearth.com
4. https://www.interviewbit.com
5. https://www.hackerrank.com

21HSX11 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

21IT304 Database Management Systems

3 0 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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	3	-	-	-	-	-	-	2	-	2	-	2
CO3	3	3	3	-	-	-	-	-	-	2	-	2	-	2
CO4	3	3	3	-	-	-	-	-	-	2	-	2	-	3
CO5	3	2	3	-	-	-	-	-	-	2	-	2	-	3
CO6	2	1	2	-	-	-	-	-	-	2	-	2	-	3

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

Unit I

Introduction to DBMS and ER Model **12 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 **12 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 **12 Hours**

Normalization and Transaction Management

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 **12 Hours**

Locking, Recovery Systems, Indexing, Different Types of Data

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

Total: 48 Hours

Textbook (s)

1. Elmasri & Navatha, Fundamentals of Database Systems, Pearson Education, 7thEdition,2016
2. SilberschatzKorth, Database System Concepts, McGraw hill, 7thEdition,2020

Reference (s)

1. SorayaSedkaoui, Data Analytics and Big Data, Wiley, 1st Edition,2018.
2. PeterRob&CarlosCoronel,DatabaseSystemsdesign,ImplementationandManagement,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 and4NF
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 -> D, E -> C, AF -> B. From this, find out all super keys for this relation, and which of these super keys form a key.

21IT403 Operating Systems

Course Outcomes **3 0 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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	3
CO3	3	3	-	-	-	-	-	-	-	-	-	2	2	3
CO4	3	3	-	-	-	-	-	-	-	-	-	2	2	2
CO5	2	2	-	-	-	-	-	-	-	-	-	2	2	2
CO6	2	2	-	-	-	-	-	-	-	-	-	2	2	2

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

Unit I

Operating-Systems Overview and Process Management **12 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 **12 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 **12 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 **12 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: 48 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. Dhamdhere, 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 Systemcalls
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. On 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?

21CS403 Computer Organization and Architecture

3 0 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. Summarizethetypesofinstructionanditsmicrooperationwithaddressingmodes(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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO6	3	2	2	-	-	-	-	-	-	-	-	1	3	-

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

Unit I

Overview & Microoperation **13 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 **11 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 wordParallelism.

BCD Adder-BCD Subtraction

UNIT III

Control Unit and Memory Systems **11 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 **13 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: 48 Hours

Text Book(s):

1. DavidA.PattersonandJohnL.Hennessey,"Computerorganizationanddesign:Thehardware /software interface", Morgan Kauffman / Elsevier, Fifth edition, 2014.
2. M.Morris Mano," Computer System Architecture", 3rd edition, Pearson/PHI,2092.

Reference(s):

1. V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization ", 6th edition, McGraw-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 Test1 (%)
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) 11111101State 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. SmithandGoodmanfoundthatforagivensmallsize,adirect–mappedinstructioncacheconsistently 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'smodel.
c. Are there any replacement polices 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 executionoftheinstructionisstoredatanaddresssymbolizedbyZ.Anindexregistercontainsthevalue X. State how Z is calculated from the other addresses if the addressing mode of the instruction is a.direct a. 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.

21CS404 Design and Analysis of Algorithms

3 0 2 4

Course Outcomes

1. Analyze the time and space complexity of algorithms using mathematical tools, big-O notation, and asymptotic analysis
2. Applying algorithmic paradigms using brute force approaches
3. Applying algorithmic paradigms such as Decrease and Conquer, Divide and Conquer, and Transform and Conquer approaches
4. Design efficient algorithms for a variety of problem-solving using greedy approaches
5. Develop problem-solving skills by tackling complex computational problems using dynamic programming
6. Comprehend the concept of NP-completeness, and identify NP-complete problems using backtracking and branch and bound approaches

COs–POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	-
CO2	2	2	3	-	-	-	-	-	-	-	-	1	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO6	3	3	2	-	-	-	-	-	-	-	-	2	3	-

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

Unit I **12 +8 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. Analysis of recursive algorithms
2. Analysis of Non-recursive algorithms
3. Solve the String matching problem using Brute Force approach
4. Solve the Sorting problem using Brute Force approach

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, Heap sort – Disjoint sets: Operations, Simple Union and simple find, Weighted Union, CollapseFind.

Graph representation, graph applications

Practical Components

1. Find the Topological order for the given graph using Decrease and Conquer approach
2. Solve sorting problem using divide and conquer approach
3. Solve sorting problem transform and conquer approach
4. Implement Simple Union and Find operation on disjoint-sets

Unit III **12+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. Find the minimum cost spanning tree for a given graph using greedy approach
2. Implement dijkstra's algorithm using greedy approach
3. Find the minimum record movements for optimal merge pattern using greedy approach
4. Find the optimal parenthesization solution for matrix chain multiplication problem using dynamic programming
5. Solve the 0/1 knapsack using dynamic programming

Unit IV **12+ 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 *0/1 knapsack problem, graph coloring problem*

Practical Components

1. Find the sum of subsets using backtracking technique
2. Find the solution for Traveling sales person problem using Branch and Bound method
3. Find the solution for Assignment Problem using branch and bound method

Total: 48+32 hours

Textbook (s)

1. Introduction to The Design and Analysis of Algorithms, 3rdEdition, AnanyLevitin, 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, SatrajSahni and Rajasekaran, University press.

Reference (s)

1. Design and Analysis of algorithms, Aho,Ullman and Hopcroft, Pearsoneducation.
2. Algorithms–Richard Johnson Baughand 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 Test2 (%)
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 other 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)+nlogn) using master theorem.
5. Demonstrate the process of Fibonacci search with an example
6. Find the shortest tour for the TSP for the given graph using FIFOBB.

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

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

```
offun()? 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;
}
```

21DS405 Foundations of Data Science

3 0 1 3

Course Outcomes

1. Understand the pipeline of machine learning to apply on real world problems
2. Understand the need of Similarity and Dissimilarity between features in data
3. Importance of Pre-processing techniques in real-time
4. Identify the characteristics of various Regression models in real-world
5. Identify the characteristics of various supervised learning and ensemble models
6. Identifying the characteristics of various algorithms of unsupervised learning

COs–POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	1	-	-	-	-	-	-	-	-	1	1
CO2	3	2	-	3	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	3	-	-	-	-	-	-	-	-	2	2
CO4	2	3	-	3	-	-	-	-	-	-	-	-	3	2
CO5	2	3	-	2	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	2	-	-	-	-	-	-	-	-	3	2

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

UNIT I **12 hours**

Introduction: Relation among AI, ML and Data Science, Importance of Data Science, Categorization of Data Science Algorithms, Usecases; **Data Science Process; Data Exploration:** Objectives of Data Exploration, Forms of Data (Structured, Semi Structured, Unstructured), Datasets (data objects and types of attributes/fields), Characteristics of Datasets and corresponding Statistical Measures; **Data Visualization:** Univariate Visualization, Multivariate Visualization, Visualization of Complex Data and Relations(High-Dimensional Data)

Discriminant Analysis, LDA

UNIT II **12 hours**

Data Similarity/Dissimilarity: Data Matrix, Dissimilarity Matrix, Proximity/Similarity Measures for various types of data (nominal, ordinal, binary, numerical, etc.), Dissimilarity for Attributes of Mixed Types, Cosine Similarity; **Data Preprocessing:** Preprocessing Pipeline, Forms of Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Discretization.

Distance based similarity (Euclidean distance, Jaccard Similarity)

UNIT III **12 hours**

Regression (forecast a given numerical quantity): Linear Regression, Logistic Regression (Regression for Classification), Regularization; **Classification:** Classification Principles, Classification Model Evaluation Metrics (Confusion Matrix, ROC and AUC, Lift Covers), Classification using Decision Trees, Bayesian Classification, Distance based Classifier(k-NN), Support Vector Machines (SVM), ANN-based Classification;

LASSO and Ridge Regression

UNIT IV **12 hours**

Ensemble Learning: Conditions for Ensemble Modeling, Ensemble Techniques (Voting, Bagging, Boosting and Random Forest); **Clustering:** Clustering Principles, Applications/Purpose of Clustering- Clustering for description/preprocessing/classification, Types of Clustering, Clustering Evaluation Parameters, Clustering Algorithms (k-Means, Agglomerative/Divisive, DBSCAN and Self Organizing Maps) and Evaluation Metrics; **Data Science Tools: Examples;**

ADABoost, XGBoost **Total: 48 hours**

Textbooks:

1. Vijay Kotu&Bala Deshpande, "Data Science: Concepts and Practice", 2nd Edition, Morgan Kaufmann Publication, 2017.
2. Jlawei Han & Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2012
3. Pang-Ning Tan et al., "Introduction to Data Mining", 2nd Edition, Pearson Publications, 2019.

References:

1. Vijay Kotu&Bala Deshpande, "Data Science: Concepts and Practice", 2nd Edition, Morgan Kaufmann Publication, 2017.
2. Tom M. Mitchell, "Machine Learning ",Tata McGraw Hill, 1997
3. SunilaGollapudi, "Practical Machine Learning" First Edition 2016,Packt Publishing Ltd.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open book Test[1] (%)
Remember	20	20	--
Understand	50	30	--
Apply	30	30	80
Analyze	--	20	20
Evaluate	--	--	--
Create	--	--	--
Total (%)	**100**	**100**	**100**

SAMPLE QUESTION (S)

Remember

1. Define machine learning
2. List the various similarity measures

Understand

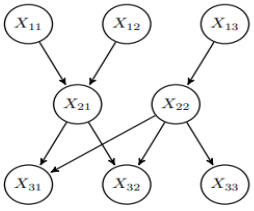
1. Explain the need of pre-processing in machine learning
2. Differentiate between supervised and unsupervised algorithms

Apply

1. Give Decision trees to represent the Boolean Functions:
   - **a.** A && - B
   - **b.** b. A V [B && C]
   - **c.** c. A XOR B
   - **d.** d. [A&&B] V [C&&D]

Open Book Question(s)

1. Suppose we clustered a set of N data points using two different clustering algorithms: k-means and Gaussian mixtures. In both cases we obtained 5 clusters and in both cases the centers of the clusters are exactly the same. Can 3 points that are assigned to different clusters in the kmeans solution be assigned to the same cluster in the Gaussian mixture solution? If no, explain. If so, sketch an example or explain in 1-2 sentences
2. Assume we have a set of data from patients who have visited UPMC hospital during the year 2011. A set of features (e.g., temperature, height) have been also extracted for each patient. Our goal is to decide whether a new visiting patient has any of diabetes, heart disease, or Alzheimer (a patient can have one or more of these diseases). Suggest a suitable machine learning approach for the above situation
3. Consider a Bayesian network B with boolean variables



   a) Is there any variable(s) conditionally independent of X33 given X11 and X12? If so, list all
   b) Is there any variable(s) conditionally independent of X33 given X22? If so, list all
   c) Write the joint probability P(X11, X12, X13, X21, X22, X31, X32, X33) factored according to the Bayes net. How many parameters are necessary to define the conditional probability distributions for this Bayesian network?
   d) Write an expression for P(X13 = 0, X22 = 1, X33 = 0) in terms of the conditional probability distributions given in your answer to part (c).

21IT308 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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	2	-	2	-	2	-	3
CO2	3	2	2	3	-	-	-	2	-	2	-	2	-	2
CO3	3	2	2	2	-	-	-	2	-	2	-	2	-	3
CO4	3	2	3	2	-	-	-	2	-	2	-	2	-	3
CO5	3	2	2	3	-	-	-	2	-	2	-	2	-	3
CO6	3	2	2	2	-	-	-	2	-	2	-	2	-	2

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

Experiment 1

Application: 1

"Established in 1977, "Roadway Travels" has been actively operating for decades, providing connectivity across various destinations in India through a fleet of several buses. Headquartered in Hyderabad, the company now aims to modernize its operations in the following key areas:

1. Reservation System:

Managing reservations is the responsibility of the booking office. Customers can reserve their seats up to 60 days in advance, utilizing either cash or credit payment methods. In instances where tickets are unavailable, customers receive wait-listed tickets, which can be confirmed once cancellations occur.

2. Ticketing:

The booking office handles ticketing processes, including sales and issuance. Both cash and credit payments are accepted for this purpose.

3. Cancellation and Modification:

Cancellation services are also facilitated at the booking office. Applicable cancellation charges will be levied as per company policy. Furthermore, modifications to reservations can be processed within this domain. Notably, wait-listed tickets that remain unconfirmed are eligible for full refunds."

The Following are the entities:

Bus (Busno, Source, Destination, coachtype)

Reservation (PNRNo,Busno, NoofSeats, JourneyDt, ContactNo, Address)

Ticket (TicketNo, BusNo, JourneyDt, Source, Destination, Dept_Time, Age, Sex

Passenger (TicketNo, PNRNo, Name, ContactNo, Age, Sex)

Cancellation (PNRNo, JourneyDt, SeatNo, ContactNo)

Application: 2

Online Learning Platform: An online learning platform requires an ER model to handle courses, students, instructors, and enrollments. Courses have titles, descriptions, and durations. Instructors have names, expertise, and contact details. Students have profiles with names, email addresses, and student IDs. Enrollments link students to courses, including enrollment dates.

Entities and Attributes:

Course (Course ID (Primary Key), Title, Description, Duration (in weeks or hours)Level (Beginner, Intermediate, Advanced), Category (e.g., Programming, Mathematics, Language), Price, Language, Thumbnail Image URL,)

Instructor (Instructor ID (Primary Key), Name, Bio, ContactInfo (Email, Phone), Expertise (Areas of specialization), ProfilePictureURL)

Student (Student_ID (Primary Key), FirstName. LastName, Email, DOB, Address, Contact)

Enrollment(Enrollment_ID (Primary Key), Course_ID (Foreign Key referencing Course), Student_ID (Foreign Key referencing Student), EnrollmentDate, Status (Enrolled, Completed, Dropped, etc.))

Lesson(Lesson_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title

Order (Sequence within the course), Duration (in minutes or hours), Content (Text, Video URL, PDF URL, etc.))

Quiz(Quiz_ID (Primary Key), Course_ID (Foreign Key referencing Course), Title, Number of Questions, Passing Score)

Question(Question_ID (Primary Key), Quiz_ID (Foreign Key referencing Quiz), Question Text, Question Type (Multiple Choice, True/False, Short Answer, etc.))
Answer(Answer_ID (Primary Key), Question_ID (Foreign Key referencing Question), AnswerText, Correct_Answer_Indicator)

Application: 3
Music Streaming Service: A music streaming service needs an ER model to organize its content and user interactions. The system should handle songs, albums, artists, playlists, and users. Songs have titles, durations, and release years. Albums include album names, release dates, and cover art. Artists have names, genres, and biographies. Users have profiles with names, email addresses, and subscription details. Playlists contain songs and are created by users.

Application: 4
Company Database: The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations. A department controls several projects, each of which has a unique name, a unique number, and a single location. We store each employee's name, social security number, address, salary, sex, and birthdate. An employee is assigned to one department but may work on several projects, which are not necessarily controlled by the same department. We keep track of the number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee. We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's name, sex, birthdate, and relationship to the employee.
Entities are:
Company Database:
EMPLOYEE (SSN, EName, Address, Sex, Bdate, Salary, SuperSSN, DNo)
DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)
DLOCATION (DNo,DLoc)
PROJECT (PNo, PName, PLocation, DNo)
WORKS_ON (SSN, PNo, Hours)
DEPENDENT (Essn, Dependent_name, Sex, Bdate, Relationship)

Apply ER Model for the above applications and identify the relations present in each application represent them in ER diagram.& Convert ER model to Relational Model.
Note: Students need to form a group minimum of 3 students and maximum of 5, and should design at least two applications into ER model by using EdrawMax software and convert them into relational model

Experiment 2
Creating users, roles and grant privileges to users and relations.

