MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Course Structure

&

Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the Academic Year 2023-24

and

B. Tech. Lateral Entry Scheme from the Academic Year 2024-25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Vision and Mission of the Institution

Vision	To become a globally recognized research and academic institution and thereby contribute to technological and socio-economic development of the nation
Mission	To foster a culture of excellence in research, innovation, entrepreneurship, rational thinking and civility by providing necessary resources for generation, dissemination and utilization of knowledge and in the process create an ambience for practice-based learning to the youth for success in their careers.

Vision and Mission of the Department

Vision	To become recognized data science center, emphasizing academic excellence, pioneering research, and data driven solutions, contributing significantly to global technological advancement and socio-economic development..
Mission	➢ To foster a culture that empowers students with state-of-the-art laboratories and learned faculty to compete in the data driven world. ➢ To provide a dynamic atmosphere for data-driven exploration in collaboration with global industry and research organization, encouraging innovation and entrepreneurship. ➢ To nurture professional ethics, inter-disciplinary and practice-based learning among students to serve the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Apply advanced skills in data analysis, utilizing cutting edge tools and techniques in higher studies, and excel in diverse professional settings.

PEO2: Demonstrate a strong aptitude for innovation and entrepreneurship, by creating novel solutions and contributing to industry and society.

PEO3: Collaborate with a culture of ethical and interdisciplinary thinking and address complex challenges.

PROGRAM OUTCOMES (POs)

At the end of the programme, graduate will be able to

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norm of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with t h e 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.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Demonstrate in statistical analysis, machine learning, and visualization, extracting insights from complex datasets.

PSO2: Apply data-driven approaches to solve intricate problems, communicate findings, and drive strategic outcomes.

PSO3: Develop and apply advanced data modeling techniques to make accurate predictions, including predictive analytics and forecasting.

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Total Credits	163 Credits for 2023(Regular) & 123 Credits 2024(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No	Title	Duration
1	Induction Program (Mandatory)	Three weeks' duration at the start of First Year

R23 - Curriculum Structure
I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23ENG101	Communicative English	2	0	0	2	2
2	BSC	23MAT101	Linear Algebra and Calculus	3	0	0	3	3
3	BSC	23CHE102	Chemistry	3	0	0	3	3
4	ESC	23CME101	Basic Civil and Mechanical Engineering	3	0	0	3	3
5	ESC	23CSE101	Introduction to Programming	3	0	0	3	3
6	HSMC	23ENG201	Communicative English Laboratory	0	0	2	2	1
7	BSC	23CHE202	Chemistry Laboratory	0	0	2	2	1
8	ESC	23CSE201	Computer Programming Laboratory	0	0	3	3	1.5
9	ESC	23ME201	Engineering Workshop	0	0	3	3	1.5
10	HSMC	23HUM201	Health and Wellness, Yoga and Sports	-	-	1	1	0.5
Total				**14**	**0**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	23MAT102	Differential Equations and Vector Calculus	3	0	0	3	3
2	BSC	23PHY101	Engineering Physics	3	0	0	3	3
3	ESC	23EEE101	Basic Electrical and Electronics Engineering	3	0	0	3	3
4	ESC	23ME101	Engineering Graphics	1	0	4	5	3
5	PCC	23CSE102	Data Structures	3	0	0	3	3
6	BSC	23PHY201	Engineering Physics Laboratory	0	0	2	2	1
7	ESC	23EEE201	Electrical and Electronics Engineering Workshop	0	0	3	3	1.5
8	ESC	23CSE202	IT Workshop	0	0	2	2	1
9	PCC	23CSE203	Data Structures Laboratory	0	0	3	3	1.5
10	HSMC	23HUM202	NSS / NCC / Scouts and Guides / Community Service	-	-	1	1	0.5
Total				**13**	**0**	**15**	**28**	**20.5**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

R23 - Curriculum Structure
II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	23HUM101	Universal Human Values	2	1	0	3	3
2	HSMC	23HUM102	Economics and Financial Accounting For Engineers	2	0	0	2	2
3	BSC	23MAT107	Probability and Statistics for Computer Science	3	0	0	3	3
4	PCC	23CSD101	Database Systems	3	0	0	3	3
5	PCC	23CSD102	Design and Analysis of Algorithms	2	1	0	3	3
6	PCC	23CSD104	JAVA Programming	3	0	0	3	3
7	PCC	23CSD201	Database Systems Laboratory	0	0	3	3	1.5
8	PCC	23CSD202	JAVA Programming Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – I** *(Refer ANNEXURE - VI)*	1	0	2	3	2
Total				**16**	**2**	**8**	**26**	**22**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	23MAT108	Discrete Mathematical Structures	3	0	0	3	3
2	ESC	23CSD103	Digital Logic and Computer Organization	3	0	0	3	3
3	ESC		Design Thinking and Innovation Related Courses (Refer ANNEXURE - II)	1	0	2	3	2
4	PCC	23CSD105	Introduction to Data Science	3	0	0	3	3
5	PCC	23CSD106	Data Engineering	3	0	0	3	3
6	PCC	23CSD203	Data Science Laboratory	0	0	3	3	1.5
7	PCC	23CSD204	Data Engineering Laboratory	0	0	3	3	1.5
8	SEC		**Skill Enhancement Course – II** *(Refer ANNEXURE - VI)*	1	0	2	3	2
9	Audit Course	23CHE901	Environmental Science	2	0	0	2	-
Total				**16**	**0**	**10**	**26**	**19**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

R23 - Curriculum Structure
III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSD107	Introduction to Machine Learning	3	0	0	3	3
2	PCC	23CSD108	Big Data Analytics	3	0	0	3	3
3	PCC	23CSD109	Software Engineering	2	1	0	3	3
4	ESC	23PHY102	Introduction to Quantum Technologies and Applications	3	0	0	3	3
5	PE		**Professional Elective-I** *(Refer ANNEXURE - IV)*	3	0	0	3	3
6	OE		**Open Elective – I** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CSD205	Introduction to Machine Learning Laboratory	0	0	3	3	1.5
8	PCC	23CSD206	Big Data Analytics Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – III** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	AUC	23ENG901	Technical Paper Writing and IPR	2	0	0	2	-
11	PROJ	23CSD701	Summer Internship I	0	0	4	4	2
Total				**20**	**1**	**12**	**33**	**25**