Experiment 3
Create and alter tables for Company Database in SQL using Integrity Constraints.
Integrity Constraints are CHECK, NOT_NULL, DEFAULT, UNIQUE, PRIMARY KEY, FOREIGN KEY.
Use atleast one constraint in one relation to understand the usage of constraints on database.
Schema:
CREATE TABLE employee (Fname varchar (15) NOT NULL, Minit varchar(1), Lname varchar(15) NOT NULL, SSN varchar(9) NOT NULL, Bdate date, Address varchar(30), Sex varchar(1), Salary float, Super_ssn varchar(9), Dno int NOT NULL, PRIMARY KEY (ssn), FOREIGN KEY (Super_ssn) REFERENCES employee(ssn));

CREATE TABLE department (Dnamevarchar(15) NOT NULL, Dnumber int NOT NULL, Mgr_ssn varchar(9) NOT NULL, Mgr_start_date date, PRIMARY KEY (Dnumber), UNIQUE(Dname), FOREIGN KEY (Mgr_ssn) REFERENCES employee(ssn));

CREATE TABLE dept_locations (Dnumber int NOT NULL, Dlocationvarchar(15), PRIMARY KEY (Dnumber, Dlocation), FOREIGN KEY (Dnumber) REFERENCES department (Dnumber));

CREATE TABLE project (Pnamevarchar(15) NOT NULL, Pnumber int NOT NULL, Plocation varchar(15), Dnum int NOT NULL, PRIMARY KEY (Pnumber), UNIQUE (Pname), FOREIGN KEY (Dnum) REFERENCES department (Dnumber));

CREATE TABLE works_on (Essnvarchar(9) NOT NULL, Pno int NOT NULL, Hours float NOT NULL, PRIMARY

KEY (Essn, Pno), FOREIGN KEY (Essn) REFERENCES employee(ssn), FOREIGN KEY (Pno) REFERENCES project(Pnumber));

CREATE TABLE dependent (Essnvarchar(9) NOT NULL, Dependent_name varchar(15) NOT NULL, Sex varchar(1), Bdate date, Relationship varchar(8), PRIMARY KEY (Essn, Dependent_name), FOREIGN KEY (Essn) REFERENCES employee(ssn));

Experiment 4

Execute basic SQL queries on Employee Database

To Create a database called Employee which consists of EMP, Dept, Salgrade, Project, Works_on and Dependent tables as relations in the database use Data Definition Language command (Create, Alter).

Run sql queries on database using DML commands like Insert, Update, Delete and for retrieval of data from database use Select statement.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)
DEPT (Deptno, Dname, Location)
SALGRADE(Grade, Losal, Hisal)
PROJECT (Pno, Pname, Plocation, Deptno)
WORKS_ON(Empno, Pno, Hours)
DEPENDENTS(EMPNO, DependentName, Sex, Bdate, Relation)

4.1 Insertion:

Insert rows into table by using datatypes like varchar, int, date, float etc.,

Syn: INSERT INTO employee (Fname, Minit, Lname, SSN, Bdate, Address, Sex, Salary, Super_ssn, Dno) values ('James', 'E', 'Borg', 888665555, '10-NOV-1937', '430 Stone, Houston, TX', 'M', 55000, NULL, 1);

4.2 Retrieval (Set operations)

Syn: Select Name from EMP Union Select Salary from EMP;

4.3 Updating

Update rows by changing the values in a row using update command syntax.

4.4 Deletion

Delete an entire row or multiple rows from the table using this command

Experiment 5

Implement the SQL operations on Employee Database created in Experiment 4.

Operations are: In, Any, All, Between, Like, Exists, Group by, Order by, having.

Employee Database:

EMP (Empno, Ename, Job, Mgr, Hiredate, sal, comm, deptno)
DEPT (Deptno, Dname, Location)
SALGRADE (Grade, Losal, Hisal)
PROJECT (Pno, Pname, Plocation, Deptno)
WORKS_ON (Empno, Pno, Hours)
DEPENDENTS (EMPNO, DependentName, Sex, Bdate, Relation)

Experiment 6

Implementing the concepts of Rollback – commit, checkpoints, and Views.

Rollback – commit, checkpoints:

Create Teacher table with the following fields(Name, DeptNo, Date of joining, DeptName, Location, Salary)

1. Insert five records
2. Give Increment of 25% salary for Mathematics Department .
3. Perform Rollback command
4. Give Increment of 15% salary for Commerce Department
5. Perform commit command.

Views:

To create different views, use the Emplpyee Database

1. Create a view to display Hiredate of all employees.
2. Create a view to display no of working hours of all employees with Plocation.

Experiment 7

Apply different types of joins availablein SQL on company database created in Experiment 4.

Types of Joins:

- Inner Join
- Outer Join
- Letf Join
- Right Join

Experiment 8

Apply subqueries and nested queries on company database (refer to experiment 4).

Experiment 9

Implement built in functions in oracle (Numeric, Aggregate functions) on Dual table(provided by Oracle) and Employee database.
Numeric Functions: ABS, CEIL, FLOOR, SQRT etc.,
Aggregate Functions: MIN, MAX, SUM, COUNT, AVG

Experiment 10

Implement String handling and Conversion functions on Dual table (provided by Oracle) and Employee database.
String Functions: Lowercase, Uppercase, Initcap, Rtrim, Ltrim, Lpad, Rpad etc.,
Conversion Functions: TO_CHAR(), TO_DATE(), TO_NUMBER().

Experiment 11

Sql Practice links from online platforms:

Employee Bonus	https://leetcode.com/problems/employee-bonus/
Big Countries	https://leetcode.com/problems/big-countries/
Employees Earning more than their managers	https://leetcode.com/problems/employees-earning-more-than-their-managers/
Managers with at least 5 direct reports	https://leetcode.com/problems/managers-with-at-least-5-direct-reports/
Second Highest Salary	https://leetcode.com/problems/second-highest-salary/
Count Salary Categories	https://leetcode.com/problems/count-salary-categories/

Experiment 12

Triangle	https://www.hackerrank.com/challenges/what-type-of triangle/problem?isFullScreen=true
Average Population of each country in a continent	https://www.hackerrank.com/challenges/average-population-of-each-continent/problem?isFullScreen=true
TopEarners	https://www.hackerrank.com/challenges/earnings-ofemployees/problem?isFullScreen=true
Occupations	https://www.hackerrank.com/challenges/occupations/problem?isFullScr
New Company	https://www.hackerrank.com/challenges/the-ompany/problem?isFullScreen=true
15Days of Learning SQL	https://www.hackerrank.com/challenges/15-days-of-learning-sql/problem?isFullScreen=true

Experiment 13

Implement PL/SQL operations on Employee Database to retrieve one row as output.

Experiment 14

Implementing functions, stored procedures on company database using PL/SQL

Experiment 15

Implement cursors on Employee database using PL/SQL to retrieve multiple rows as output.

Experiment 16

Creating triggers using PL/SQL

E-RESOURCES AND OTHER DIGITAL MATERIAL

1. Prof Arnab Bhattacharya IIT Kanpur, SQL Introduction https://nptel.ac.in/courses/106104135/10
2. Prof Arnab Bhattacharya IIT Kanpur SQL: Updates, Joins, Views, and Triggers
3. https://nptel.ac.in/courses/106104135/11

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

21DS407 Foundations of Data Science Lab 0 0 3 1.5

Course Outcomes

1. Demonstrate data formats and linear algebra matrices operation
2. Analyzing similarities/dissimilarities and visualizing data importance through plots
3. Demonstrate regression techniques on various datasets
4. Demonstrate Classification techniques on various datasets
5. Demonstrate Clustering techniques on various datasets
6. Build and evaluate the performance of various machine learning models

CO–PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	3	2	-	-	-	-	-	-	-	1	1
CO2	-	-	2	3	3	-	-	-	-	-	-	-	2	2
CO3	-	-	1	3	1	-	-	-	-	-	-	-	3	3
CO4	-	-	2	2	2	-	-	-	-	-	-	-	3	3
CO5	-	-	2	2	2	-	-	-	-	-	-	-	3	3
CO6	-	-	1	1	2	-	-	-	-	-	-	-	3	3

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

Experiments:

1. Linear Algebra Operations
2. Data Formats, Processing& Transformation
3. Obtaining Statistical Properties of data
4. Basic Experiments on Data Visualization, Interpretation, and Identification of outliers
5. Single Valued Decomposition and PCA
6. Optimization Techniques
7. Regression and variants (Prediction)
8. Regression with regularization (Prediction/classification)
9. Decision Tree Induction, Rule Generation and Classification
10. Implementation of K-Nearest Neighbor Classifier
11. Implementation of Bayesian Classifier
12. Implementation of Ensemble models
13. Implementation of K-Means Clustering
14. Implementation of Hierarchical clustering
15. Implementation of DBSCAN Clustering
16. Build, Train, Test and Deployment on cloud environment (e.g.AWS/Google Cloud)

Augmented Experiments:

Classification:

1. Design and Deploy a machine learning model for health care System

Sample Datasets:

a. https://www.kaggle.com/datasets/rashikrahmanpritom/heart-attack-analysis-predictiondataset

b. https://www.kaggle.com/datasets/kmader/skin-cancer-mnist-ham10000

2. Design and Develop a machine learning model for Business Analytics

Sample Datasets:

a. https://www.kaggle.com/datasets/arashnic/hr-analytics-job-change-of-data-scientists

3. Design and Develop a machine learning model for Education institutions

Sample Datasets:

a. https://www.kaggle.com/datasets/spscientist/students-performance-in-exams

4. Design and Develop a machine learning model for TV Shows

Sample Datasets:

a. https://www.kaggle.com/datasets/shivamb/netflix-shows

5. Design and Develop a machine learning model for E-Commerce applications

Sample Datasets:

a. https://www.kaggle.com/datasets/shivamb/netflix-shows

6. Design and Develop a machine learning model Supermarket store applications
Sample Datasets:
a. https://www.kaggle.com/datasets/surajjha101/stores-area-and-sales-data
Classification/Clustering:
7. Design and Develop a machine learning model for Drugs Review
Sample Datasets:
a. https://archive.ics.uci.edu/ml/datasets/Drug+Review+Dataset+%28Druglib.com%29
8. Design and Develop a machine learning model for Plants
Sample Datasets:
a. https://archive.ics.uci.edu/ml/datasets/Plants
9. Design and Develop a machine learning model for TV News Channel Commercial Detection
Sample Datasets:
a. https://archive.ics.uci.edu/ml/datasets/TV+News+Channel+Commercial+Detection+Dataset
10. Design and Develop a machine learning model for SMS Spam Collection
Sample Datasets:
a. https://archive.ics.uci.edu/ml/datasets/SMS+Spam+Collection

21ESX01 Employability Skills I

0 0 2 2

Course Outcomes

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	3	2	-	-	-	2	2	2	3	-	-
CO2	3	2	3	2	3	-	-	-	2	2	2	3	-	-
CO3	3	2	3	2	3	-	-	-	2	2	2	3	-	-
CO4	3	2	3	2	2	-	-	-	3	3	3	3	-	-
CO5	3	2	3	2	2	-	-	-	3	3	3	3	-	-
CO6	2	1	2	3	2	-	-	-	3	3	3	3	-	-

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

Unit-I

Communication Skills **16 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 (SimpleTopics).

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 **16 hours**

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

Unit-II

Competitive Programming Phase – II **16 Hours**

Module-1:

Fundamental mathematical concepts: Basic Mathematics, Number Theory, Geometry - Bit manipulation - Two-pointer technique.

Practice Problems:

Week	Topic	Practice Problem Links
1	Math-I	https://www.codechef.com/practice-old/topics/math
		https://leetcode.com/tag/math/
		https://www.codechef.com/practice-old/tags/mathematics
		https://www.interviewbit.com/courses/programming/math
2	Math-II	https://www.hackerrank.com/domains/mathematics
		https://www.codechef.com/practice-old/tags/mathematics

		https://www.hackerearth.com/practice/math/number-theory/basic-number-theory-1/practice-problems/
3	Number Theory	https://www.codechef.com/practice-old/tags/number-theory
		https://leetcode.com/tag/number-theory/
		https://www.hackerrank.com/domains/mathematics?filters%5Bsubdomains%5D%5B%5D=number-theory
4	Geometry	https://www.codechef.com/practice-old/tags/geometry
		https://www.hackerrank.com/domains/mathematics?filters%5Bsubdomains%5D%5B%5D=geometry
		https://leetcode.com/tag/geometry/
5	Bit Manipulation-I	https://www.codechef.com/practice-old/tags/bit-manipulation
		https://www.hackerearth.com/practice/basic-programming/bit-manipulation/basics-of-bit-manipulation/practice-problems/
6	Bit Manipulation-II	https://leetcode.com/tag/bit-manipulation/
		https://www.interviewbit.com/courses/programming/bit-manipulation
		https://www.hackerrank.com/domains/algorithms?filters%5Bsubdomains%5D%5B%5D=bit-manipulation
7	Two Pointer	https://www.interviewbit.com/practice/#topics[]=two-pointers
		https://leetcode.com/tag/two-pointers/
		https://www.codechef.com/practice-old/tags/two-pointers

Module-2:
Data Structures: Searching - Linked List - Stack – Queue – Graph Traversal Methods - Hashing Techniques.

8	Searching - I	https://www.codechef.com/practice/topics/binary-search
		https://leetcode.com/tag/binary-search/
		https://www.interviewbit.com/practice/#topics[]=binary-search
		https://www.codechef.com/practice/tags/searching
9	Searching - II	https://www.codechef.com/practice/topics/binary-search
		https://leetcode.com/tag/binary-search/
		https://www.interviewbit.com/practice/#topics[]=binary-search
		https://www.codechef.com/practice/tags/searching
10	Stacks	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=stacks
		https://leetcode.com/tag/stack/
		https://www.interviewbit.com/practice/#topics[]=stacks-and-queues
11	Queues	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=queues
		https://leetcode.com/tag/queue/
		https://www.interviewbit.com/practice/#topics[]=stacks-and-queues
12	Linked List-I	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=linked-lists
		https://leetcode.com/tag/linked-list/
13	Linked List-II	https://www.interviewbit.com/practice/#topics[]=linked-lists
		https://leetcode.com/tag/doubly-linked-list/

14	BFS	https://www.codechef.com/practice-old/tags/bfs&two-pointers
		https://leetcode.com/tag/breadth-first-search/
		https://www.hackerearth.com/practice/algorithms/graphs/breadth-first-search/practice-problems/
15	DFS	https://leetcode.com/tag/depth-first-search/
		https://www.hackerearth.com/practice/algorithms/graphs/depth-first-search/practice-problems/
16	Hashing	https://www.codechef.com/practice-old/tags/hashing
		https://leetcode.com/problemset/?page=1&topicSlugs=hash-function

References:

1. https://leetcode.com
2. https://www.codechef.com
3. https://www.hackerearth.com
4. https://www.interviewbit.com
5. https://www.hackerrank.com

21HSX11 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

21IT405 Web Technologies

3 0 2 4

Course Outcomes

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

1. Illustrate client-side scripting tools to create and modify web pages.
2. Infer the knowledge of web programming to develop and maintain web pages.
3. Develop portable and dynamic web pages.
4. Demonstrate server-side scripting languages to develop business logic.
5. Make use of database connectivity to communicate database server from web server.
6. Test for client-server web application development in real time internet domains.

CO–PO Mapping

Cos	PO_1	PO_2	PO_3	PO_5	PSO_1	PSO_2
1	3	3	3	2	3	3
2	3	3	3	2	3	3
3	2	2	2	3	3	3
4	2	2	2	3	2	3
5	3	3	3	3	3	3
6	2	2	2	2	3	3

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

Syllabus

Unit- I **12+8 Hours**

HTML Tags

Introduction, Links, Lists, Tables, Forms, Canvas, Semantics, Plug-ins.**CSS:** Introduction, CSS Properties, Selectors, Combinators, Controlling Fonts, Forms, Pseudo classes, Transitions, Animations (data-aos), 2D and 3D Transforms, Navigation Bar, Layouts,

Java Script: Introduction, Functions, Events, Validations, Objects, Document Object Model (DOM), Division Replacement, Browser Object Model (BOM)

CSS Tooltips, Font Combinations.