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSD110	Deep Learning	2	1	0	3	3
2	PCC	23CSD111	Predictive Analytics	3	0	0	3	3
3	PCC	23CSD112	Data Visualization	3	0	0	3	3
4	PE		**Professional Elective - II** *(Refer ANNEXURE - IV)*	3	0	0	3	3
5	PE		**Professional Elective - III** *(Refer ANNEXURE - IV)*	3	0	0	3	3
6	OE		**Open Elective - II** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	PCC	23CSD207	Deep Learning Laboratory	0	0	3	3	1.5
8	PCC	23CSD208	Predictive Analytics and Visualization Laboratory	0	0	3	3	1.5
9	SEC		**Skill Enhancement Course – IV** *(Refer ANNEXURE - VI)*	1	0	2	3	2
10	ESC	23ECE501	Tinkering Laboratory	0	0	2	2	1
11	MC	23CSD901	Workshop*	0	0	0	0	0
Total				**18**	**1**	**10**	**29**	**24**

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* Domain specific workshop should be completed at the end of III Year I Semester

Tentative Structure for Final Year:

R23 - Curriculum Tentative Structure
IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	23CSD113	Data and Information Security	3	0	0	3	3
2	MC		**Management Course** *(Refer ANNEXURE - V)*	2	0	0	2	2
3	PE		**Professional Elective – IV** *(Refer ANNEXURE - IV)*	3	0	0	3	3
4	PE		**Professional Elective – V** *(Refer ANNEXURE - IV)*	3	0	0	3	3
5	OE		**Open Elective - III** *(Refer ANNEXURE - III)*	3	0	0	3	3
6	OE		**Open Elective – IV** *(Refer ANNEXURE - III)*	3	0	0	3	3
7	SEC		**Skill Enhancement Course – V** *(Refer ANNEXURE - VI)*	1	0	2	3	2
8	AUC	23HUM901	Gender Sensitization	2	0	0	2	-
9	PROJ	23CSD702	Summer Internship II	0	0	4	4	2
Total				**20**	**0**	**6**	**26**	**21**

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	23CSD703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

- ***Proficiency modules***

  - Basic Computer Proficiency
  - Interpersonal skills
  - Computer Graphics
  - Web programming
  - Mobile Apps
  - Vocabulary enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

DESIGN THINKING AND INNOVATION RELATED COURSES (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1	23IIC5M01	Design, Technology and Innovation
2	23IIC5M02	Introduction on Intellectual Property to Engineers and Technologists
3	23IIC5M03	Product Engineering and Design Thinking
4	23IIC5M04	Intellectual Property Rights and Competition Law
5	23IIC5M05	Innovation, Business Models and Entrepreneurship
6	23IIC5M06	Understanding Incubation and Entrepreneurship
7	23IIC5M07	Intellectual Property
8	23IIC5M08	Roadmap for Patent Creation
Any new Innovation and Incubation Course offered by SWAYAM NPTEL can be appended in future.		

ANNEXURE - III

OPEN ELECTIVE – I (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM301	Indian Knowledge System	Humanities
2	23MAT301	Advanced Numerical Methods	Mathematics
3	23MAT302	Engineering Optimization	Mathematics
4	23PHY301	LASER Physics and Advanced LASER Technology	Physics
5	23PHY302	Thin Film Technology and its Applications	Physics
6	23PHY303	Wastage To Sustainable Energy And Energy Systems	Physics
7	23CHE301	Chemistry of Polymers and its Applications	Chemistry
8	23CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
9	23CHE303	Chemistry of Energy Systems	Chemistry
10	23CE301	Disaster Management	Civil
11	23CE302	Green Buildings	Civil
12	23ME301	Materials Science for Engineers	Mechanical
13	23ME302	Sustainable Energy Technologies	Mechanical
14	23EEE301	Electrical Safety Practices and Standards	EEE
15	23EEE302	Introduction to MEMS	EEE
16	23ECE301	Bio-Medical Electronics	ECE
17	23ECE302	VLSI Design	ECE
Any new Interdisciplinary Course can be appended in future.			

OPEN ELECTIVE – II (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM3M01	English Language for Competitive Exams	Humanities and Social Sciences
2	23HUM3M02	Public Speaking	Humanities and Social Sciences
3	23HUM3M03	Indian Business History	Humanities and Social Sciences
4	23HUM3M04	Indian Economy: Some Contemporary Perspectives	Humanities and Social Sciences
5	23MG3M01	E – Business	Management
6	23MG3M02	AI in Human Resource Management	Management
7	23MG3M03	AI in Marketing	Management
8	23MG3M04	Artificial Intelligence for Investments	Management
9	23CE3M01	Plastic Waste Management	Civil
10	23CE3M02	Safety in Construction	Civil
11	23ME3M01	Operations Management	Mechanical
12	23EEE3M01	Transducers For Instrumentation	EEE
13	23ECE3M01	Microprocessors and Interfacing	ECE
14	23ECE3M02	Microprocessors and Microcontrollers	ECE
15	23MD3M01	Research Methodology	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23HUM3M05	Indian Society: Sociological Perspectives	Humanities and Social Sciences
2	23MAT3M01	Foundations of R Software	Mathematics
3	23MAT3M02	Foundations of R Software (in Hindi Language)	Mathematics
4	23MGM05	HR Analytics	Management
5	23MG3M06	Management Information System	Management
6	23MG3M07	Business Analytics & Text Mining Modeling using Python	Management
7	23CE3M03	Building Materials and Composites	Civil
8	23ME3M02	Power Plant Engineering	Mechanical
9	23EEE3M02	Design of Photovoltaic Systems	EEE
10	23ECE3M03	System Design Through Verilog	ECE
11	23MD3M03	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	23PHY304	Smart Materials and Devices	Physics
2	23CHE304	Introduction to Nano Science and Technology	Chemistry
3	23CHE305	Water Pollution and its Management	Chemistry
4	23CE303	Environmental Impact Assessment	Civil
5	23CE304	Ground Improvement Techniques	Civil
6	23CE305	Sustainability in Engineering Practice	Civil
7	23ME303	Total Quality Management	Mechanical
8	23ME304	3D Printing Technologies	Mechanical
9	23EEE303	Robotics	EEE
10	23ECE303	Embedded Systems	ECE
11	20ECE304	DSP Architecture	ECE
12	20ECE305	Community Radio Technology	ECE
Any new Interdisciplinary Course can be appended in future.			

ANNEXURE - IV

List of Professional Elective

Professional Elective – I (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD4M01	Operating System Fundamentals
2.	23CSD4M02	Introduction to Internet of Things
3.	23CSD4M03	Introduction to Soft Computing
4.	23CSD4M04	Introduction to Operating Systems
5.	23CSD4M05	Fundamentals of Artificial Intelligence
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD401	Social Network Analysis
2.	23CSD402	Computer Networks
3.	23CSD403	Recommender Systems
4.	23CSD404	Natural Language Processing
Any advanced courses can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD405	Software Project Management
2.	23CSD406	Computer Vision
3.	23CSD407	Cloud Computing
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD408	Software Architecture and Design Pattern
2.	23CSD409	Blockchain Technology
3.	23CSD410	NoSQL Databases
Any advanced courses can be appended in future.		

Professional Elective –V		
Sl. No.	**Course Code**	**Course Title**
1	23CSD411	Agile Methodologies
2	23CSD412	Expert Systems
3	23CSD413	Reinforcement Learning
4	23CSD414	High Performance Computing
Any advanced courses can be appended in future.		

ANNEXURE - V

MANAGEMENT COURSE		
Sl. No.	**Course Code**	**Course Title**
1	23HUM103	Business Ethics and Corporate Governance
2	23HUM104	Principles of Management
3	23HUM105	Human Resource Development
4	23HUM106	Management Science
5	23HUM107	National Cadet Corps

ANNEXURE - VI

List of Skill Enhancement Courses

Skill Enhancement Course – I		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD601	Python programming
Any Courses can be appended in future.		

Skill Enhancement Course – II		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD602	Exploratory Data Analysis with Python
2.	23CSD603	Devops
Any Courses can be appended in future.		

Skill Enhancement Course – III		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD604	Full Stack Development
2.	23CSD605	MLOps
Any Courses can be appended in future.		

Skill Enhancement Course – IV		
Sl. No.	**Course Code**	**Course Title**
1.	23ENG601	Soft Skills
Any Courses can be appended in future.		

Skill Enhancement Course – V		
Sl. No.	**Course Code**	**Course Title**
1.	23CSD606	Generative AI
Any Courses can be appended in future.		

ANNEXURE - VII

Minor in Computer Science and Engineering (Data Science)
(Applicable to CE, ECE, EEE, ME)

Stream Name: Data Science

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDCSD101	Predictive Analytics	3	0	0	3	3
2	Professional Core Course	23MDCSD102	Data Visualization	3	0	0	3	3
3	Professional Core Course	23MDCSD201	Predictive Analytics and Data Visualization Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDCSD103	Data Engineering	3	0	0	3	3
5	Professional Core Course	23MDCSD104	Natural Language Processing	3	0	0	3	3
6	Professional Core Course	23MDCSD202	Data Engineering Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDCSD105	Big Data Analytics	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

Minor in Quantum Computing

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Computing

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS101	Introduction to Quantum Computing	3	0	0	3	3
2	Professional Core Course	23MDINS102	Mathematical Foundations for Quantum Computing	3	0	0	3	3
3	Professional Core Course	23MDINS201	Quantum Programming and Simulation Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS103	Quantum Algorithms	3	0	0	3	3
5	Professional Core Course	23MDINS104	Quantum Information and Communication	3	0	0	3	3
6	Professional Core Course	23MDINS202	Quantum Algorithms Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS105	Quantum Machine Learning (QML)	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

Minor in Quantum Technologies

(Applicable to CE, EEE, ME, ECE, CSE, CST, CSE (AI), CSE (DS), CSE (CS), CSE (AI and ML) and CSE (Networks))

Stream Name: Quantum Technologies

Sl. No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23MDINS106	Foundations of Quantum Technologies	3	0	0	3	3
2	Professional Core Course	23MDINS107	Solid State Physics for Quantum Technologies	3	0	0	3	3
3	Professional Core Course	23MDINS203	Quantum Devices and Materials Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23MDINS108	Introduction to Quantum Communication	3	0	0	3	3
5	Professional Core Course	23MDINS109	Introduction to Quantum Sensing	3	0	0	3	3
6	Professional Core Course	23MDINS204	Quantum Communication and Sensing Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23MDINS110	Quantum Optics Prerequisites for Quantum Technologies	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

ANNEXURE - VIII

Honors in Computer Science and Engineering (Data Science)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	Professional Core Course	23HDCSD101	Data Science for Business	3	0	0	3	3
2	Professional Core Course	23HDCSD102	Software Project Management using Agile	3	0	0	3	3
3	Professional Core Course	23HDCSD201	Data Science for Business Laboratory	0	0	3	3	1.5
III Year II Semester								
4	Professional Core Course	23HDCSD103	Health Care Analytics	3	0	0	3	3
5	Professional Core Course	23HDCSD104	Software Defined Data Center	3	0	0	3	3
6	Professional Core Course	23HDCSD202	Health Care Analytics Laboratory	0	0	3	3	1.5
IV Year I Semester								
7	Professional Core Course	23HDCSD105	Digital and Mobile Forensics	3	0	0	3	3
			Total	**15**	**0**	**6**	**21**	**18**

I Year I Semester

B. Tech I Year I Semester

23ENG101 COMMUNICATIVE ENGLISH

L	T	P	C
2	0	0	2

Pre-requisite: None

Course Objectives:

The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

UNIT I Lesson: HUMAN VALUES: Gift of Magi (Short Story) 9 hours

Listening: Identifying the topic, the context and specific pieces of information by listeningto short audio texts and answering a series of questions.
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 ofinformation.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II Lesson: NATURE: The Brook by Alfred Tennyson (Poem) 9 hours

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

UNIT III Lesson: BIOGRAPHY: Elon Musk 9 hours

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what

isdiscussed
Reading: Readinga text in detail by making basic inferences -recognizing and interpretingspecific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV Lesson: INSPIRATION: The Toys of Peace by Saki **9 hours**

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

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT V Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay) **9 hours**

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

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Course Outcomes:

CO1: Understand the topic, context, and pieces of specific information from personal , professional and social situations

CO2: Apply discourse markers to speak clearly in formal discussions

CO3: Analyze and apply grammatical structures to formulate contextualized phrases and sentences

CO4: Analyze texts and images to write summaries based on global comprehension

CO5: Draft coherent paragraphs and structured essays

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.

Web Resources

Grammer

1 www.bbc.co.uk/learningenglish
2 https://dictionary.cambridge.org/grammar/british-grammar/
3 www.eslpod.com/index.html
4 https://www.learngrammar.net/
5 https://english4today.com/english-grammar-online-with-quizzes/

VOCABULARY

1 https://www.youtube.com/c/DailyVideoVocabulary/videos
2 https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23MAT101 LINEAR ALGEBRA AND CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

UNIT I MATRICES 9 hours

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION 9 hours

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem,Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonicalforms by Orthogonal Transformation.

UNIT III CALCULUS 9 hours

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS) 9 hours

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functionsof two variables, method of Lagrange multipliers.

UNIT V MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS) 9 hours

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Course Outcomes:

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

CO1: Solve the system of linear equations and apply the matrix algebra techniques in practical applications.

CO2: Utilize the Eigenvalues, Eigenvectors and applications of diagonalization in the field of Science and Technology.