Practical Components

1. Design the following static web pages required for Online Examination System web site.
   a) Home Page
   b) Login Page: a. Student Login Page b. Admin Login Page
   c) Registration page
   d) Test Page
   e) Results Page.
2. For Specific pages of Online Examination System like Test page and Result page Apply different font styles, font families, font colors, animations and other formatting styles to the above static web pages.
3. Validate login page and registration page using Java Script.
4. Create an HTML page with any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Unit- II **12+8 Hours**

Bootstrap

Responsive Design, Layouts, Grids, Media Queries, **Components**- Forms, Drop Downs, Cards, Input Groups, Collapse, List Groups, Navbar, Popovers, Flex Box. **Utilities**- Borders, Positions, Scroll spy, Visibility, CSS Components, SVG, Java Script Components. **JSON:** Introduction, Parsing, Objects, JSON arrays, Dynamic HTML Data. **jQuery:** Selectors, Filters, Form Plug-ins, Auto Validations

Bootstrap icons, Jumbotron.

Practical Components

1. Design an interactive area using HTML and CSS. Use JavaScript to implement the color change effect during mouseover and reversion during mouse out.
2. **Inner Function with Constant Addition**: Design a function "createAdderWithConstant" that takes a constant as a parameter and returns an inner function. The inner function, when given a number, adds the constant to it and returns the result. Use the inner function to add the same constant to different numbers.
3. Make the static pages Responsive and attractive using Bootstrap components (***Mobile View)
4. Validate login page and registration page using JQuery**.**

Unit- III **12+8 Hours**

PHP

Introduction, Modal View Architecture (MVC), Creating PHP script, Running PHP script, Introduction to PHP, Arrays, Functions, sending parameters in URL, working with Forms, **working with Database:** Running SQL Queries, connecting with Databases, Uploading Files, PHP Sessions, Redirecting, Routing, Connecting PHP with JavaScript and jQuery, Authentication.

PHP Cookies, PHP Exception Handling, Introduction to PHP Laravel

Practical Components

1. Write a PHP to connect to the database, Insert the details of the student who registered through Online Examination System student login page including photograph.
2. Develop and demonstrate PHP Script for the following problems:
    a. Write a PHP Script to find out the Sum of the Individual Digits.
    b. Write a PHP Script to check whether the given number is Palindrome or not
3. Write a PHP program to insert the questions and respective answers into the database through admin page, sending mails to registered students through admin.
4. Write a PHP program, assuming four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Create a Cookie and add these four user ID‟s and passwords to this Cookie. 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.
    a. 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"

Unit- IV **12+8 Hours**

Flask

Introduction to Flask, Virtual Environment, features of flask, url building, routing, Templates and Jinja Code, Rendering Templates, Static files, Building Forms, Sending Form data to Templates, Template Inheritance (header, footer, etc), Session Tracking, connecting database (SQLite), Retrieving database values to templates, File uploading, Sending Mails, Deployment of website.

wsgi file, csrf token, http methods.

Practical Components

1. Write a Flask code to connect to the database, and authenticate Login pages with jQuery and start a Session for Student, Change password for Student
2. After user login, display Questions from the database into test page in shuffled manner using flask and store in database.
3. Write a Flask code to do the following

a) Evaluate the answers of the test which is given by the student in the Test page.
b) Calculate the total score of the student and store it into the database and display score in dashboard of student.

4. Using flask retrieve results in a responsive table format of all students with filtering. Deploy the application developed in real time environment

Total: 48+32 Hours

Textbook(s):

1. Programming the World Wide Web, 8th edition Robert W. Sebesta, pearson.
2. Bootstrap: Responsive Web Development, 1st Edition, jake spurlock foreword by dave winer, O'Reilly publications.

Reference Book(s):

1. Web programming with HTML, XHTML and CSS, 2e, Jon Duckett, Wiley India
2. Web programming Bai, Michael Ekedahl, CENAGE Learning, India edition.
3. An Introduction to Web Design + Programming, Paul S.Wang, India Edition
4. Flask Web Development 2e Miquel Grinberg O'Reilly publications.

Internal Assessment Pattern

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

Sample Question (S)

Understand

1. What is the use of cascading style sheet? Explain different style sheets used in HTML.
2. Explain string object with suitable example.
3. Illustrate how work java script events.
4. Describe procedure for how to connect PHP to MYSQL.
5. Explain AJAX technologies

Apply

1. Write an HTML program to display your class timetable.
2. Write a java script to find reverse of a given number using functions.
3. Design a responsive registration page using bootstrap.
4. Insert an image into a web page. Write a script which displays a message when the mouse is over the image. The co-ordinates of the mouse should be displayed if click is attempted on the image.
5. A person X has created the table (emp) and inserted the data in the table. After the completion of insertion, he found that one of the inserted record is invalid. So, write a PHP program to update the table by deleting the invalid record. [Assume database table name is emp (empno, ename, dept, age)]

Analyse

1. Compare traditional web application development with AJAX and analyze what way AJAX useful for real time internet application.

21DS502 Deep Learning for Data Science

3 0 0 3

Course Outcomes

1. Illustrate the knowledge of the basic Concepts of Neural Networks.
2. Classify the various types of Learning rules.
3. Understand the concept of Single and Multi-Layer Perception.
4. Make use of different CNN models.
5. Compare different character encoding techniques.
6. Exemplify different Deep unsupervised models.

COs–POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	PSO1
1	3	3	2	2	3	2
2	3	2	2	1	2	2
3	3	3	3	2	3	2
4	3	2	3	2	3	2
5	3	2	2	1	2	2
6	3	3	2	2	3	1

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

Unit I **12 Hours**

Introduction: Introduction to Deep Learning, Historical Trends in Deep Learning, The Neural Network, limitations of traditional computer programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptron as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Types of Activation Function: Sigmoid, Tanh, ReLU, and Softmax, learningrules
Bias, Mean, Variance, Co-Variance

Unit II **12 Hours**

Single Layer Perceptron: Adaptive Filtering Problem, Unconstrained Organization Techniques-Method of Steepest Descent, Newton's Method, Gauss Newton Method, Perceptron-Convergence Theorem, Relation Between Perceptron, Bayes Classifier for a Gaussian Environment
Multilayer Perceptron: Back Propagation Algorithm-Two Passes of Computation, Activation Function, Rate ofLearning, Sequential and Batch Model of Training, Stopping Criteria, optimization settings.
Linear Least Square Filters, Least Mean Square Algorithm, XOR Problem

Unit III **12 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-tasklearning, end-to-end deep learning.
CNN models: AlexNet, VGG –16, Residual Networks, YOLO
Keras ,tensorflow, data augmentation, Batch Normalization, Dropout

Unit IV **12 Hours**

Recurrent Networks
One-hot encoding of words and charcters, using word embedings, 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.
n-grams ,bag-of-words, Bi directional RNN, Exploding gradient

Total: 48 Hours

Textbook (s)

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, October 2022: Third Edition.
2. Simon Haykin, "Neural Networks - A comprehensive foundation", Pearson Education, 2003.
3. S. N. Sivanandam, S. N. Deepa, “Principles of Soft Computing”, Willy, 3rd edition, 2019.
4. Nikhil Buduma, “Fundamentals of Deep Learning”, ORELLIY, 1st Edition, 2017.
5. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education, 2004.
6. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation,2015

Reference (s)

1. Satish Kumar,”Neural Networks: A Classroom Approach” Tata McGraw Hill Education, 2004.
2. Simon Haykin, " Neural networks and Learning Machines", Prentice Hall, 2008
3. Josh Patterson and Adam Gibson ”Deep Learning A Practitioner’s Approach” O’Reilly Media, Inc. 2017

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Lab Examination %
Remember	20	20	---
Understand	40	40	---
Apply	40	40	40
Analyze	---	---	40
Evaluate	---	---	20
Create	---	---	---
Total (%)	100	100	100

Remember

1. Define Neural Networks.
2. Write Short notes on Hebbian Learning.
3. What is mean by Perceptron
4. What are the applications of Deep Learning?

Understand

1. What is are the benefits of Neural Networks?
2. How can deep learning models be optimized?
3. How do you evaluate deep learning models?
4. What are some common architectures used in deep learning?

Apply

1. Discuss some popular deep learning frameworks and libraries?
2. Discuss various activation function in CNN models

Analyze

1. Illustrate the working model of VGG-16 with diagram

21DS503 Data Analytics and Visualization Techniques

3 0 2 4

Course Outcomes

1. Understand the Data Analysis Fundamentals
2. Apply data transformation techniques for preprocessing and feature engineering in datasets.
3. Analyze and visualize data using descriptive statistics, correlation measures, and advanced plotting techniques.
4. Apply data transformation, statistics, and plots like violin and heatmaps for data analysis.
5. Analyze and visualize associations using scatterplots, correlograms, and treemaps.
6. Analyze and visualize individual and multivariate time series data.

COs–POs Mapping

COs	PO1	PO2	PO3	PO4	PO5	P012	PSO1	PSO2
1	2	3	1	-	2	1	3	1
2	2	2	1	2	2	-	3	2
3	2	3	1	1	3	-	3	3
4	2	2	1	1	3	-	3	3
5	2	2	3	-	2	2	3	3
6	2	3	3	-	2	2	3	3

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

Unit I 12+8 Hours

Data Analysis Fundamentals

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, Measurment scales-Nominal, Ordinal, Interval, Ratio. Comparing EDA with classical and Bayesian analysis, getting started with EDA: Numpy, Pandas,Scipy, and Matplotlib.

Grouping of data: Groupby mechanics, rearranging, reshaping data structures, data aggregation methods, and cross-tabulation methods.

Objectives of Exploratory data Analysis, The applications of EDA

Practical Components

1: Explore Scipy Library
2: Explore Stat Library
3: Experiment with all group by functionalities & cross tabulation methods
4: Analyzing and Visualizing Real-World Data.

Unit II 12+8 Hours

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.

Correlation and Inferences: Introducing correlation, covariance, Pearson's Correlation, Spearman's Rank Correlation.

Descriptive statistics: Understanding statistics, measure of central tendenacy, measure of dispersion (standard deviation, variance, skewness, kurtosis, percentiles, quartiles)

Violin Plots, Inter Quartile Range, Discretization & binning, heatmaps

Practical Components

5: Experiment with various data pre-processing & Transformation techniques
6:Experiment and Analyse the correlations among attributes.
7: Experiment with the statistical measures
8: Outlier Detection and Handling.

Unit III 12+8 Hours

Visualizing Distributions

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

Kernel Density Estimation (KDE), Geospatial Distributions, Interactive Visualization

***Practical* Components**

Download the House Pricing dataset from Kaggle
9: Use different Color scales on the Rainfall Prediction dataset
10: Create different Bar plots for variables in any dataset
11: Visualization of different Distributions in various ways
12: Visualizing Empirical Cumulative Distribution Functions (ECDF) for Real-world Data.

Unit IV 12+8 Hours

Visualizing Associations & Time Series

Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions-Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Fundamentals on Time Series Data, Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables

Multidimensional Scaling, MANOVA vs ANOVA

Practical Components

Experiment 13: Visualization through Pie charts, Stacked Bars & Stacked Densities
Experiment 14: Show an example of Skewed data and Experiment with different skewness removal techniques
Experiment 15: For a sales dataset do a Time Series Visualization
Experiment 16: Geospatial Visualization for Regional Sales Analysis

Total: 45+32 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. Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.
4. Downey, Allen. Think stats: exploratory data analysis. " O'Reilly Media, Inc.", 2014.
5. 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. 1 Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O'Reilly ,2016 2 OssamaEmbarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems,Apress, 2018
4. Wendy L. MartinezAngel R. MartinezJeffrey L. Solka: Exploratory Data Analysis with MATLAB, 2nd Edition,CRC Press,2011
5. Radhika Datar, Harish Garg : Hands-On Exploratory Data Analysis with R , Packt,2020
6. Joseph F Hair, Barry J. Babin, Rolph E. Anderson, William C. Black: Multivariate Data Analysis Cengage, 2018

SAMPLE QUESTION (S)

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

Remember

1. What is data science.
2. Define purpose of different data visualization 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. Compare and contrast various 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.

1. Correlation Analysis
   i. Correlation Heat Map
   ii. Zoomed Heat Map
2. Investigation of missing values
   1. What's missing? to what extent?
   2. Visualizing missing values in a DataFrame

21ML504 Computer Networks

3 0 0 3

Course Outcomes

1. Understand the basic network infrastructure to learn the overall functions of networking systems
2. Classify various wired and wireless transmission media for data communication networks
3. Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
4. Compare various routing algorithm and select an appropriate one for a routing design.
5. Design a proper routing for IP networks.
6. Understand the internal functionalities of main protocols such as HTTP, FTP, SMTP, TCP, UDP, IP.

CO-PO Mapping:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	2	1	-	2	-	-	-	-	2	1	-
CO2	3	2	-	2	1	-	2	-	-	-	-	2	2	-
CO3	2	3	-	2	2	-	2	-	-	-	-	2	1	-
CO4	3	3	-	3	3	-	2	-	-	-	-	2	1	-
CO5	2	3	-	3	3	-	2	-	-	-	-	2	2	-
CO6	3	1	-	3	2	-	2	-	-	-	-	2	2	-

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

SYLLABUS:

UNIT I **12 Hours**

Network Hardware-Network Software-and Transmission Media

OSI-TCP/IP reference models, ARPANET, Network Topologies,

Physical Layer: Transmission media: Guided Media-Twisted Pair-Coaxial Cable-Fiber optics-Unguided Media: Electromagnetic Spectrum, Radio Transmission and Microwave Transmission. Switching Techniques: Circuit Switching-Packet Switching-Message Switching.

Taxonomy of networking devices.

Unit II Data link layer

12 Hours

Design Issues: Framing-error detection and correction-CRC-Elementary Data link Protocols: Stop and wait-Sliding Window protocols: Go-back-n-Selective Repeat ARQ

Medium Access sub layer and Multiple Access protocols: ALOHA-CSMA-IEEE Standard 802.3 and Ethernet-IEEE Standard 802.4: Token bus.

Data Link Control Protocols: HDLC-SLIP-PPP

Unit III Network Layer

12 Hours

Network Layer design issues-Virtual circuit and Datagram Subnets-Routing algorithms: shortest path routing-Flooding-Hierarchical Routing-Distance vector routing-Broad cast and Multi cast routing, Congestion Control: Congestion prevention policies.

Internet control protocols

Unit IV Transport Layer

12 Hours

Transport Services-Connection management - Elements of Transport Protocols-Internet Transport Protocols: UDP and TCP. IPv4 & IPv6, Application Layer-Domain name system - Electronic Mail-WWW

ATM Transport protocol-Proxy Servers-Multimedia: Data compression-digital representation of analog signals

48 Hours

Textbook (s)

1. Andrew S Tanenbaum, Computer Networks, 4th Edition, Pearson Education /PHI, 2002.
2. Behrouz A. Forouzan, Data Communications and Networking, 3rdEdition, Tata McGraw Hill Higher Education, 2003

Reference (s)

1. Willam Stallings, Data and Computer Communications,8th Edition, Pearson Prentice Hall, 2007.
2. W.A. Shay, Thomson, Understanding communications and Networks, 3rd Edition, Cengage Learning, 2005

SAMPLE QUESTION (S)

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	25	20	--
Understand	40	40	20
Apply	30	40	40
Analyze	--	--	40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	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:
    1. Character count.
    2. Flag bytes with byte stuffing.
    3. Starting and ending flag bytes, with bit stuffing.

21MLC11 Computer Vision & Pattern Recognition

3 0 0 3

Course Outcomes

1. Explain fundamental computer vision concepts, including applications and challenges.
2. Understand image processing techniques and their application in computer vision.
3. Apply feature detection and matching techniques to analyze image data.
4. Understand pattern recognition and machine learning concepts and their application in image analysis.
5. Describe and implement segmentation techniques to partition images into meaningful regions.
6. Understand and apply object detection and recognition techniques for identifying and analyzing objects in images or sequences.

CO–PO Mapping

CO	PO1	PO2	PO3	PO12	PSO1
1	3	2	1	1	1
2	3	2	2	1	1
3	3	3	3	1	3
4	3	3	3	2	3
5	2	3	3	2	3
6	2	3	3	2	3

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

Unit I **12 Hours**

Introduction to Computer Vision and Image Processing

Computer Vision: Introduction to computer vision - applications of computer vision - Image formation, Geometric primitives, 2D transformations, and photometric image formation - Sampling and aliasing in images: Image processing Techniques: Point operators: Thresholding, Image Enhancement - Linear filters - Non-Linear filters - Multi-resolution representations : Gaussian pyramid, Laplacian Pyramid - wavelets: 1D Haar wavelet transform , 2D Haar wavelet transform.

Neighborhood operators (morphological operations) and content-based image retrieval.

Unit II **12 Hours**

Feature Detection and Matching

Feature detection : Image features - Edge Detection - Overview of edge detection methods, Prewitt, Sobel, and Canny Edge detectors - Line detection: Hough Transform for line detection - Feature descriptors: Histogram of Oriented Gradients (HOG), Local Binary Pattern (LBP), SIFT and SURF- Feature Matching techniques - Performance Analysis.

Harris corner detection, and Piecewise Linear Approximation

Unit III **12 Hours**

Pattern Recognition and Machine Learning

Introduction to pattern recognition: Pattern, Features, RST invariant features - Pattern recognition systems - Different approaches to pattern recognition - Statistical Pattern Recognition: Bayesian decision theory and discriminant functions. Supervised learning: Parametric methods (linear regression), Nonparametric methods (k-nearest neighbors, decision trees) - Unsupervised learning: Clustering algorithms (k-means, mean shift clustering). Neural pattern recognition: Structure and types of neural networks, Learning algorithms for neural networks.

Dimensionality reduction methods- PCA (Principal Component Analysis) and LDA (Linear Discriminant Analysis)

Unit IV **12 Hours**

Image Analysis and Object Recognition

Segmentation techniques: Region-based segmentation: Split and merge, region growing, Contour-based segmentation: Active contours, Clustering-based segmentation: K-means, mean shift. Object detection: Techniques for object detection - Face recognition: Methods and challenges in face recognition - Instance recognition Techniques – Image Classification – Semantic segmentation - Motion estimation: Optical flow, activity recognition, motion estimation.

Medical image segmentation and Deep learning object detection

Total: 48 Hours

Textbook (s)

1. Richard Szeliski, Computer Vision: Algorithms and Applications , Springer, 2022, ISBN:978-1848829343
2. Rober.J. Shelkoff, John Wiley &Sons,Pattern Recognition- Statistical, Structural and Neural Approaches,Wiley, 2007, ISBN: 978-8126513703.

Reference (s)

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, Wiley India, 2006, ISBN: 978-8126511167.
2. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012,78-1107011793
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, Brooks/Cole, 2007, ISBN:978-0495082521.

Internal Assessment Pattern

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

Remember

1. What is computer vision and what is its role in image processing?
2. Define Hough transform.
3. List the roles of linear filtering in image processing.
4. What is Instance recognition?

Understand

1. How does sampling affect the quality of an image?
2. Explain the working principles of K-nearest neighbors (KNN) and decision trees in pattern recognition.
3. Explain the concept of wavelets and their use in multi-resolution representations.
4. Describe the process of feature detection in computer vision.
5. Describe the process of optical flow estimation and its applications in motion tracking.

Apply

1. Discuss the application of mean shift and mode finding in image segmentation.
2. Explain the concept of multi-resolution representations in image analysis. How are wavelets used in this context?

Analyze

1. Analyze the impact of aliasing in images and discuss methods to mitigate its effects.
2. Compare and contrast parametric and nonparametric methods in supervised learning for pattern recognition.
3. Analyze the challenges and potential solutions for object tracking in crowded or occluded scenes.

21CSC21 Web Programming Languages

3 0 0 3

Course Outcomes

1. Understand web applications.
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.

COs–POs Mapping

COs	PO1	PO2	PO3	PO5	PSO1	PSO2
1	3	2	2	1	3	2
2	2	3	3	2	3	1
3	3	2	3	3	1	3
4	2	3	2	2	1	3
5	2	2	2	3	2	2
6	1	2	3	1	1	1

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

Unit I **12 Hours**

Overview of the web

Web application Overview: Basic concepts of web, Hyper Text Mark-up Language (HTML) and Cascading style sheets (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

12 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 **12 Hours**

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 **12 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: 48 Hours

Textbook (s)

1. Learn Web Development with Python, Fabrizio Romano, Gaston C. Hillar, Arun Ravindran, 1st Edition, 2018.

2. Learn Java for Web Development, Vishal Layka, 1st Edition, 2014.
3. Node.js, John Bach, Alexander Aronowitz, 3rd Edition, 2021

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 backendstorage.

Analyze

1. There is a common body parsing workflow that every request to a server must obey. What is agood way to implement it?
2. Compare Servlet and Java Server Page
3. 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

1. A file is to be stored in the web server. However, the access to this file is to be limited to specificset 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 withoutaffecting the performance of the website?

21MLC31 Fundamentals of Cloud Computing

3 0 0 3

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 datacenters.
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. Interpret the security and risk issues in cloud computing

COs–POs Mapping

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PSO_1	PSO_2
1	3	2	2	1	2	2	1
2	3	3	2	2	3	2	2
3	2	2	3	2	3	3	2
4	3	2	3	2	2	2	2
5	3	3	3	2	2	2	2
6	2	2	2	2	2	2	2

3–Stronglylinked|2–Moderatelylinked|1–Weaklylinked

Unit I **12 Hours**

Cloud Computing

Cloud computing: Introduction, SOA, Cloud computing architectures, Value of cloud computing, Cloud Infrastructure models including SaaS, PaaS, IaaS, Storage-as-a-Service, Database-as-a-Service, Information-as-a-Service,Process-as-a-Service,Application-as-a-Service, Integration-as-a-Service, and Security-as-a-Service. Public cloud, private cloud and hybrid cloud, Cloud Services.
Before moving into the cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model. History of Cloud Computing, Advantages of Cloud Computing, and Disadvantages of Cloud Computing.

Companies in the Cloud Today, Amazon Web Services, Google services, IBM Cloud, Windows Azure, Tata Cloud, Salesforce.com

Unit II **13 Hours**

Virtualization & Design

Virtualization,Virtualmachine, Implementation Levels of Virtualization,Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Datacentre, 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,oracleVM,

Unit III **12 Hours**

Cloud centres, Scaling a Cloud Infrastructure and Disaster Recovery:

Cloud centres in detail: Comparing approaches, Xen, Eucalyptus, CloudStack, and OpenStack. Cloud Scaling:Capacity Planning, Cloud Scale, Types of cloud scaling.
Disaster Recovery:Disasters in cloud,Disaster Recovery Planning, Cloud Disaster Management.

Requirements for modern data centres-high availability and Service Orientated-Infrastructures(SOI).Modern data centre use case studies.

Unit IV **11 Hours**

Cloud Computing Software Security Fundamentals

Data Security, Network Security, Host Security, Compromise Response.

Cloud information Security Objectives, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Approaches to Cloud Software Requirements Engineering, Cloud Security Policy Implementation.

Cloud Computing Risk Issues: The CIA Triad, Privacy and Compliance Risks, Threats to Infrastructure Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.

MicrosoftAzure, IBMBluemix

Total:48 Hours

Textbook(s)

1. GeorgeReese,Cloud ApplicationArchitectures,1st Edition O'ReillyMedia,2009
2. RonaldL.KrutzandRussell DeanVines,CloudSecurity,1st Edition,WileyPublishing,2010

Reference(s)

1. MichaelMiller,CloudComputing-WebBasedApplicationsthatchangethewayyouworkandcollaborateonline, 1st Edition,PearsonEducation,Publishing, 2011
2. KaiHwang,GeoffreyCFoxandJackJ.Dongarra,Distributed&CloudComputingfromParallelProcessingto theInternet ofThings,1st Edition, MK Publishing,2010
3. DavidSLinthicum,CloudComputingandSOAConvergenceinYourEnterprise:AStep-by-StepGuide,1st Edition, Addison-Wesley, 2009

SAMPLEQUESTION(S)

Internal Assessment Pattern

Cognitive Level	Int.Test1 (%)	Int.Test2 (%)	AssignmentTest[3](%)
Remember	40	45	20
Understand	40	45	60
Apply	20	10	
Analyze	--	--	20
Evaluate	--	--	--
Create	--	--	--
Total(%)	100	100	100

Remember

1. Define Cloud Computing.
2. List types of virtualization.
3. Define proactive scaling.
4. What is CIAT RAID?

Understand

1. Explain different cloud Infrastructure models.
2. Explain different levels of virtualization.
3. Explain about Recovery Point Objective.
4. With neat diagram explain the functioning of Xen Architecture.
5. List and explain various cloud service providers risks.

Analyze

1. Compare cloud center and service infrastructure.
2. Analyze different cloud services provided by Amazon

21CS004 Principles of Programming Languages

3 0 0 3

Course Outcomes

1. Explain the concepts of programming languages.
2. Describe syntax and semantics of programming languages.
3. Explain data types, and basic statements of programming languages.
4. Illustrate the concept of subprogram.
5. Demonstrate the concepts of ADT and OOP.
6. Summarize the concept of exception handling and event handling.

CO–PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	-
CO3	3	1	3	1	-	-	-	-	-	-	-	-	3	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	3	-	-	-	-	-	-	-	-	3	-
CO6	3	2	2	3	-	-	-	-	-	-	-	-	3	-

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

Unit I

Preliminary Concepts **12 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 **12 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 **12 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 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: 48 Hours

Textbook (s)

1. Robert W. Sebesta, "Concepts of Programming Languages", Tenth Edition, Addison Wesley, 2012.
2. Programming Languages, Principles & Paradigms, 2ed, Allen B Tucker, Robert E Noonan, TMH

Reference (s)

1. R. Kent Dybvig, "The Scheme programming language", Fourth Edition, MIT Press, 2009.
2. Jeffrey D. Ullman, "Elements of ML programming", Second Edition, Prentice Hall, 2098.
3. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009.
4. 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

1. Explain numeric types?
2. Summarize grammars for simple assignment statements.
3. 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>

21CS005 Mobile Computing

3 0 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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	3	-	-	-	-	2	-	2	-	2	-	2
CO2	2	-	2	-	-	-	-	2	-	2	-	2	-	3
CO3	2	-	1	-	-	-	-	2	-	2	-	2	-	3
CO4	2	-	2	-	-	-	-	2	-	2	-	2	-	3
CO5	2	-	2	-	-	-	-	2	-	3	-	2	-	3
CO6	2	-	2	-	-	-	-	2	-	3	-	2	-	3

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

Unit I

Introduction to Mobile Communications **12 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 **12 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) **12 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 **12 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: 48 Hours

Textbook (s)

1. Raj Kamal, Mobile Computing, Oxford press, Third Edition, 2018
2. Jochen Schiller, Mobile Communications, Pearson Eduction, Secon Edition, 2020

Reference (s)

1. Asoke K Talukder, Hasan Ahmad and RoopaYavagal, 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

1. Define Mobile Computing
2. List the applications of mobile computing
3. List the limitations of mobile computing
4. Define Mobile Adhoc Network
5. List the MANET routing issues

Understand

1. Explain mobile computing with architecture
2. Explain TDMA and FDMA with neat diagrams
3. Illustrate the different services provided by the GSM, Explain with system architecture
4. Explain IP Packet delivery with diagram
5. Describe DSSM (Direct Sequence Spread Spectrum)

Apply

1. Illustrate Registration process achieved in mobile network layer
2. Discuss the feature of tunneling and encapsulation
3. Illustrate the function of Dynamic Host Configuration Protocol (DHCP)
4. Discuss about security in Ad-hoc network
5. 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?

21CS006 Distributed Operating Systems

3 0 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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO6	3	1	2	-	-	-	-	-	-	-	-	1	2	2

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

Unit I

Introduction and Communication in Distributed System **12 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 **12 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 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 **12 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: 48 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 theCPU 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 anode, the available memory space of the node can be distributed among these processes 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.

21DS507 Deep Learning Lab

0 0 3 1.5

Course Outcomes

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

1. Design and implement the basic structure of neural network.
2. Design and develop the various Neural Network Models for classification problems.
3. Develop the different type of CNN models for solving real-time problems.
4. Understand and apply the transfer learning techniques with various standard DL models.
5. Develop the different type of RNN models for solving real-time problems.
6. Apply the deep learning models for solving various computer vision and NLP tasks.

CO–PO Mapping

CO	PO4	PO5	PO8	PSO1	PSO2
1	3	2	2	3	3
2	3	3	2	3	3
3	3	3	2	3	3
4	2	2	3	3	3
5	2	2	2	3	3
6	1	1	3	3	3

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

Lab Manual

1. Deep Learning for Data science Laboratory– AIDS Department, GMRIT

Textbook (s)

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron, October 2022: Third Edition.
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. Yegnanrayana , “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, 2019)
4. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006
5. Kevin P. Murphy., Machine Learning: A Probabilistic Perspective

List of Experiments

Week 1: Define the Structure and Parameter’s Initialization in a Neural Network Model.

Week 2: Implement the Forward propagation and Compute the Cost Function.

Week 3: Implement Back propagation to get the gradients and Update parameters (gradient descent)

Week 4: Build a Neural Network Model and predict the Output.

Week 5: Implement the Hebbian Learning neural networks.

Week 6: Digit and Character recognizer using CNN.

Week 7: Explore implementation of AlexNet.

Week 8: Exploring Different CNN Models: VGG16, VGG19
Week 9: Exploring Different CNN Models: GoogleNet,

Week 10: Explore implementation of VGG16 with transfer learning and fine tuning

Week 11: One-hot encoding of words and characters using word embedding.

Week 12: Study the construction and working of Recurrent Neural Network.

Week 13: Explore LSTM

Week 14: GRU to predict stock prices based on historic data.

Week 15: Explore applications like Image segmentation and object detection.

Week 16: Automatic image captioning and video to text models.

Augmented Experiments:

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

a. Image Segmentation
b. Object Detection
c. Human Facial Recognition.
d. Automatic image captioning
e. Stock Market Prediction.
f. Social Media
g. Aerospace
h. Defense
i. Healthcare
j. Signature Verification.
k. Social media
l. Aerospace
m. Defense
n. Healthcare
o. Handwriting Analysis
p. Speech Recognition
q. Weather forecasting

Open Elective-II

21DS001 Fundamentals of Data Science

Course Outcomes

1. Understand the key steps and pipeline of Data Science and its application in solving real-world problems.
2. Recognize the importance of measuring similarity and dissimilarity between features in data for various analysis tasks.
3. Appreciate the significance of pre-processing techniques in preparing data for analysis in real-time scenarios.
4. Identify the characteristics and practical applications of different regression models used in real-world scenarios.
5. Evaluate classification models using appropriate metrics, including the confusion matrix, to assess model performance and make informed decisions.
6. Understand the principles of ensemble modeling and clustering, and apply appropriate ensemble techniques to improve the accuracy and reliability of machine learning models.

COs–POs Mapping

COs	PO1	PO3	PSO1	PSO2
1	1	2	2	2
2	2	2	3	3
3	2	2	3	3
4	3	2	2	2
5	3	2	2	2
6	3	2	2	2

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

UNIT-I **12+8 hours**

Introduction: Relation among AI, ML and Data Science, Importance of Data Science; Data Science Process; **Data Exploration:** Objectives of Data Exploration, Forms of Data(Structured, Semi Structured, Unstructured),Datasets(data objects and types of attributes/fields), Characteristics of Datasets and corresponding Statistical Measures;

Data Visualization: Univariate Visualization, Multivariate Visualization.

Categorization of Data Science Algorithms. Overview of different kind of dataset (i.e. text, image) and the different format(ie. CSV, json).

Practical Components

1. Perform data exploration and statistical analysis on a real-world dataset to understand its characteristics and calculate relevant statistical measures.
2. Explore datasets of different formats (text and image) and apply data exploration techniquesaccordingly.
3. Visualize a dataset using univariate and multivariate visualization techniques to analyze the distribution of data and explore relationships between variables.
4. Analyze a dataset using categorical data visualization techniques (bar plots, pie charts) to gain insights into demographic patterns and distributions.

UNIT-II **12+8 hours**

Data Similarity/Dissimilarity: Understanding data similarity and dissimilarity, Measures for comparing different types of data (nominal, ordinal, binary, numerical).

Data Preprocessing: Data Preprocessing Pipeline, Preprocessing techniques for cleaning and integrating data, Data reduction techniques for handling large datasets, Cosine Similarity.

Distance based similarity (Euclidean distance, Jaccard Similarity).