CO3: Relate the results of mean value theorems in real life problems.

CO4: Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.

CO5: Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition

2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14^{th} Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, AlphaScience International Ltd., 2021 5^{th} Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5^{th}Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9^{th}edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CHE102 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

UNIT I STRUCTURE AND BONDING MODELS 9 hours

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of N2, O2 and NO, CO π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II MODERN ENGINEERING MATERIALS 9 hours

Semiconductors – Introduction, basic concept, role of doping agents, applications
Super conductors -Introduction, basic concept, applications.
Supercapacitors: Introduction, Basic Concept-Classification – Applications.
Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphene nanoparticles.

UNIT III ELECTROCHEMISTRY AND APPLICATIONS 9 hours

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells – Zinc-air battery, Sodium-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV POLYMER CHEMISTRY 9 hours

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation, Poly Dispersity Index (PDI) & it's significance
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Bio-Degradable polymers - Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA).

UNIT V INSTRUMENTAL METHODS AND APPLICATIONS 9 hours

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopy, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

Course Outcomes:

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

CO1: Explain the foundations of Quantum mechanics and concept of bonding in homo and hetero diatomic molecules like O2, CO etc.

CO2: Apply the principle of Band diagrams in the application of conductors and semiconductors. Properties and applications of nanomaterials.

CO3: Compare the materials of construction for battery, its working principles, fuel cells & electrochemical sensors.

CO4: Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.

CO5: Explain the principles of spectrometry, technique of HPLC in separation of solid and liquid mixtures. Summarize the concepts of Instrumental methods.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

3. G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGraw-Hill; First Edition, 2019.

Reference Books:

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

2. J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley Publications, Feb.2008

3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CME101 BASIC CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

PART A: BASIC CIVIL ENGINEERING

UNIT I BASICS OF CIVIL ENGINEERING 8 hours

Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II SURVEYING 8 hours

Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III TRANSPORTATION ENGINEERING 8 hours

Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Course Outcomes:

CO1: Identify various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Measure of distances, angles and levels through surveying.

CO3: Identify various transportation infrastructures, sources of water and various water conveyance, storage structures like dams and reservoirs.

Text Books:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt.Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers.2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. FifthEdition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, KhannaPublishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives:

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

UNIT I **8 hours**

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries andSociety-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II **8 hours**

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III **8 hours**

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Course Outcomes:

On completion of the course, the student should be able to

CO1: Understand the role and importance of mechanical engineering and engineering materials

CO2: Identify the different manufacturing processes for engineering applications and explain the basics of thermal engineering and its applications.

CO3: Explain the working of different mechanical power transmission systems, power plants and robotics.

Text Books:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.

2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.

3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengagelearning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications

3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.

4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23CSE101 INTRODUCTION TO PROGRAMMING

L	T	P	C
3	0	0	3

Course Objectives:

- Comprehensive knowledge to computer systems, programming languages, and problem-solving techniques.
- Know the concept of control structures and their usage in programming.
- Introduce to the arrays, memory models, and basic string concepts
- Gain a knowledge from the concept of functions, including declaration, definition, and various aspects of function usage.
- Acquire the advanced programming concepts, including user-defined data types, pointers, and file handling.

UNIT I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING **9 hours**

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II CONTROL STRUCTURES **9 hours**

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do- while) Break and Continue.

UNIT III ARRAYS AND STRINGS **9 hours**

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings, String Operations and String functions.

UNIT IV POINTERS & USER DEFINED DATA TYPES **9 hours**

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions, Dynamic memory allocation.

UNIT V FUNCTIONS & FILE HANDLING **9 hours**

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation**.**

Course Outcomes:

A student after completion of the course will be able to

CO1: Illustrate the basic computer concepts and programming principles of C language.

CO2: Develop programs using various control structures in 'C'.

CO3: Design applications using arrays and basic string manipulation.

CO4: Demonstrate the applications of pointers, user-defined types and dynamic memory allocation.

CO5: Design various applications using functions and file concepts.

Text Books:

1. C Programming, A Problem Solving Approach, Forouzan, Gilberg,Prasad, CENGAGE, 3rd edition.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-HillEducation, 2008.

2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition

3. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988

4. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I Semester

23ENG201 COMMUNICATIVE ENGLISH LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Course Outcomes:

CO1: Understand the English speech sounds, stress, rhythm, intonation and syllabic division for better listening and speaking
CO2: Apply communication strategies and implement them in language learning activities.
CO3: Analyze and enhance job-relevant writing skills
CO4: Evaluate and exhibit professionalism in debates and group discussions.
CO5: Make effective presentations by developing public speaking abilities

Suggested Software:

1. Walden Infotech
2. Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.

2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India,2016

3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed),Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com

3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CHE202 CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

- Verify the fundamental concepts with experiments.

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of functional groups in simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Course Outcomes:

At the end of the course, the students will be able to
CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer Bakelite materials.
CO3: Measure the strength of an acid present in secondary batteries.
CO4: Measure the wavelength of absorption of some organic compounds using UV-Vis spectroscopy.
CO5: Determine the EMF & redox potentials using potentiometric titrations.

Reference Books:

1. Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23CSE201 COMPUTER PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- Provide hands-on experience in programming fundamentals, algorithm design, and basic problem-solving techniques.
- Enable students to implement control structures for program flow control in practical scenarios.
- Reinforce understanding of arrays, memory models, and string manipulation through practical exercises
- Provide hands-on practice with functions, function calls, and parameter manipulation using pointers.
- Offer practical exposure to advanced programming concepts, including user-defined data types, file handling, and pointer operations.

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writingthe first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a seriesof finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa

Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:
Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.
Problems to Practice:

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4
Objective: Explore the full scope of expressions, type-compatibility of variables & constantsand operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:
Lab4: Write C program to solve Simple computational problems using the operator' precedence and associativity
Problems to Practice:

i) Evaluate the following expressions.
    a. A+B*C+(D*E) + F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5
Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:
Tutorial 5: Branching and logical expressions:
Lab 5: Write C program for Problems involving if-then-else structures.
Problems to Practice:

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when eachof these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Write a C program for Iterative problems e.g., the sum of series
Problems to Practice:

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:Write a C program to solve 1D Array manipulation, linear search
Problems to Practice:

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be usedas Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Write a C program to solve Matrix problems, String operations, Bubble sort
Problems to Practice:

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gainexperience processing command-line arguments received by C

Suggested Experiments/Activities:
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Write a C program for Pointers and structures, memory dereference.
Problems to Practice:

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details alongwith the total.
v) Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures(Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the samewithout using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Write a C program to solve Simple functions using call by value, solving differential equations using Eulers theorem.
Problems to Practice:

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler'smethod

WEEK 12:
Objective: Explore how recursive solutions can be programmed by writing recursive functionsthat can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Write C program for Recursive functions.
Problems to Practice:
i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Write a C program to solve Simple functions using Call by reference, Dangling pointers.
Problems to Practice:
i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and othercharacters using pointers.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore thedifferences between text and binary files.