Practical Components

1. Apply data preprocessing techniques and impute missing values on a real-world dataset.
2. Select a large dataset and apply data reduction techniques such as feature selection and

dimensionality reduction (e.g., PCA, t-SNE) to handle its size while preserving important information and patterns in the data.

3. Calculate the cosine similarity between pairs of text documents to measure their similarity.
4. Integrate multiple datasets and perform data cleaning to create a unified and consistent dataset.

UNIT-III **12+8 hours**

Regression: Introduction to linear regression for forecasting numerical quantities, Logistic regression for classification problems, Regularization techniques for improving model performance;
Classification: ClassificationPrinciples,ClassificationModelEvaluationMetrics(ConfusionMatrix), Classification using Decision Trees, Distance based Classifier(k-NN),Bayesian classifier.
Regression vs Classification.

Practical Components

1. Perform linear regression on a dataset to forecast a specific target variable. Evaluate theperformance of the regression model using appropriate evaluation metrics.
2. Apply the Decision Trees algorithm to build a classification model. Utilize appropriate evaluationmetrics and construct a confusion matrix to assess the model's performance.
3. Perform linear regression on a dataset and apply regularization techniques such as L1 or L2regularization to improve the model's performance.
4. Implement a Bayesian classifier to classify emails as spam or non-spam. Use appropriate evaluation metrics to assess the classifier's performance.

UNIT-IV **12+8 hours**

Ensemble Learning: Conditions for Ensemble Modeling, Overview of ensemble techniques(Voting, Bagging,Boosting and Random Forest);
Clustering: Clustering Principles, Clustering for description/preprocessing/classification, Types of Clustering, Clustering Evaluation Parameters, Clustering Algorithms (k-Means) and Evaluation metrics for assessing the quality of clustering results;
Applications/ Purpose of Clustering.

Practical Components

1. Explore ensemble learning techniques such as Random Forest on a dataset suitable for classification or regression.
2. Apply the K-means clustering algorithm on a dataset for classification purposes. Use evaluation metrics to assess the quality of the clustering results and experiment with different values of k.
3. Use a voting classifier to combine multiple classification algorithms and improve the accuracy of thefinal model.
4. Perform Hyperparameter tuning for any Ensemble Algorithms(ie. RF)

Total: 48+32 Hours

Textbooks:

1. Vijay Kotu & Bala Deshpande, “Data Science: Concepts and Practice”, 2nd Edition, MorganKaufmann Publication, 2017.
2. JlaweiHan&MichelineKamber,“DataMining:ConceptsandTechniques”,3rdEdition,MorganKau f mannPublishers,2012.
3. Pang-NingTanetal.,“IntroductiontoDataMining”,2nd Edition,PearsonPublications,2019.

References:

1. Vijay Kotu & Bala Deshpande, “Data Science: Concepts and Practice”, 2nd Edition, MorganKaufmann Publication, 2017.
2. TomM.Mitchell,"MachineLearning",TataMcGrawHill,1997.
3. SunilaGollapudi,“PracticalMachineLearning”FirstEdition2016,PacktPublishingLtd.

Internal Assessment Pattern

Cognitive Level	Int.Test1(%)	Int.Test1(%)	OpenbookTest[1](%)
Remember	20	20	--
Understand	50	30	--
Apply	30	30	80
Analyze	--	20	20
Evaluate	--	--	--
Create	--	--	--
Total(%)	**100**	**100**	**100**

SAMPLEQUESTION(S)

Remember

1. What are the different forms of data in data science? Provide examples for each form.
2. Name the statistical measures used to analyze datasets in data science.

Understand

1. Why is pre-processing important in machine learning? Explain with relevant examples
2. What is the difference between supervised and unsupervised algorithms? Provide an example for each type.

Apply

1. Imagine you have a dataset containing information about houses. How would you handle the followingscenarios using pre-processing techniques:
    a. Data Cleaning: How would you deal with missing values in the dataset? What approach wouldyou take to handle outliers or inconsistent data?
    b. Data Integration: Suppose you have additional datasets with relevant information about houses,such as neighborhood demographics or school ratings. How would you combine this information with the existing dataset?
    c. Data Reduction: The dataset contains numerous features. How would you simplify the datasetby reducing the number of features without losing important information?
    d. Data Transformation and Discretization: How would you standardize numerical features in thedataset? Additionally, how would you convert continuous variables, such as house prices, into categorical variables for analysis purposes?

Open Book Question(s)

1. Discuss the importance of data visualization in data science. Provide examples of univariate and multivariate visualizations, and explain how they can be used to gain insights from complex datasets. Support your answer with relevant illustrations or diagrams.
2. Compare and contrast supervised and unsupervised learning algorithms. Provide a detailed explanation of each type, including their characteristics, applications, and differences in the training process. Give an example scenario where you would use each type of algorithm.
3. Assume you have been given a dataset with various features related to customer demographics and their purchasing behavior. Design a data science pipeline to address the following tasks:
    a. Data exploration and statistical analysis of the dataset.
    b. Preprocessing steps, including handling missing values, data cleaning, and feature transformation.
    c. Applying a suitable regression model to predict customer spending based on the available features.
    d. Evaluating the performance of the regression model using appropriate evaluation metrics.

21TPX01 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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	2	3	-	3	2	3	-	3	2	2
CO2	2	2	-	3	3	3	-	2	3	3	-	3	2	2
CO3	3	3	-	3	2	3	-	3	2	3	-	3	2	2
CO4	3	3	-	3	2	3	-	3	3	3	-	3	2	2
CO5	2	2	-	3	3	3	-	2	2	3	-	3	2	2
CO6	3	2	-	3	1	3	-	3	3	3	-	3	2	2

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

Term Paper: The term paper is a self-study report with an objective enhancing the students' written technical-communication and shall be carried out in 5th semester. Every student will take up this either individually or as a batch of maximum four members 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 nominated by HoD with the approval of the Controller of Examinations (CoE)

21ESX02 Employability Skills II

0 0 2 0

Course Outcomes

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	-	-	-	2	3	3	3	-	-
CO2	1	1	3	1	1	-	-	-	2	3	3	3	-	-
CO3	1	1	3	1	1	-	-	-	2	2	3	3	-	-
CO4	2	2	3	2	2	-	-	-	3	3	2	3	-	-
CO5	3	2	3	2	2	-	-	-	3	2	2	3	-	-
CO6	2	2	2	2	3	-	-	-	3	2	3	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?	02
2.	**Motivational Talk on Positive Thinking:** Beliefs, Thoughts, Actions, Habits & Results (Success)	02
3.	**Resume Preparation:** Resume? Templates? Mistakes to be avoided in a Resume, Steps to be followed in preparing it.(with examples)	03
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)	03
5.	**Psychometric Tests:** Definition, Types of Psychometric Tests: Numerical Computation, Data Interpretation, Verbal Comprehension, Verbal Critical Reasoning and Personality Questionnaires	03
6.	**Exercises related to Communication:** Story Writing, TAT etc	03
	Total Periods	**16**

Quantitative Aptitude:

Sl No.	Semester-V (Topic)	No. of Periods
1.	Square &Cube roots	02
2.	Partnership	02
3.	Partnership	02
4.	Logarithms	02
5.	Progressions	02
6.	Mensuration	02
7.	Mensuration	02
8.	Data Sufficiency	02
	Total Periods	**16**

Domain Specific: (Data Structures and Algorithms (DSA)-Phase-1) **16 Hours**

Module-1:

Introduction: Importance of Competitive Programming, Conditional Statements, Loops, Nested Loops. Strings, Arrays, Recursion and pointers

Practice Problems:

Week	Topic	Practice Problem Links
1	Introduction to CP	Creating accounts on Globla Coding Platforms
2	Conditional Statements	https://www.codechef.com/practice/tags/conditional-statements
3	Loops	https://www.codechef.com/practice/tags/loops
		https://leetcode.com/tag/math/
		https://www.interviewbit.com/practice/#topics[]=math
4	Nested Loops	https://www.codechef.com/practice/topics/math
		https://www.interviewbit.com/practice/#topics[]=math
5	Strings	https://www.codechef.com/practice/topics/strings
		https://leetcode.com/tag/string/
		https://www.interviewbit.com/practice/#topics[]=strings
6	Arrays	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=arrays
		https://leetcode.com/tag/array/
		https://www.codechef.com/practice/topics/arrays
		https://www.interviewbit.com/practice/#topics[]=arrays
7	Two Pointer	https://www.interviewbit.com/practice/#topics[]=two-pointers
		https://leetcode.com/tag/two-pointers/
8	Recursion	https://leetcode.com/tag/recursion/
		https://www.codechef.com/practice/tags/recursion

Module-2:
Searching, Sorting, Linked List, Linked List: Double Linked List, Circular Linked List, Stack, Queue, hashing

Practice Problems:

Week	Topic	Practice Problem Links
9	Searching-I	https://www.codechef.com/practice/topics/binary-search
		https://leetcode.com/tag/binary-search/
		https://www.interviewbit.com/practice/#topics[]=binary-search
		https://www.codechef.com/practice/tags/searching
10	Searching-II	https://www.codechef.com/practice/topics/binary-search
		https://leetcode.com/tag/binary-search/
		https://www.interviewbit.com/practice/#topics[]=binary-search
		https://www.codechef.com/practice/tags/searching
11	Sorting-I	https://www.codechef.com/practice/topics/sorting
		https://leetcode.com/tag/sorting/
		https://leetcode.com/tag/merge-sort/
12	Sorting-II	https://www.codechef.com/practice/topics/sorting
		https://leetcode.com/tag/sorting/
13	LinkedList: Double LinkedList, Circular LinkedList	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=linked-lists
		https://leetcode.com/tag/linked-list/
		https://www.interviewbit.com/practice/#topics[]=linked-lists
		https://leetcode.com/tag/doubly-linked-list/
14	Stack	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=stacks
		https://leetcode.com/tag/stack/
		https://www.interviewbit.com/practice/#topics[]=stacks-and-queues
15	Queue	https://www.hackerrank.com/domains/data-

		structures?filters%5Bsubdomains%5D%5B%5D=queues
		https://leetcode.com/tag/queue/
		https://www.interviewbit.com/practice/#topics[]=stacks-and-queues
16	Hashing	https://www.interviewbit.com/practice/#topics[]=hashing

References:

1. https://leetcode.com
2. https://www.codechef.com
3. https://www.hackerearth.com
4. https://www.interviewbit.com
5. https://www.hackerrank.com

21HSX12 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		-	-

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 @ 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 beaken into account for CGPA calculation.

21SIX01 Summer Internship I

0 0 0 1

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	2	3	1	3	3	3	3	3	3	3
CO2	3	3	3	3	2	2	1	3	3	1	1	3	3	1
CO3	3	2	3	2	2	1	1	3	2	3	3	2	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3

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

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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	3	1	2	-	2	-	-
CO2	-	-	-	-	-	3	2	1	1	1	-	1	-	-
CO3	-	-	-	-	-	2	3	1	1	1	-	2	-	-
CO4	-	-	-	-	-	3	2	3	1	2	-	2	-	-
CO5	-	-	-	-	-	2	2	1	3	2	-	1	-	-
CO6	-	-	-	-	-	2	2	3	1	2	-	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 3rdsemester. 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

21DS601 Optimization techniques for machine learning

3 0 0 3

Course Outcomes

1. Understand the optimization fundamentals
2. Determine unconstrained optimization techniques
3. Model constrained optimization and convex optimization techniques
4. Understand large scale optimization and regularization techniques
5. Understand advanced optimization techniques
6. Explain optimization for deep learning.

CO–PO Mapping

CO	PO1	PO2	PO4	PSO1	PSO2
1	3	1	2	2	1
2	3	1	2	2	1
3	3	2	2	2	2
4	3	2	2	2	2
5	3	2	2	2	2
6	3	2	2	2	2

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

Unit I **12 Hours**

Introduction to Optimization: Introduction to optimization problems and applications in machine learning, Convexity, convex functions, and convex optimization

Unconstrained Optimization: Gradient descent, Newton's method, and their variants, stochastic gradient descent

Proximal Methods, Online Learning, Distributed and Parallel Optimization

Unit II **12 Hours**

Constrained Optimization: Linear programming and its applications in machine learning, Quadratic programming and its applications in machine learning, Nonlinear programming and its applications in machine learning

Convex Optimization: Convex optimization algorithms: sub gradient methods, projected gradient methods, interior point methods. Duality theory and its applications in machine learning Convex relaxation and its applications in machine learning

Karush-Kuhn-Tucker (KKT) Conditions, Duality in Convex Optimization, Robust Optimization

Unit III **12 Hours**

Large Scale Optimization: Mini-batch gradient descent and stochastic gradient descent, Distributed optimization algorithms, Optimization for online learning

Regularization and Sparsity: L1 and L2 regularization, Elastic net regularization and its applications in machine learning, Group sparsity and its applications in machine learning

Optimization on Parallel Architectures, Sparse Recovery and Compressed Sensing

Unit IV **12 Hours**

Advanced Optimization Techniques: Conjugate gradient methods and their variants, Quasi-Newton methods and their variants, Trust region methods and their variants

Optimization for Deep Learning: Back propagation and optimization in deep learning, Optimization for recurrent neural networks and long short-term memory networks, Optimization for generative models, such as variational auto-encoders and generative adversarial networks

Gradient Clipping, Weight Initialization Techniques, Adaptive Learning Rate Methods

Total: 48 Hours

Textbook (s)

1. "Convex Optimization" by Stephen Boyd and Lieven Vandenberghe
2. "Optimization for Machine Learning" by Suvrit Sra, Sebastian Nowozin, and Stephen Wright
3. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright

Reference (s)

1. "Stochastic Gradient Descent and Beyond" by Martin Jaggi
2. "Sparse Modeling: Theory, Algorithms, and Applications" by Irina Rish and Genady Grabarnik

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 optimization
2. Define purpose of optimization

Understand

1. Explain different convex optimization
2. Explain the advanced optimization techniques

Apply

1. Apply various visual aids to identify behavior of data
2. Make use of Multivariate Analysis methods for data analysis

Analyze

1. Compare and contrast various L1 and L2 regularization

Open Book Exam Questions

Question 1:
Perform below analysis on a house price prediction dataset.

a) Univariate Analysis
   iii. Analysis of a numerical feature
   iv. Analysis of a categorical feature
b) Bivariate Analysis
   v. Relationship of a numerical feature with another numerical feature
   vi. Relationship of a numerical feature with a categorical feature

Question 2:
Perform below analysis on weather prediction dataset.

1. Correlation Analysis
   i. Correlation Heat Map
   ii. Zoomed Heat Map
2. Investigation of missing values
   i. What's missing? to what extent?
   ii. Visualizing missing values in a data frame

21ML602 AUTOMATA THEORY AND LANGUAGE PROCESSORS

3 0 0 3

Course Outcomes

1. Understand State machines, languages and computations
2. Understand regular grammars and regular languages
3. Design Pushdown automata for Context free languages
4. Acquire knowledge of compiler & its Phases
5. Construct parse table for a given context free grammar
6. Apply code optimization techniques to improve the performance of a program

CO–PO Mapping

COs	PO1	PO2	PO3	PO5	PO12
1	3	2	2	1	2
2	3	3	2	--	1
3	3	3	3	1	2
4	2	3	1	2	2
5	3	2	2	2	2
6	3	3	3	3	3

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

Unit I **12 Hours**

Finite Automata: Finite automata model-Deterministic Finite Automata – Nondeterministic Finite automata - Recognition of a language by an Automaton - Equivalence of DFA and NFA, Minimization of Finite Automata - **Regular sets:** Regular Expressions-Arden's theorem –Pumping Lemma for Regular Languages - Closure Properties of Regular sets.

Applications of finite automata, Equivalence of finite automata.

Unit II **12 Hours**

Context free language- Chomsky Classification of languages- Context-free grammar -simplification of Context free Grammar- Chomsky Normal Form-Closure Properties of Context free Languages.

Pushdown Automata: PDA Model-Design-Acceptance by empty stack and final state- Non-deterministic PDA.

Context Sensitive Languages, Linear bounded automata

Unit III **12 Hours**

Language Processing-Phases of a Compiler-Top-down Parsing: Derivation of a string- ambiguous grammar-Left recursion-Left factoring-First and Follow-Non-Recursive Predictive Parsing- LL(1) Grammar-Bottom-up parsing: Model of an LR Parsers-Construction of SLR Parsing Table.

Shift-Reduce parsing – Regular definitions

Unit IV **12 Hours**

Intermediate Code generation and optimization: Three Address Code- Quadruples-Triples-Indirect Triples-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

Syntax directed translation – DAG for expressions **Total 48 Hours**

Text Books:

1. J. E. Hopcroft and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson/Addison Wesley
2. Mishra & Chandra Sekharan, Theory of Computer Science& Automata Language and Computation, 3rd Edition, Prentice Hall of India
3. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers, Principles Techniques an Tools,2nd Edition, Pearson.

Reference books:

1. P. Linz, Introduction to Formal Language and Computation, 2nd Edition, Narosa, 2006.
2. V. Raghavan, Principles of Compiler Design, 2nd Edition, TMH, 2011.

Internal Assessment Pattern

Cognitive Level	Int. Test 1 (%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	30	40	--
Apply	50	40	60
Analyze			40
Evaluate	--	--	--
Create	--	--	--
Total (%)	100	100	100

SAMPLE QUESTION (S)

Remember

1. Write the analytical representation of NFA.
2. Define context free grammar.
3. Define token.

Understand

1. Explain the closure properties of regular languages.
2. Explain the phases of compiler.
3. Explain about code optimization techniques.

Apply

1. Design pushdown automata for L={$a^n b^n$/n>=1}.
2. Calculate the first and follow functions for the given grammar-
   S → (L) / a
   L → SL'
   L' → ,SL' / ∈
1. Construct SLR(1) parsing table for the following grammar
   S' → S
   S → C C
   C → c C
   C → d

Analyse

1. Differentiate Chomsky classification of languages.
2. How does machine dependent code optimization is different from machine independent code optimization?

Open Book Exam Questions

1. Suppose r1 and r2 are regular expressions over the same alphabet Σ. We say r1 = r2 to denote equality of the languages represented by r1 and r2. In other words, every string in the language represented by r1 is also included in the language represented by r2 and vice versa. For each of the following pairs of regular expressions over Σ = {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) r1 = 1 ∗ (1 + 0) ∗0 ∗ and r2 = (0 ∗1 ∗) ∗
   (b) r1 = ((0 + 1) ∗0) ∗0 and r2 = (0 + 1) ∗0 ∗0
   (c) r1 = (0 + 1) ∗01(0 + 1) ∗ and r2 = 1 ∗ (0 + 1) ∗0(0 + 1) ∗1