Suggested Experiments/Activities:
Tutorial 14: File handling
Lab 14: Write a C program to handle File operations.
Problems to Practice:
i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-linearguments.
v) Find no. of lines, words and characters in a file.
Write a C program to print last n characters of a given file.

Course Outcomes:

CO1: Implement coding and debugging the simple programs, create algorithms, and practice problem solving strategies using programming languages.

CO2: Demonstrate programs that incorporate conditional statements, loops, and break/continue statements to control program execution.

CO3: Apply coding for real time examples with arrays, array indexing, and manipulate strings in programming tasks.

CO4: Create, call, and debug functions, modify function parameters using pointers, and gain practical knowledge of variable scope within functions.

CO5: Apply user-defined data types, manipulate files, pointer operations to solve real-world programming challenges.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.

2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India

2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23ME201 ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridlejoint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire punctureand change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.
CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, MediaPromoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year I Semester

23HUM201 HEALTH AND WELLNESS, YOGA AND SPORTS

L	T	P	C
0	0	1	0.5

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

UNIT I **5 hours**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II **5 hours**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III **5 hours**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
ii) Practicing general and specific warm up, aerobics
iii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Course Outcomes:

After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO2: Demonstrate an understanding of health-related fitness components.
CO3: Compare and contrast various activities that help enhance their health.
CO4: Assess current personal fitness levels.
CO5: Develop Positive Personality

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty,
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

I Year II Semester

B. Tech I Year II Semester

23MAT102 DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

L	T	P	C
3	0	0	3

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

UNIT I DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE **9 hours**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS) **9 hours**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **9 hours**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV VECTOR DIFFERENTIATION **9 hours**

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V VECTOR INTEGRATION **9 hours**

Line Integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Course Outcomes:

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

CO1: Find the solution of engineering problems formulated in the form of linear first order differential equations.

CO2: Solve the linear higher order differential equations related to various engineering fields.

CO3: Determine the solutions for linear partial differential equations that model the physical processes.

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence.

CO5: Estimate the work done against field, circulation and flux using vector calculus.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, PearsonPublishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones andBartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018,5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23PHY101 ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

UNIT I WAVE OPTICS 9 hours

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II CRYSTALLOGRAPHY AND X-RAY DIFFRACTION 9 hours

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III QUANTUM MECHANICS AND FREE ELECTRON THEORY 9 hours

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT IV SEMICONDUCTORS 9 hours

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

UNIT V DIELECTRIC AND MAGNETIC MATERIALS 9 hours

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility

and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

Course Outcomes:

CO1: Apply the knowledge of Interference, Diffraction and Polarization techniques for materials testing and explore their applications in both science and technology.

CO2: Explain the crystal structure in terms of atomic positions, unit cells, and crystal symmetry and also relate the crystal symmetry to the symmetry observed in a diffraction pattern.

CO3: Evaluate the Schrodinger wave equations for simple potentials and explain the concept of conductivity of different types of materials.

CO4: Distinguish the semiconductors using Fermi level and identify the type of semiconductors using Hall effect.

CO5: Explain the origin of fundamental magnetic phenomena and types of magnetic materials. Understand the induced fields in dielectrics, and electrical behaviour of dielectrics.

Text Books:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S. Chand Publications, 11th Edition 2019.

2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.

2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.

3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010

4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23ME101 ENGINEERING GRAPHICS

L	T	P	C
1	0	4	3

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

UNIT I **9 hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.
Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.
Scales: Plain scales, diagonal scales and vernier scales.

UNIT II **9 hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.
Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes
Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III **9 hours**

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV **9 hours**

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.
Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V **9 hours**

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (Not for end examination).

Course Outcomes:

Students will use the Auto CAD software and will be able to

CO1: Construct the geometrical constructions, engineering curves and scales.

CO2: Draw the projections of points, straight lines and planes

CO3: Draw the projections of solids in various positions

CO4: Sketch the sections of solids and developments of surfaces

CO5: Draw the conversion of the isometric views to orthographic views and vice versa.

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.

2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.

3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, TataMcGraw Hill, 2017.

Mode of Evaluation: Day-to-day Evaluation, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23EEE101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC CIRCUITS **8 hours**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II MACHINES AND MEASURING INSTRUMENTS **8 hours**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES **8 hours**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops,Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricitytariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker(MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types,Safety Precautions to avoid shock

Course Outcomes:

After the completion of the course students will be able to

CO1: Infer the basic AC and DC electrical circuits.

CO2: Analyze construction and operation of AC and DC machines, different electrical measuring instruments.

CO3: Illustrate operation of various power generating stations, energy consumption and electrical safety.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti,Dhanpat Rai & Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, ThirdEdition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019,Fourth Edition

2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020

3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford UniversityPress, 2017

4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

UNIT I SEMICONDUCTOR DEVICES 8 hours

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION 8 hours

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS 8 hours

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of BooleanAlgebra, Truth Tables

and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Course Outcomes:

After the completion of the course students will be able to

CO1: Explain the theory, construction, and operation of electronic devices.

CO2: Apply the concept of science and mathematics to explain the working of diodes, transistors, and their applications.

CO3: Analyze logic gates and its applications in design of combinational circuits.

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.

2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.

2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.

3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23CSE102 DATA STRUCTURES

L	T	P	C
3	0	0	3

Course Objectives:

- To attain proficiency in essential knowledge and skills for effectively employing linear data structures and making informed decisions when utilizing them to tackle real-world practical challenges.
- To gain a comprehensive understanding of linked lists, including their different types, operations, and practical applications.
- To explore stacks properties, operations and how stacks are utilized for the evaluation of mathematical expressions, including infix, postfix, and prefix notations.
- To understand the concepts of queues, their operations, and their applications in areas like breadth-first search and scheduling.
- To Provide an overview of Trees and Hashing as a technique for data organization.

UNIT I **9 hours**

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort.

UNIT II **9 hours**

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists

UNIT III **9 hours**

Applications of stacks in expression evaluation, backtracking, reversing list etc.

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deques: Introduction to deques (double-ended queues), Operations on deques and their applications.

UNIT IV **9 hours**

Trees: Introduction to Trees, Binary Tree, Tree Traversal, Binary Search Tree – Insertion, Deletion & Traversal, Height Balanced Trees, Heap Tree, Heap Sort

UNIT V **9 hours**

Graphs: Representations, Biconnected components, Topological sort.

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Course Outcomes:

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

CO1: Apply their knowledge and skills in the context of linear data structures, algorithmic analysis, searching, and sorting, enabling them to solve practical problems.

CO2: Implement linked lists, stack and their applications.

CO3: Implement queues and its applications.

CO4: Implement tree operations for binary tree, binary search tree, height balanced trees and heap tree.

CO5: Design graph and analyse various collision resolution techniques for hashing.

Text Books:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.

2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and PeterSanders

2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E.Hopcroft

3. Problem Solving with Algorithms and Data Structures" by Brad Miller and DavidRanum

4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, and Clifford Stein

5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching,and Graph Algorithms" by Robert Sedgewick

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year II Semester

23PHY201 ENGINEERING PHYSICS LABORATORY

L	T	P	C
0	0	2	1

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a Compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

Course Outcomes:

CO1: Know the various phenomena of light practically and gain knowledge about various optical technique methods.
CO2: Verify the theoretical concepts of optics, magnetism and dielectrics by hands on experiment.
CO3: Apply the scientific process in the conduct of semiconductor experiments and report the experimental findings.
CO4: Understand mechanical phenomena by instruments and apply them in real time applications.
CO5: Acquire and interpret experimental data to examine the physical laws.

Web Resources:

www.vlab.co.in
https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; AtulPrakashan, 2021-22.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23EEE201 ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set,wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be usedby the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by thestudents.
3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LABORATORY

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Note: Minimum Six Experiments to be performed.

Course Outcomes:

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

CO1: Analyze basic DC circuits.

CO2: Understand the usage of common electrical & electronic measuring instruments.

CO3: Understand the basic characteristics of electrical machines and perform energy calculations.

PART B: ELECTRONICS ENGINEERING LABORATORY

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifier.
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters,AC Voltmeters, CROs, all the required active devices.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using Hardware / Software.

Course Outcomes:

At the end of the course, the student will be able to
CO1: Plot and discuss the characteristics of various electron devices.
CO2: Explain the operation of a digital circuit.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version,Pearson Education,2009.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CSE202 IT WORKSHOP

L	T	P	C
0	0	2	1

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSSTo teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

PC Hardware & Software Installation

Task 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 and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Labinstructors should verify the work and follow it up with a Viva. Also students need to go throughthe video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Labinstructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configuredas dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finallystudents should demonstrate, to the instructor, how to access the websites and email. If there isno internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD
Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL
Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT
Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT
Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
- Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Course Outcomes:

CO1: Gain expertise in computer hardware, assembly, and dual-boot OS configuration, enhancing their ability to manage and troubleshoot computer systems effectively.
CO2: Learn to connect to the LAN, configure browsers, use search engines effectively, and practice cyber hygiene for secure internet use.
CO3: Create well-formatted documents and presentations using Microsoft Office and Latex
CO4: Gain proficiency in using Excel or its FOSS equivalent for tasks like scheduling, GPA calculation, data manipulation, and formatting.
CO5: Craft effective and tailored inputs to obtain desired responses from AI tools like ChatGPT.

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech,2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and KenQuamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCOPress, Pearson Education, 3rd edition

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23CSE203 DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

The course aims to strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

List of Experiments:

Exercise 1: Array Manipulation

i) Write a program to reverse an array.
ii) C Programs to implement the Searching Techniques – Linear & Binary Search
iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

i) Implement a singly linked list and perform insertion and deletion operations.
ii) Develop a program to reverse a linked list iteratively and recursively.
iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

i) Create a program to detect and remove duplicates from a linked list.
ii) Implement a linked list to represent polynomials and perform addition.
iii) Implement a double-ended queue (deque) with essential operations.

Exercise 4: Double Linked List Implementation

i) Implement a doubly linked list and perform various operations to understand its properties and applications.
ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

i) Implement a stack using arrays and linked lists.
ii) Write a program to evaluate a postfix expression using a stack.
iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

i) Implement a queue using arrays and linked lists.
ii) Develop a program to simulate a simple printer queue system.
iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

i) Use a stack to evaluate an infix expression and convert it to postfix.
ii) Create a program to determine whether a given string is a palindrome or not.
iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Tree & Binary Search Tree

i) Implement Binary tree using array and linked list.
ii) Implement BST using Linked List.
iii) Traversing of BST.

Exercise 9: Hashing

i) Implement a hash table with collision resolution techniques.
ii) Write a program to implement a simple cache using hashing.

Course Outcomes:

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

CO1: Implement different types of sorting and searching algorithms using array.

CO2: Demonstrating the different types of linked lists with its basic operations and applications.

CO3: Develop programs using stacks to handle evaluating expressions and solve related problems.

CO4: Apply queue-based algorithms for efficient task scheduling and other related real world problems.

CO5: Implement trees, graph and recognize scenarios where hashing is advantageous and design hash-based solutions for specific problems.

Text Books:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.

2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and PeterSanders

2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E.Hopcroft

3. Problem Solving with Algorithms and Data Structures" by Brad Miller and DavidRanum

4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, and Clifford Stein

5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching,and Graph Algorithms by Robert Sedgewick.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech I Year II Semester

23HUM202 NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE

L	T	P	C
0	0	1	0.5

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

UNIT I ORIENTATION **5 hours**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II NATURE & CARE **5 hours**

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III COMMUNITY SERVICE **5 hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders-Surveyin the village, identification of problems- helping them to solve via media-authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and PopulationEducation.
v) Any other programmes in collaboration with local charities, NGOs etc.

Course Outcomes:

After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme*
2. Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
3. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
4. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGraw Hill, New York 4/e 2008
5. Masters G. M., Joseph K. and Nagendran R. "Introduction to EnvironmentalEngineering and Science", Pearson Education, New Delhi. 2/e 2007

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

II Year I Semester

B. Tech II Year I Semester

23HUM101 UNIVERSAL HUMAN VALUES

L	T	P	C
2	1	0	3

Course Prerequisite: None or Universal Human Values – I (desirable)

Course Description :

The course has 28 lectures and 14 tutorials in 5 Units. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

Course Objectives: None. Universal Human Values-I (desirable)

The main objectives of the course is to

1. help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure happiness and prosperity in continuity, which are the core aspirations of all human beings.
2. facilitate the development of a Holistic perspective among students towards life and profession based on right understanding of the Human reality, family, society and the rest of nature. Such holistic perspective forms the basis of Universal Human Values (UHV) and movement towards value-based living in a natural way.
3. highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. aid the students to realize their full human potential and act accordingly.
5. assist the students to live with feeling of relationship, harmony and co-existence.