2. 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;
```

21CS603 Software Engineering

3 0 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

COs–POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	-	-	2	-	-	2	-	3	-
CO2	3	2	3	-	2	-	-	2	-	-	3	-	3	-
CO3	3	2	3	-	3	-	-	-	-	-	3	-	3	-
CO4	3	2	3	-	2	-	-	2	-	-	3	-	3	-
CO5	3	2	3	-	2	-	-	1	-	-	3	-	3	-
CO6	3	2	2	-	2	-	-	1	-	-	3	-	3	-

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

Unit I **12 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 **12 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 **12 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, Static and Dynamic UML diagrams : class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, etc.,

Data Acquisition System - Monitoring and Control System

Unit IV **12 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: 48 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, 7thEdition, 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

SAMPLE QUESTION (S)

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

Remember

1. Define software engineering.
2. List different types software myths.

Understand

1. Applying the process of requirement analysis, discuss how the requirements can be collected for aproject.
2. Applying debugging strategy fin an error from a code?

Apply

1. Applying the process of requirement analysis, discuss how the requirements can be collected for aproject.
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 units 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 releasedto the field.

21MLC12 Machine Learning for Business Intelligence

3 0 2 4

Course Outcomes

1. Understand the basic concepts of business analytics.
2. Identify the application of business analytics and use tools to analyze business data.
3. Apply data mining techniques to find useful patterns in large data and help make better business decisions.
4. Become familiar with various metrics, measures used in business analytics.
5. Illustrate various descriptive, predictive, and prescriptive methods and techniques.
6. Model the business data using various business analytical methods and techniques.

CO–PO Mapping

CO	PO1	PO2	PO3	PO4	PSO1	PSO2
1	3	1	2	1	2	2
2	3	1	3	1	3	3
3	3	3	1	2	2	2
4	1	3	1	3	2	2
5	1	1	3	3	3	3
6	1	2	2	1	3	3

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

UNIT I **11+ 9 Hours**

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

Recommender Systems, Automated Decision-Making, Reinforcement Learning for Decision-Making

Practical Components

1. Descriptive, Predictive analysis on numeric data
2. Implementation of central tendency models on an appropriate dataset
3. Sample case study on Types of Social Media Analytics Report
4. Sample case study on Decision making

UNIT II **12+ 9 Hours**

Data mining, Text mining, Web mining, Spatial mining, Process mining, Data warehouse and datamarts. Data mining process KDD, CRISP-DM, SEMMA and Domain-Specific, Classification and Prediction performance measures -RSME, MAD, MAP, MAPE, Confusion matrix, Receiver Operating Characteristic curve & AUC; Validation Techniques - hold-out, k-fold cross-validation, LOOCV, random subsampling, and bootstrapping.

Nested Cross-Validation, Stratified Cross-Validation, Time Series Cross-Validation

Practical Components

1. Measure Prediction performance with confusion matrix on sample dataset
2. Implement ROC curve and AUC
3. Implementation of K-fold cross validation for sample dataset
4. Implementation of bootstrapping with suitable datasets

UNIT III **11+ 6 Hours**

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, autoregressive moving process, ARIMA, Theil's coefficient.

Coefficient of Variation, Shannon Diversity Index, Simpson's Diversity Index, Gini Coefficient

Practical Components

1. Implementation of various smoothing techniques on sample datasets
2. Implement Moving Average forecasting technique
3. Implement Holt-Winter forecasting technique
4. Implementation of regression for forecasting
5. Measure the Theil's coefficient for suitable data

UNIT IV **11+ 6 Hours**

Six Sigma: Introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox
Statistical Process Control, Design of Experiments, Theory of Constraints (TOC

Practical Components

1. Illustrate difference between 3-sigma vs six-sigma process
2. Implementation of DMAIC method with suitable scenario
3. Case study on Enhancing Employee Management using Lean Six Sigma toolbox

48+32 Hours

Textbooks:

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005
4. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications with SAS", Associate Publishers,2015.

References:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis andDecision Making", 5th Edition, Cengage, 2015.
2. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017.
3. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013.
4. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc,2nd Edition, 2011
5. https://machinelearningmastery.com/time-series-forecasting-methods-in-python-cheat-sheet/
6. https://leansixsigmatoolbox.com/2023/06/08/ongoing-education-lean-six-sigma-employee-engagement/

Internal Assessment Pattern

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

Remember

1. What is business intelligence?
2. Define predictive analysis

Understand

1. Explain the k-fold cross validation with a suitable machine learning algorithm
2. Explain forecasting techniques for time-series data

Apply

1. Illustrate difference between 3-sigma vs six-sigma process
2. Implementation of DMAIC method with suitable scenario

21CSC22 Web Application Developments Framework

3 0 2 4

Course Outcomes

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.

COs–POs Mapping

COs	PO1	PO2	PO3	PO5	PSO1	PSO2
1	3	3	1	1	2	1
2	3	3	3	3	2	3
3	3	3	3	3	2	3
4	3	3	3	3	3	2
5	2	3	2	3	2	3
6	3	3	3	2	2	3

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

UNIT- I **10+4 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. Realization of separation of data, data fetch and representation logics
2. Realization of markup- language and it's styling

UNIT- II **14+10 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 angular components
3. Implementation of custom/user-defined directive
4. Create a TODO Application using Angular JS
5. Implement routing and navigation in Angular JS

Unit III **13+12 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
4. Create a TODO Application using React JS
5. Creating a movie list Application in React JS

6. Creating a Progressive web application with Reusable React Components

Unit IV **11+6 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 template for rendering data
3. Implementation of REST API using Django

Total: 48+32 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 (%)	Assignment Test (%)
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 action Form bean in Struts.
5. Ilustrate the steps required for setting up validator framework in Struts

Analyze

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 preferrable 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.

21MLC32 Cloud Services using AWS

3 0 2 4

Course Outcomes

1. Comprehend different services provided AWS
2. Understand Identify and Access Management in AWS
3. Demonstrate AWS Directory services and AWS Artifact
4. Make use of Amazon Elastic Compute Cloud (EC2) to scalable computing capacity
5. Understand about Elastic File Systems and its features
6. Describe about AWS Storage Options

COs–POs Mapping

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PSO_1
1	2	2	2	2	2	2
2	2	2	2	2	2	2
3	2	2	3	2	2	2
4	3	3	3	3	3	2
5	2	2	2	2	2	2
6	2	2	2	2	2	2

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

Unit-I **12+8 Hours**

Introduction to AWS:

Classic Data Center , Virtualization, Service Comparison: AWS, Azure, and GCP, Amazon Web Services (AWS) and its Benefits, AWS Global Infrastructure, Signup an AWS Free Tier Account.

Different Amazon Web Services, Ways to access AWS: CLI, Console, and SDKs, Explore Management Console and Configure AWS CLI

AWS CloudShell

Practical Components

1. Signup an AWS Free Tier Account
2. Explore Management Console and configure AWS CLI
3. Access AWS: CLI, Console, and SDKs
4. Working with AWS services in AWS CloudShell

Unit-II **12+8 Hours**

Identity and Access Management in AWS:

Identity and Access Management (IAM), Managing Users with IAM, Managing Permissions with Groups, IAM Policy and its Elements, IAM Roles ,Password Policy, Best Practices for IAM

AWS Security Token Services, AWS Single Sign-on, AWS Resources Access Manager, Active directory, Microsoft Active directory, AWS Directory Services, AWS Artifact, AWS Audit Manager, Accessing Billing and Alerts.

AWS Certificate Manager

Practical Components

1. Creating New Users, Roles, and Policies on AWS Console
2. Creating an user group for a collection of IAM users
3. Login to AWS Console via MFA
4. AWS Artifact

Unit-III **12+8 Hours**

Amazon Elastic Compute Cloud (EC2):

Amazon Elastic Compute Cloud (EC2) and Its Benefits, Amazon Machine Image (AMI), Security Groups in AWS, Authentication through Key-pair, Hardware Tenancy – Shared vs. Dedicated, Networking Layer in EC2: VPC, Elastic Network Interface (ENI) and Its Attributes

Public IP vs. Elastic IP, Instance Store

Elastic Block Store (EBS), Its Features and Volume Types

Solid State Drive: General Purpose SSD and Provisioned IOPS

Hard Disk Drive: Throughput Optimized HDD and Cold HDD

Snapshots, Elastic File System (EFS) and Its Features, Amazon Batch, Windows File Server

Amazon FSx for Windows File Server

Practical Components

1. Creating an EC2 instance and Custom AMI
2. Host the Website Inside EC2 instance
3. Create an Elastic IP and attaching an EBS Volume Externally
4. Creating a Snapshot

Unit-IV **12+8 Hours**

AWS Storage Options:

Traditional Storage, Need to Move to Cloud Storage, Traditional vs. Cloud Storage Cost, Cloud Storage, Different Storage Options Available on AWS, Simple Storage Service (S3) and Its Components, Working of S3, Bucket Policy, Access Control List (ACL)

Cross-Region Replication (CRR) and Its Use Case, Amazon S3 Transfer Acceleration, Choice of Storage Classes on S3, Lifecycle Policy of S3 Bucket, AWS Backup.

CDN: CloudFront, Storage Gateway

Practical Components

1. Hosting a Static Website on Amazon S3
2. Replicating Data Across Regions
3. Transfer and Retrieve Data from Glacier
4. Accessing Website Using CloudFront

48+32 Hours

Textbook(s):

1. Amazon Web Services (AWS) 2022 Everything You Need To Know About The Amazon Web Service From Start To End, 2022, Maxwell Harris, Maxwell Harris.
2. Implementing AWS: Design, Build, and Manage your Infrastructure, Yohan Wadia, Rowan Udell, Lucas Chan, Udita Gupta, packt publishers.

Internal Assessment Pattern

Cognitive Level	Internal Test 1 %	Internal Test 2 %	Lab Examination %
Remember	25	25	---
Understand	50	25	---
Apply	25	50	40
Analyze	---	---	20
Evaluate	---	---	40
Create			
Total (%)	**100**	**100**	**100**

Sample Question(s)

Remember

1. List any two cloud services provided by Amazon AWS.
2. What is AWS Artifact?
3. Define EC2.
4. What is Access Control List?

Understand

1. What is Virtualization and explain about that.
2. Explain about Identity and Access Management (IAM).
3. Write and explain about AWS Directory Services.
4. Explain about Access Control List (ACL).

Apply

1. How do we sign up for an AWS Free Tier Account?
2. Illustrate the process of Move to Cloud Storage from normal storage.
3. How Cross-Region Replication (CRR) works?

21CS007 Cloud Computing Essentials (Elective III)

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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	3	-	-	3	2	3	1	-	-	-	-	-
CO2	2	-	3	-	-	1	1	2	3	-	-	-	-	-
CO3	3	-	2	-	-	2	3	1	2	-	-	-	-	-
CO4	4	-	2	-	-	1	3	3	1	-	-	-	-	-
CO5	5	-	2	-	-	1	3	1	2	-	-	-	-	-
CO6	6	-	2	-	-	3	3	3	3	-	-	-	-	-

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

Unit I **12+6 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 Modal.

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 **12+8 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 Servies, 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.
4. Signup an AWS Free Tier Account and Explore Management Console and configure AWS CLI

Unit III **12+10 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. Working on to transfer the files from one virtual machine to another virtual machine.
2. Working on to launch virtual machine using trystack (Online Openstack Demo Version)

3. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster(one master and multiple slaves).Hadoop file management: Adding files and directories, Retrieving files, Deleting files
4. Run Wordcount application using Hadoop single node cluster.
5. Move files between regular Linux file-system and HDFS using put and get commands

Unit IV

Cloud Service Providers **12 + 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
4. Working with AWS services in AWS CloudShell

Total: 48+32 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: RajkumarBuyya, 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, SubraKumaraswamy, ShahedLatif, 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 CIATriad?

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

21CS008 Cryptography and Network Security (Elective III)

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's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	2	-	3	-	-	-	2	-	-
CO2	3	2	2	-	-	2	-	3	-	-	-	2	-	-
CO3	3	2	2	-	-	2	-	3	-	-	-	2	-	-
CO4	3	1	2	-	-	2	-	2	-	-	-	2	-	-
CO5	3	1	2	-	-	2	-	3	-	-	-	2	-	-
CO6	3	1	2	-	-	2	-	2	-	-	-	2	-	-

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

Unit I **12+10 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
4. Write a program to perform encryption and decryption using the following algorithms
    a. Mono-alphabetic cipher
    b. Hill Cipher
5. Write a program to perform encryption using the following algorithms
    a. Railfence Technique
    b. Transposition Technique

Unit II **12+8 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.
3. Write a program to implement the Triple-DES algorithm logic.
4. Write a program to implement the AES algorithm logic.

Unit IV

Locking, Recovery Systems, Indexing, Different Types of Data **12 + 6 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 InjectionCybercrime and Computer Crime, Intellectual Property.*

Practical Components:

1. Implement the Diffie-Hellman Key Exchange mechanism.
2. Write a program that can encrypt and decrypt using a general substitution block cipher.
3. Write a program that can encrypt and decrypt in 4-bit in cipher clock chaining mode using DES.

Total: 48+32Hours

Textbook (s)

1. William Stallings, "Cryptography And Network Security – Principles and Practices", 7th edition, Pearson Education Limited 2017.
2. AtulKahate, "Cryptography and Network Security", 2nd edition Tata McGraw-Hill, 2003.
3. Behourz A Forouzan, Cryptography and Network Security, 2nd edition, Tata McGraw-Hill 2011

Reference (s)

1. Matt Bishop ,"Computer Security art and science ", Second Edition, Pearson Education, 2002
2. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory" Second Edition, Pearson Education, 2007
3. Jonathan Katz, and Yehuda Lindell, Introduction to Modern Cryptography, CRC Press, 2007
4. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006
5. Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, First Edition, 2006.
6. 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 favorite 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.

21DS606 Optimization techniques for Machine Learning Lab

0 0 3 1.5

Course Outcome

1. Develop basic classification & regression ML models
2. Apply constrained and un constrained optimization techniques
3. Understand the convex optimization techniques
4. Demonstrate the working of large scale optimization techniques, regularization and sparsity
5. Implement advanced optimization techniques
6. Demonstrate the application of optimization techniques in DL Models

CO–PO Mapping

CO	PO3	PO4	PO5	PSO1	PSO2
1	3	3	3	3	3
2	3	3	3	3	3
3	3	3	3	3	3
4	3	3	3	3	3
5	3	2	3	3	3
6	3	2	3	3	3

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

Lab Manual

1. **Optimization for Machine Learning Lab**– AIDS Department, GMRIT.

Textbook (s)

1. "Optimization for Machine Learning" by SuvritSra, Sebastian Nowozin, and Stephen Wright
2. "Convex Optimization" by Stephen Boyd and LievenVandenberghe
3. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright

Reference (s)

1. "Stochastic Gradient Descent and Beyond" by Martin Jaggi
2. "Sparse Modeling: Theory, Algorithms, and Applications" by Irina Rish and GenadyGrabarnik

Lab Experiments

1. Implementation of Regression problem for a sample dataset
2. Implementation of Binary and Multiple-Class Classification for a sample datasets
3. Understanding and implementation of Gradient descent.
4. Solving Newton's Method for optimization using Python programming.
5. Implementing and Interpreting Stochastic Gradient Descent
6. Solving a Linear and Non-Linear Programming problem with suitable dataset
7. Convex Optimization in Python using CVXPY and PULP
8. Illustration and implementation of Mini Batch gradient descent.
9. Implementation Elastic net Regression with L1 and L2 penalties
10. Implementing conjugate gradient method with python
11. Implementation and solution of Quasi Newton's method for advanced optimization.
12. Illustration of Artificial Neural network and implementing MNIST dataset
13. ANN with back propagation using ReLu and Adam.
14. Implementing Convolution neural networks (cat vs dog dataset)
15. Implementing LSTM neural **network for textual** sentimental analysis.
16. Implement the Variational Auto-encoder in neural network.

Augmented experiments

1. Comparison of Optimization Algorithms
2. Hyper parameter Optimization
3. Regularization Techniques Comparison
4. Optimizing Neural Network Architecture

5. Large-scale Optimization for Deep Learning
6. Online Learning with Optimization
7. Optimization for Sparse Data
8. Optimization for Deep Reinforcement Learning

21MPX01 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	PSO1	PSO2
CO1	3	3	2	3	2	3	2	2	2	2	3	3	3	3
CO2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO3	2	3	3	3	3	3	3	2	2	2	3	3	3	3
CO4	2	2	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	2	2	3	3	3	3	3	2	3	3	3	3
CO6	3	3	2	2	3	3	3	3	3	3	3	3	3	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

21ESX02 Employability Skills II

0 0 2 2

Course Outcomes

1. Demonstrate oral communication and writing skills as an individual to present ideas coherently
2. Develop life skills with behavioral etiquettes and personal grooming.
3. Assess analytical and aptitude skills.
4. Develop algorithms for engineering applications.
5. Solve engineering problems using software.
6. Utilize simulation tools for testing

COs – POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	1	-	-	-	2	3	3	3	-	-
CO2	1	1	3	1	1	-	-	-	2	3	3	3	-	-
CO3	1	1	3	1	1	-	-	-	2	2	3	3	-	-
CO4	2	2	3	2	2	-	-	-	3	3	2	3	-	-
CO5	3	2	3	2	2	-	-	-	3	2	2	3	-	-
CO6	2	2	2	2	3	-	-	-	3	2	3	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: (Advanced Competitive Programming) **16 Hours**

Module-1:
Non-Linear Data Structures: Heaps - Maps- Trees- Graphs - Tries.

Practice Problems:

Week	Topic	Practice Problem Links
1	Searching	https://www.hackerearth.com/practice/algorithms/searching/linear-search/practice-problems/
		https://www.codechef.com/practice/topics/binary-search
		https://leetcode.com/tag/binary-search/
		https://www.interviewbit.com/practice/#topics[]=binary-search
2	Sorting	https://www.codechef.com/practice/topics/sorting

		https://leetcode.com/tag/sorting/
		https://leetcode.com/tag/merge-sort/
		https://www.codechef.com/practice/topics/sorting
3	Heaps & Maps	https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=heap
		https://www.interviewbit.com/courses/programming/heaps-and-maps
		https://workat.tech/problem-solving/topics/bst-heaps-and-map/practice
4	Trees - I	https://www.codechef.com/practice-old/tags/trees
		https://leetcode.com/problemset/?page=1&topicSlugs=binary-tree
		https://www.hackerearth.com/practice/data-structures/trees/binary-and-nary-trees/practice-problems/
		https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=trees
5	Trees - II	https://www.codechef.com/practice-old/tags/tree-data-structure
		https://leetcode.com/problemset/?page=1&topicSlugs=binary-search-tree
6	Trees - III	https://leetcode.com/problemset/?page=1&topicSlugs=segment-tree
		https://www.interviewbit.com/courses/programming/tree-data-structure
7	Graphs - I	https://www.codechef.com/practice-old/tags/graphs
		https://www.hackerrank.com/domains/algorithms?filters%5Bsubdomains%5D%5B%5D=graph-theory
8	Graphs - II	https://leetcode.com/problemset/?page=1&topicSlugs=graph
		https://www.interviewbit.com/courses/programming/graph-data-structure-algorithms

Module-2:
Algorithm design Techniques: Backtracking – Dynamic Programming – Greedy Approach.

9	Backtracking - I	https://www.codechef.com/practice-old/tags/backtracking
		https://leetcode.com/tag/backtracking/
10	Backtracking - II	https://www.interviewbit.com/courses/programming/backtracking#problems
		https://workat.tech/problem-solving/topics/backtracking/practice
11	Dynamic Programming - I	https://www.codechef.com/practice-old/tags/dynamic-programming
		https://www.hackerrank.com/domains/algorithms?filters%5Bsubdomains%5D%5B%5D=dynamic-programming
		https://www.hackerearth.com/practice/algorithms/dynamic-programming/introduction-to-dynamic-programming-1/practice-problems/
12	Dynamic Programming - II	https://leetcode.com/problemset/?page=1&topicSlugs=dynamic-programming
		https://www.interviewbit.com/courses/programming/dynamic-programming#problems
13	Greedy Algorithms - I	https://www.codechef.com/practice-old/tags/greedy
		https://www.hackerrank.com/domains/algorithms?filters%5Bsubdomains%5D%5B%5D=greedy
		https://www.hackerearth.com/practice/algorithms/greedy/basics-of-greedy-algorithms/practice-problems/
14	Greedy Algorithms - II	https://www.interviewbit.com/courses/programming/greedy-algorithm#problems
		https://leetcode.com/problemset/?page=1&topicSlugs=greedy
15	Tries - I	https://www.codechef.com/practice-old/tags/tries
		https://www.hackerrank.com/domains/data-structures?filters%5Bsubdomains%5D%5B%5D=trie
		https://www.hackerearth.com/practice/data-structures/advanced-data-structures/trie-keyword-tree/practice-problems/
16	Tries - II	https://leetcode.com/problemset/?page=1&topicSlugs=trie

		https://workat.tech/problem-solving/topics/string-and-tries/practice

References:

1. https://leetcode.com
2. https://www.codechef.com
3. https://www.hackerearth.com
4. https://www.interviewbit.com
5. https://www.hackerrank.com

21HSX12 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 beaken 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:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	3	1	2	-	2	-	-
CO2	-	-	-	-	-	3	2	1	1	1	-	1	-	-
CO3	-	-	-	-	-	2	3	1	1	1	-	2	-	-
CO4	-	-	-	-	-	3	2	3	1	2	-	2	-	-
CO5	-	-	-	-	-	2	2	1	3	2	-	1	-	-
CO6	-	-	-	-	-	2	2	3	1	2	-	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 3rdsemester. 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.

7th Semester
Career Path III (ML Ops)

21MLC13 Conversational AI (Elective V)

3 0 0 3

Course Outcomes

1. Understand the fundamentals of Natural Language Processing and basic vectorization approaches.
2. Understand the types of AI assistants, platforms and able to build their own Conversational AI.
3. Understand Dialog systems and Speech Recognition.
4. Understand the Dialog Management and Modeling.
5. Apply different rule based dialog management.
6. Make use of End-to-End Neural Dialogue Systems.

CO–PO Mapping

COs	PO1	PO2	PO4	PO12	PSO1
1	3	2	1	1	1
2	2	3	1	3	1
3	3	2	2	3	2
4	2	3	1	3	3
5	1	3	2	3	3
6	1	2	3	1	1

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

Unit I **12 Hours**

Introduction to NLP:

Definition, History, Building blocks of language, Approaches to NLP, NLP Pipeline, Deep learning in NLP and Transformers in NLP.

Basic Vectorization approaches- One-Hot Encoding, Bag of Words, Bag of N-Gram, TF-IDF; Neural language models, N-gram language model Sequence labeling for POS and Named Entities: POS tagging, Named Entities tagging.

Evaluation of Named Entity Recognition, Markov chains.

Unit II **12 Hours**

Introduction to Conversational AI: Introduction to AI assistants and their platforms: Types of AI assistants and their platforms, Primary use cases for AI assistant technology: self-service assistant, agent assist, and classification and routing.

Building your first conversational AI: Building a conversational AI for Fictitious Inc, What's the user's intent and Responding to the user.

The applications of Conversational AI and Objective of Chatbots.

Unit-III **12 Hours**

Dialog Management and Modelling