UNIT I INTRODUCTION TO VALUE EDUCATION 8 hours

Lecture 1: Understanding Value Education
Lecture 2: self-exploration as the Process for Value Education
Tutorial 1: Practice Session PS1 - Sharing about Oneself
Lecture 3: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 - Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 - Exploring Natural Acceptance

UNIT II HARMONY IN THE HUMAN BEING 8 hours

Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 - Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 - Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 - Exploring Harmony of self with the body

UNIT III HARMONY IN THE FAMILY AND SOCIETY **10 hours**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 - Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 - Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 - Exploring Systems to fulfil Human Goal

UNIT IV HARMONY IN THE NATURE/EXISTENCE **8 hours**

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 - Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 - Exploring Co-existence in Existence.

UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS **8 hours**

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 - Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 - Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 - Exploring Steps of Transition towards Universal Human Order

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the Natural Acceptance and basic human aspiration.
CO2: Aware of themselves and self-regulation.
CO3: Recognize human-human relationship (Justice) and identify human goals in the society.
CO4: Appreciate the harmony in the nature and existence.
CO5: Develop as socially and ecologically responsible engineers in handling problems with sustainable solutions (user-friendly and eco-friendly).

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Learning Resources

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

10. https://uhv.org.in/
11. https://www.youtube.com/@UniversalHumanValues/playlists
12. https://fdp-si.aicte-india.org/index.php

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23HUM102 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
2	0	0	2

Course Prerequisite: NIL

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

This course enables students to

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the different market structures and price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS **7 hours**

Scope and Significance of Economics- Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS **7 hours**

Production Function – Short-run and long-run production – Cost Analysis: Cost concepts - Cost Structure of Firms and Output Decision- Break-Even Analysis (BEA) – significance and Limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING **6 hours**

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic – Price determination under Perfect, Monopoly, and Monopolistic Competition, Pricing objectives- Pricing Strategies.

UNIT IV BASICS OF ACCOUNTING **7 hours**

Accounting - Double Entry System - Accounting Principles - Classification of Accounts - Rules of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING **7 hours**

Ratio Analysis - Liquidity, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand Engineering economics basic concepts,

CO2: Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

CO3: Compare various different market structures and identify suitable market,

CO4: Demonstrate an understanding and analyzing the accounting statements, and

CO5: Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Books:

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007
2. Aryasri: Business Economics and Financial Analysis, 4/e. MGH.
3. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009
4. Varshney & Maheswari: Management Economics, Sultan Chand
5. Financial Statement Analysis, Khan and Jain, PHI, 2009
6. Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books:

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007
2. Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007
3. Financial Management and Policy, Van Horne, James, C., Pearson, 2009.
4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23MAT107 PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE

L	T	P	C
3	0	0	3

Course Prerequisite: 23MAT101, 23MAT102

Course Description:

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, descriptive statistics, Correlation and Regression, Estimation, Confidence intervals, Hypothesis testing.

Course Objectives:

This course enables students to

1. To extend and formalize knowledge of the theory of probability and random variables.
2. To solve real time problems in engineering and science by using discrete and continuous distributions
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To analyze the data by using descriptive statistics for decision making
5. To apply the statistical inference involving confidence interval and hypothesis testing in data analysis.

UNIT I PROBABILITY **9 hours**

Introduction to Probability, Sample space and events, axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Baye's theorem.

Random variables (discrete and continuous), probability density functions, distribution function, mathematical expectation, properties. moment generating function.

UNIT II PROBABILITY DISTRIBUTIONS **9 hours**

Discrete probability distributions - Binomial, Poisson, Geometric and their properties

Continuous probability distributions - Uniform, Exponential, Gamma, Normal distributions and their properties, Chebychev's inequality.

UNIT III JOINT DISTRIBUTIONS **9 hours**

Joint densities and Independence - Marginal distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of regression, Transformation of random variables.

UNIT IV STATISTICS FOR DATA ANALYSIS **9 hours**

Data Visualization, Moments, skewness, kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, lines of regression, regression coefficients and their properties.

UNIT V STATISTICAL INFERENCE **9 hours**

Population, sampling, Estimation, Point estimation, MLE, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the probability concepts and their importance in engineering.

CO2: Apply discrete and continuous probability distributions to solve various engineering problems.

CO3: Get an idea about joint density functions, distribution functions to the random variables and analyse the multivariate problems in engineering

CO4: Apply the method of least squares to estimate the parameters of a regression model.

CO5: Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text Books:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Dr.B.S.Grewal, " Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books:

1. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3. Dean G. Duffy, "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E Books:

1. http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
2. https://www.khanacademy.org

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSD101 DATABASE SYSTEMS

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand the concept of DBMS and ER Modeling.
2. To explain the normalization, Query optimization and relational algebra.
3. To have an introductory knowledge about the storage and query processing techniques and the basic concepts of Information retrieval techniques
4. To learn about the internal storage structures using different file and indexing techniques which will help in physical DB design
5. To apply the concurrency control, recovery, security and indexing for the real time data.

UNIT I DATABASE SYSTEMS CONCEPTS AND DATA MODELING 9 hours

Introduction to Databases- File System Vs Database System - Data Models- Schemas and Instances - DBMS Architecture- Centralized - Client Server - Database Applications, Types of Databases.

Entity Relationship Model: Types of Attributes, Entities and Entity set, Relationship, Structural Constraints - Relational Model, Relational model Constraints - Mapping ER model to a relational schema - Integrity Constraints, Specialization and generalization using ER Diagrams.

UNIT II SQL 9 hours

The Database Language SQL – Simple Queries in SQL – Queries Involving Morethan One Relation, SQL functions(Data & Time, String conversion, Sub Queries, aggregate operators, null values, complex integrity constraints, triggers, views and indexes, Dynamic SQL, Cursors, Introduction to JDBC, Stored Procedures.

UNIT III NORMALIZATION 9 hours

Translating SQL Queries into Relational Algebra and Relational Calculus, Guidelines for Relational Schema – Functional dependency; Normalization, Boyce Codd Normal Form, Multi-valued dependency and Fourth Normal form; Join dependency and Fifth Normal form

UNIT IV DATA STORAGE AND TRANSACTION MANAGEMENT 9 hours

Storage strategies: Indices, B-trees, B+-trees, hashing. Two-Phase Locking Techniques for Concurrency Control -ACID Property– Concurrency Control based on timestamp – Recovery Concepts – Recovery based on deferred update – Recovery techniques – Buffer management

UNIT V SECURITY AND RECENT TRENDS 9 hours

Database Authentication, Authorization and access control, DAC, MAC and RBAC models, SQL injection. Introduction, Need of NoSQL, CAP Theorem and Recent trends.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Construct an ER model and derive the relational schemas from the model.

CO2: Understand the conceptual and logical database design using SQL queries.