Introducing Dialogue Systems: Dialogue System, History, Present-day Dialogue System, Modelling conversation in dialogue systems.

Rule-Based Dialogue Systems: A typical dialogue systems architecture and Tools for developing dialogue systems and Evaluating Dialogue Systems

Challenges of the dialogue systems, Conversational Agents and Multimodal dialogue systems.

Unit IV **12 Hours**

End-to-End Neural Dialogue Systems

Neural Network Approaches to Dialogue Modelling, A Neural Conversational Model, Introduction to the Technology of Neural Dialogue and Open-Domain Neural Dialogue Systems.

Case Study: Chatbots in healthcare and mental health support, Voice-enabled devices and smart home applications.

Objective of Conversational AI with Rasa and Design Principles of the Chatbot.

Total: 48 Hours

Textbook (s)

1. Andrew R. Freed. Conversational AI: Chatbots that work, Manning; 1st edition (12 October 2021)
2. Yoav Goldberg. Neural Network Methods for Natural Language Processing, Morgan and Claypool Life Sciences, 30 April 2017
3. Michael McTear . Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots (Synthesis Lectures on Human Language Technologies), Morgan & Claypool Publishers, 30 October 2020
4. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft), Pearson, 22 Nov 2023.

Reference (s)

1. Xiaoquan Kong , Guan Wang . Conversational AI with Rasa by Packt., 1st edition, Oct 2021.
2. Stephan Bisser . Microsoft Conversational AI Platform for Developers End-to-End Chatbot Development from Planning to Deployment.1st edition, 17 Feb 2021.
3. Lee Boonstra . The Definitive Guide to Conversational AI with Dialog flow and Google Cloud build advanced enterprise chatbots, voice., 1st edition, 24 June 2021.
4. https://hao-cheng.github.io/ee596_spr2019/

Internal Assessment Pattern

Cognitive Level	Int. Test 1(%)	Int. Test 2 (%)	Open Book Exam (%)
Remember	20	20	--
Understand	50	40	--
Apply	30	40	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 the Spoken Language Understanding (SLU)
2. Explain the role of various Intent Classification.

Apply

1. Demonstrate the Frame-based SLU.
2. Make Use of Speech Technology in Dialogue System.

Analyze

1. Distinguish of modeling conversation in Dialogue systems.
2. Compare the Rule-Based Dialogue Systems and Evaluating Dialogue Systems.

Evaluate

1. Evaluate the End-to-End Neural Dialogue Systems.
2. Design an automated speech recognition system

Open book Question:

1. Design a model to analyse a given sentence is negative, positive or neutral for a given dataset and build end to end system.
2. Design and develop a model to Chatbots in healthcare and mental health support.

Career Path II (Full Stack Developer)

21CSC23 Web Application Databases (Elective V)

3 0 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	PO1	PO3	PO5	PSO2
1	3	3	1	1
2	3	2	2	2
3	3	3	3	3
4	3	3	2	3
5	3	2	2	3
6	2	3	3	2

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

Syllabus

Unit I **12 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 **12 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 **12 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 **12 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: 48 Hours

Textbook (s)

1. Web Database Applications with PHP and MySQL, Hugh E. Williams, David Lane, 2nd Edition, O'Reilly, 2004.
2. NoSQL Distilled, PramodSadalage, Martin Fowler, 1st Edition, 2012

Reference (s)

1. Getting Started with NoSQL, GauravVaish, Paperback, Packt, 2013.
2. Fundamentals of Database Systems, ElmasriNavathe Pearson Education. 6th edition, 01 Jan 2013.
3. An Introduction to Database systems, C.J. Date, A.Kannan, S.SwamiNadhan, Pearson, 8th Edition.2004.
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 (Cloud Computing)

21MLC33 Cloud Security Essentials (Elective V)

3 0 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. Anlayze the Security Requirements for the Architecture in cloud services
6. Understand Data Security and best practices involved in securing the cloud.

CO–PO Mapping

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PSO_1
1	3	2	2	2	2	2
2	3	2	2	2	2	2
3	2	2	2	2	2	2
4	2	2	2	2	2	2
5	3	2	3	2	3	2
6	3	2	2	2	2	2

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

Unit I — 12 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 II — 12 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, Disaster Recovery-Disaster Recovery Planning, Disasters in cloud, Cloud Disaster Management.
Security Challenges- Security Policy Implementation, Virtualization Security Management, VM Security Recommendations, VM-Specific Security Techniques.

Unit III — 12 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.

Unit IV — 12 Hours

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: 48 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 (%)	Open Book Exam
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

21IT010 Social Network Analysis (Elective V)

3 0 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	PO2	PO_4	PO_5
1	2	2	2	3
2	2	2	2	3
3	2	2	1	3
4	2	2	1	2
5	2	2	2	3
6	2	2	2	2

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

Syllabus

Unit I **11 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 **13 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 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 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 **12 Hours**

Total: 48 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. GuandongXu, 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 Test2 (%)
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

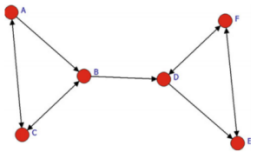
1. What are the limitations of current web?
2. List the statistical properties of social networks
3. Define social similarity.
4. What are the two different measures in influence related statistics

Understand

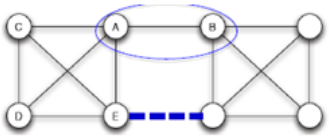
1. Explain about development of semantic web in research.
2. Demonstrate web based networks.
3. Illustrate the ways of visualizing social networks with matrix based representation and node – link diagram.
4. Explain core methods of community detection and mining.
5. Explain algorithms and systems for 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.

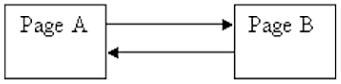


2. Solve Path, Length and Distance between nodes (i.e., Density measures) using SNA Data Processing Tools.
3. Make use of the above graph to solve network density and cut points.
4. Develop random graphs using ErdosReini Model
5. Solve Weak Ties,Traidic closure for the following graph.

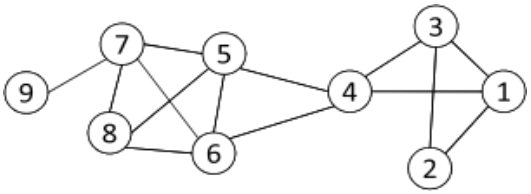


Analyse

6. Compute PageRank for the following figure.



7. Discover Spectral Clustering steps for the following graph.



[2]Comprehensive test should contain only questions related to Higher Order Thinking (HOT) Skills Pertaining to this course

8. Examine the ways to visualize community's hubs and node centrality measures using sna package.
9. 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?

21ML001 Human Computer Interaction (Elective V)

3 0 0 3

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	PO1	PO2	PO3	PO12	PSO1
1	1	1	1	1	2
2	1	1	1	1	2
3	2	2	2	1	2
4	2	1	2	1	2
5	2	2	1	1	2
6	2	2	2	1	2

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

Unit I **12 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 **12 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 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 **12 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: 48 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 Fincay, GreGoryd, Abowd, Russell Bealg, 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

21CS012 Wireless Adhoc Network (Elective-V)

3 0 0 3

Course Outcomes

1. Understand the various challenging issues of wireless Adhoc networks.
2. Apply the MAC protocols using reservation and scheduling mechanisms.
3. Apply the routing protocols and transport layer protocol using various TCS mechanisms in wireless Adhoc 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 Adhoc networks.
6. Analyze the security requirements and secure routing in wireless Adhoc networks.

COs–POs Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	2	1	-	-	2	-	-	-	-
CO2	3	3	2	-	-	1	2	-	-	1	-	-	-	-
CO3	3	3	3	-	-	2	3	-	-	1	-	-	-	-
CO4	3	3	2	-	-	2	1	-	-	2	-	-	-	-
CO5	3	3	2	-	-	1	1	-	-	2	-	-	-	-
CO6	3	2	3	-	-	3	3	-	-	2	-	-	-	-

3–Stronglylinked|2–Moderatelylinked|1–Weaklylinked

UNIT I **12 Hours**

Wireless AdHoc Networks: Introduction, Properties, applications, limitations, Issues in AdHoc Wireless Networks, Ad Hoc Wireless Internet. **MAC Protocols:** Introduction, Issues in Designing a MAC protocol for AdHoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MACProtocols, Contention-Based Protocols, Contention-Based Protocols with reservation Mechanisms.
Contention–Based MAC Protocols with Scheduling Mechanisms

UNIT II **12 Hours**

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for AdHoc 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 AdHoc Wireless Networks.
Other Transport Layer Protocol for AdHoc Wireless Networks.

UNIT III **12 Hours**

Quality of Service: Introduction, Issues and Challenges in Providing QoS in AdHoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad HocWirelessNetworks.**EnergyManagement:**Introduction,NeedforEnergyManagementinAdHocWirelessNetworks,ClassificationofAdHocWirelessNetworks,BatteryManagementSchemes,TransmissionPowerManagementSchemes.
System Power Management Schemes.

UNIT IV **12 Hours**

Security Protocols: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in AdHoc 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: 48 Hours

Textbook(s)

1. AdHoc 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, Taylor & Francis, 1 January 2007.

Reference(s)

1. Wireless Sensor Networks-C.S.Raghavendra, Krishna.M. Sivalingam, 2004, Springer.

2. Ad-HocMobileWirelessNetworks:Protocols&Systems,C.K.Toh,Firsted.PearsonEducation, 1st edition, December 2001.

SAMPLEQUESTION(S)
Internal Assessment Pattern

Cognitive Level	Int.Test1 (%)	Int.Test2 (%)	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 Adhoc wireless networks.
2. List few latest application systems of Adhoc wireless networks.
3. Identify the challenging issues in Adhoc 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 adhoc wireless system.
7. List the benefits when deployment of a commercial adhoc wireless network 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 adhoc 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 adhoc wireless system.
2. Outline the benefits when deployment of a commercial adhoc wireless networks compared to wired network.
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 mechanisms and contention-based protocols with scheduling mechanisms by means of packet delivery, reception, and acknowledgment 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 Adhoc on-demand Distance vector routing protocol (AODV) and dynamic sequence routing protocol (DSRP).
9. Identify any four reasons that lead to the quick power drain of nodes in mobile adhoc 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 20 dB.
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) What do 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.

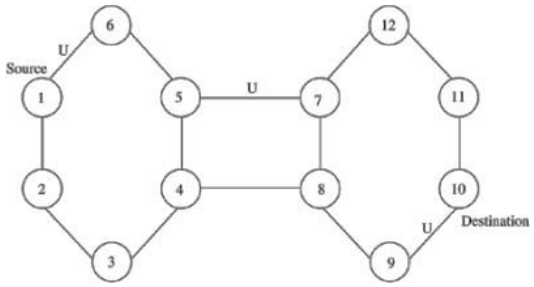
5. With reference to the discussion on scatternets, illustrate the trade-off of synchronization and bandwidth using a timing diagram. (Hint: Consider the case when a Bluetooth device acts as a master in one piconet and as a slave in another.)

Analyze

1. Discuss the deployment scenarios for various HIPERLAN standards in the ETSI BRAN system.
2. Compare the EY-NPMA and the CSMA/CA mechanisms.
3. In serial communications, the baud rate of transmission is specified. Legacy applications on Bluetooth devices specify the baud rate. In the case of old serial communications, the data rate is the specified baud rate, but in the case of Bluetooth serial communications, it is not so. Why?
4. Identify and elaborate some of the important issues in pricing for multi-hop wireless communication.
5. Channel quality estimation can be done both at the sender and the receiver. Which is more advantageous? Why?
6. Compare an adhoc network and a cellular network with respect to bandwidth usage and cost-effectiveness.
7. Compare the pros and cons of using scheduling-based MAC protocols over reservation-based MAC protocols.

Evaluate

1. 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*packetssentinthenetwork.(Linkslabeled"U"refertounstableones.)



2. Justify whether the LCC algorithm (when run consistently with node degrees or node IDs) gives a deterministic result? If so, prove the above fact. Otherwise, give a counter-example.
3. Critique on how content-based multicasting (CBM) could be advantageous or disadvantageous as far as the bandwidth utilization of the network is concerned.
4. Discuss how network security requirements vary in the following application scenarios of ad hoc wireless networks:
   A. Home Network
   B. Classroom Network
   C. Military Network
   D. Emergency Search and Rescue Network
5. Discuss how security provisioning in ad hoc wireless networks differs from that in infrastructure-based networks?

21DS002 Data Visualization with Power BI

3 0 0 3

Course Outcomes

1. Understand the fundamentals & building blocks of Data Visualization using Power BI.
2. Exemplify different Data Visualization charts and techniques.
3. Understand Data Transformation and Modeling.
4. Understand the concepts of DAX and Measures.
5. Apply different Visualization principles and techniques.
6. Make use of End-to-End Power BI Features.

CO–PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2
1	3	2	1	1	1	3	2	2
2	2	3	3	2	3	3	2	3
3	3	3	2	3	1	3	2	3
4	3	3	2	3	3	3	2	3
5	2	3	3	2	3	3	2	3
6	2	3	3	2	3	3	2	3

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

Unit I

Introduction to Data Visualization with Power BI **12 Hours**

Introduction to Data Visualization: Overview, Basic Principles and data types, Types of Data Visualization, Tools and Technologies, Effective Design Principles.

Introduction to Power BI: Definition, History, role in Business Intelligence, Capabilities, Building Blocks of Power BI, Components of Power BI.

Comparison with other data visualization tools and create a semantic model.

Unit II **12 Hours**

Exploring Power BI Features

Data loading and Transformation: Importing data from different data sources, Basic Transformation techniques, Data Cleaning, Power Query for data transformation.

Data Modeling and visualization: Power BI Model Fundamentals, Star Schema Design, Analytic Queries, Data granularity, relationships and cardinality, standard graphs and tables, Hierarchies and groups, slicers and filters.

Case Study : Analyzing a dataset using Basic Power BI Features.

Fact vs Dimension tables, Merging vs Appending tables.

Unit III

Power BI Integration and Collaboration

12 Hours

DAX and Measures: DAX- formulas, data types, functions, operators and variables, Measures – Simple measures, compound measures, quick measures, Calculates Column vs Measures.

Integration and collaboration: Collaborative features in Power BI service, Real time dashboards, Streamline datasets, Power BI Integration options.

Drill-downs, cross-filtering, and bookmarks.

Unit IV

Advanced Topics and Business Intelligence Solutions

12 Hours

Predictive Modeling, Power BI AI Features, DAX time intelligence functions, Model Security, Row level security, Auditing and Monitoring power BI Usage, Performance Optimization.

Case Study: Power BI dashboard for a healthcare organization to analyze patient demographics, treatment outcomes, and resource utilization.

Understanding OLAP (Online Analytical Processing) and multidimensional data modeling.

Total: 48 Hours

Textbook (s)

1. Greg Deckler and Brett Powell, "Microsoft Power BI Cook Book", 2nd Edition, Packt Publisher, 2022.

Reference(s)

1. Errin O' Connor, "Microsoft Power BI Dashboards Step by Step", 1st Edition, Pearson Education, 2020.

SAMPLEQUESTION(S)
Internal Assessment Pattern

Cognitive Level	Int.Test1 (%)	Int.Test2 (%)	OBE(%)
Remember	40	40	--
Understand	35	20	--
Apply	25	20	60
Analyze	--	20	40
Evaluate	--	--	--
Create	--	--	--
Total(%)	100	100	100

21CS015 SOFTWARE PROJECT MANAGEMENT (Elective VI)

3 0 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 on going project performance

CO–PO Mapping

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	2
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	3
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	3
CO4	3	2	3	-	-	-	-	-	-	-	2	2	-	3
CO5	3	2	3	-	-	-	-	-	-	-	3	2	-	3
CO6	3	2	3	-	-	-	-	-	-	-	3	2	-	3

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

Unit I **12 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 **12 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 **12 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 **12 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

Total: 48 Hours

Textbook (s)

1. Walker Royce, "Software Project Management – A Unified Framework", 1stEdition, Pearson Education, 2005.
2. PankajJalote, "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]

21ML002 Reinforcement Learning (Elective VI)

Course Outcomes

The student will be able to

1. Understand the key principles and terminology in reinforcement learning
2. Understand how real-world problems can be structured as Markov Decision Processes
3. Describe the use of dynamic programming in reinforcement learning
4. Apply model-free reinforcement learning methods in reinforcement learning tasks.
5. Explain the concepts behind policy gradient methods and deep learning-based approaches in reinforcement learning.
6. Identify various advanced reinforcement learning methods and summarize their applications in different fields.

CO–PO Mapping

COs	PO1	PO2	PO3	PSO1	PSO2
1	2	1	1	1	1
2	2	2	2	1	1
3	1	1	2	1	1
4	1	3	2	2	1
5	1	3	2	2	1
6	1	3	2	2	1

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

Unit 1: Introduction to Reinforcement Learning and Markov Decision Processes 12 Hours

Introduction to RL terminology: Agent, Environment, Action, State, Reward, Episode -Taxonomy of RL methods - Reinforcement Learning Framework: Agent-environment interface, Goals and rewards. Markov Decision Processes (MDPs): Understanding states, actions, and rewards, Episodes in RL, Markov property - Dynamics and Returns: Transition probabilities and dynamics of MDPs, Calculation of returns.

Real world applications of reinforcement learning.

Unit 2: Dynamic Programming and Monte Carlo Methods 12 Hours

Policy and Value Functions - Bellman equations for value functions -Dynamic Programming in RL: Policy iteration and value iteration, Limitations of dynamic programming - Monte Carlo Methods in RL: Monte Carlo Policy Evaluation, Monte Carlo Control, Control without Exploring Starts, Importance Sampling in Policy Prediction, Incremental Implementation, Policy Monte Carlo Control.

Eligibility Traces

Unit 3: Model-Free Control Methods 12 Hours

Temporal Difference Learning: TD learning Algorithms: TD(0) and TD(λ) algorithms. Model-Free Control Algorithms: SARSA, Q-learning, Double Q-learning, n-step Bootstrapping methods - Exploration vs. exploitation strategies: Exploration Strategies in RL, Exploration-exploitation trade-off.

Function approximation, hierarchical reinforcement learning

Unit 4: Advanced Algorithms and Strategies 12 Hours

Deep Reinforcement Learning: Introduction to Deep Q-Networks (DQN), Experience Replay, Target Networks - Policy Gradient Methods: Basics of policy gradients, REINFORCE algorithm - Actor-Critic Methods: Combining policy gradients with value functions, Actor-critic algorithms, Function Approximation in Actor-Critic - Proximal Policy Optimization (PPO).

Policy Approximation, Multi-Agent Reinforcement Learning

Total: 48 Hours

Textbooks:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction," Second Edition, The MIT Press, 2019.
2. Marco Wiering and Martijn Van Otterlo, "Reinforcement Learning: State-of-the-Art," Adaptation, Learning, and Optimization, Vol. 12, Springer, 2012.
3. Maxim Lapan, "Deep Reinforcement Learning Hands-On," Second Edition, Packt Publishing, 2018.

Reference Books:

1. Csaba Szepesvári, "Algorithms for Reinforcement Learning," Synthesis Lectures on Artificial Intelligence and Machine Learning, Morgan & Claypool Publishers, 2009.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning," MIT Press, 2016.

3. Yuxi Li, "Reinforcement Learning Applications", arXiv preprint arXiv:1908.06973v1, 2019.

Internal Assessment Pattern

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

21SIX02 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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	2	3	1	3	3	3	1	3	3	1
CO2	3	3	3	3	2	2	1	3	3	1	1	3	3	2
CO3	3	2	3	2	2	1	1	3	2	3	1	2	3	1
CO4	3	3	3	3	3	3	2	3	3	3	1	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	2	3	3	2
CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	2

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

21PWX01Project 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	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**	**PSO_1**	**PSO_2**
CO1	3	3	2	3	2	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO3	3	3	3	3	2	3	2	3	2	3	3	2	3	3
CO4	3	3	3	3	2	2	3	3	2	3	3	2	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3

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

8th Semester

21CS018 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

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	3	-	-	-	3
CO2	3	2	2	2	-	-	-	-	-	2	-	-	-	3
CO3	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO4	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO5	2	3	1	1	-	-	-	-	-	2	-	-	-	3
CO6	3	3	2	2	-	-	-	-	-	2	-	-	-	3

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

Unit I **11 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 **13 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 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 **12 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

Total: 48 Hours

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

21CS019 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:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	3	-	-	3
CO2	3	3	2	-	-	-	-	-	-	-	2	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	2	-	-	3
CO4	3	2	3	-	-	-	-	-	-	-	2	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	2	-	-	3
CO6	3	2	3	-	-	-	-	-	-	-	2	-	-	3

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

UNIT I **12 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 **12 Hours**

Value Stream in DevOps: Concept and Goals of Streams, Picking a Value Stream, Understanding Organizational Change, Enabling Transformation;

UNIT III **13 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 Hours**

Learning Acceleration with DevOps: Concept and Goal of Learning, Learning Organizations, Communication, Blameless Culture;

Total: 48 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, Addison-Wesley Professional, February 2017.

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

21DS003 Cyber Security (Elective VIII)

0 0 0 3

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 **12 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 cybercrimes, Reasons for Cyber Crimes, Cyber Security Tools : Nmap, Metasploit, wireshark, tcpdump, snort.

Cyber security awareness, social engineering, cyber stalking

Unit II

Web security **12 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.

Unit III

Intrusion Detection System **12 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

Unit IV

Cyber Laws and Digital Forensics **12 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 Cyber security, 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

Total: 48 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, 6th edition 2018.

Reference (s)

1. Pande, Jeetendra. "Introduction to Cyber Security.", (2017)
2. Pavan Duggal, Cyber frauds, cybercrimes & law in India. 21 July 2013.
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. DafyddStuttard and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley Publication, 2nd edition, 31 Aug 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	-

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 introduter.
2. Apply snort rules to detect intrusion
3. Identify open ports in a network using namp.
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 post scanning methods.
4. Distinguish nmap and metasploit.
5. Compare different tools related to digital forensics

21FIX01 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	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**	**PO_9**	**PO_{10}**	**PO_{11}**	**PO_{12}**	**PSO_1**	**PSO_2**
CO1	3	3	3	2	3	2	2	2	2	2	2	2	3	3
CO2	3	3	3	3	3	2	2	2	2	2	2	2	3	3
CO3	3	3	3	2	3	3	3	2	2	2	3	2	3	3
CO4	2	2	2	3	3	3	3	2	2	2	3	2	2	3
CO5	2	2	3	3	3	3	3	2	2	3	3	3	3	3
CO6	3	3	3	3	3	3	3	2	2	3	3	3	3	3

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