CO3: Apply Normalization to improve database design.

CO4: Interpret the basic issues of storage and transaction management.

CO5: Analyse the fundamental security concepts for database

Text Books:

1. A. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 7th Edition 2021.

2. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015

Reference Books:

1. Raghu Ramakrishnan,Database Management Systems,Mcgraw-Hill,4th edition,2015.

2. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSD102 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course are to

1. Introduce the concepts of algorithm analysis, Tree and Graph applications.
2. Discuss various algorithm design strategies with examples.
3. Introduce NP-Hard and NP-Complete problem concepts

UNIT I **9 hours**

Introduction to Algorithm Analysis, Space and Time Complexity Analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion Operations and Applications, B-Trees – Creation, Insertion, Deletion operations and Applications, Graphs – Basic search and Traversals

UNIT II **9 hours**

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication. Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees

UNIT III **9 hours**

Dynamic Programming: General Method, Allpairs shortest paths, Single Source Shortest Paths– General Weights (Bellman-Ford Algorithm), 0/1 Knapsack, Travelling Salesperson problem

UNIT IV **9 hours**

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring.

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT V **9 hours**

NP-Hard and NP-Complete Problems: Basic Concepts, Cook's theorem. NP-Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP). NP-Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Course Outcomes:

After completion of the course, students will be able to

CO1: Illustrate the working of the advanced tree and graph data structures and their applications.

CO2: Design Divide and Conquer strategy and Greedy method for different problems.

CO3: Demonstrate Dynamic programming method to solve problems.

CO4: Apply Backtracking and Branch & bound strategy to solve problems.

CO5: Understand NP-Hard and NP-Complete problems

Text Books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with Applications, Trembley& Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs:, N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgotia Pub.

Online Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSD104 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

Course Objectives:

The learning objectives of this course are to:

1. Identify Java language components and how they work together in applications.
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and interfaces in Java applications.
4. Understand how to use Java packages, Exceptions and I/O Streams for program development.
5. Understand how to design applications with threads in Java.

UNIT I FUNDAMENTAL BUILDING BLOCKS 9 hours

Object Oriented Programming: Basic concepts, Program Structure in Java: Introduction, Writing Simple Java Programs, Data types, Type casting, Tokens in Java Programs, Java Statements –Control statements, Looping Statements, Break Statement, Continue Statement. Command Line Arguments, User Input to Programs, Escape Sequences, Comments, Programming Style.

Arrays: one dimensional and multi-dimensional array.

UNIT II CLASSES AND METHODS 9 hours

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, this and static keywords.

Methods: Introduction, Defining Methods, Overloaded Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods.

UNIT III INHERITANCE 9 hours

Inheritance: Basics, Types of Inheritances, Usage of Super, Method Overriding, Abstract Classes, Final Keyword.

Interfaces: Creating, Implementing, Using, Extending, and Nesting of interfaces.

UNIT IV PACKAGES AND STREAMS 9 hours

Packages: Defining, Finding and Importing packages, Member Access.

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

I/O Streams: Byte Stream Classes and Character Stream Classes.

UNIT V MULTITHREADED PROGRAMMING 9 hours

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Course Outcomes:
After completion of the course, students will be able to
CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects.
CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and interface concept.
CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5: Develop multithreaded applications with synchronization.

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.

2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH

2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

3. JAVA for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Online Resources

1. https://nptel.ac.in/courses/106/105/106105191/

2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01288046454761881634 7_shared/overview

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year I Semester

23CSD201 DATABASE SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

1. To understand the components of DBMS and to study the database design.
2. To study the retrieval of data using relational algebra and calculus and the concept of normal forms in the design of database.
3. To comprehend the structure of SQL Queries to query, update, and manage a database.
4. To understand all constraints to develop a business application using cursors, triggers and stored procedures.
5. To provide sufficient skill to utilize the DBMS concept in real time applications.

List of Programs:

1. Design Conceptual database schema using ER Modelling Software Tools.
2. Development of Relational Database Schemas for Deposit/Customer/ borrow/ branch using DDL Constructs of SQL.
3. To perform various data manipulation commands such as select, insert, update etc. of SQL on Relational Database.
4. To perform various DCL and TCL construct of SQL on Relational Database.
5. Implement different types of referential and integrity constraints on Relation Database.
6. To apply the concept of Aggregating Data using Group functions.
7. To retrieve the queries using Group by, Having and Order by clauses of SQL.
8. Design and development of Banking database and perform various type of JOIN operations.
9. Insert the Data into table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL
10. Write a trigger that automatically deletes students when they graduate
11. Develop programs using features parameters in a CURSOR for UPDATE
12. a) Create a cursor to update the salary of employees in EMP table.

    b) Write a PL/SQL program to raise an Exception when the bonus exceeds salary.
13. Design and implementation real time project with database connection.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Perform table creation, maintain, and manipulate a relational database using SQL.
CO2: Implement complex queries using SQL.
CO3: Apply Queries using Advanced Concepts of SQL.
CO4: Build PL/SQL programs including stored procedures, functions, cursors and triggers.
CO5: Develop a real-world application to access and render data.

Reference Books:

1. NetworkAnalysis–MEVanValkenburg,PrenticeHallofIndia,revised3rdEdition,2019.
2. EngineeringCircuitAnalysisbyWilliamH.Hayt,JackKemmerly,JamiePhillips,StevenM.Durbin,9th Edition2020.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year I Semester

23CSD202 JAVA PROGRAMMING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

The aim of this course is to

1. Practice object-oriented programming in the Java programming language
2. Implement Classes, Objects, Methods, Inheritance and interfaces concepts.
3. Illustrate implement Packages and Exception handling mechanism.
4. Construct Threads and various states.

List of Experiments:

1. Write a JAVA program to display default value of all primitive data type of JAVA.
2. Write a Java program that checks whether a given string is a palindrome or not.
   Ex: MADAM is a Palindrome.
3. Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
4. Write a JAVA program to implement constructor overloading.
5. Write a JAVA program implement method overloading.
6. Write a JAVA program to implement multi level Inheritance
7. Write a JAVA program give example for "super" keyword.
8. Write java program to create a super class called Figure that receives the dimensions of two dimensional objects. It also defines a method called area that computes the area of an object. The program derives two subclasses from Figure. The first is Rectangle and second is Triangle. Each of the sub class overridden area() so that it returns the area of a rectangle and a triangle respectively.
9. Write a JAVA program for abstract class to find areas of different shapes.
10. Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
11. Write a JAVA program that import and use the user defined packages
12. Write a JAVA program that describes exception handling mechanism
13. a) Write a JAVA program that creates threads by extending Thread class. First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds,(Repeat the same by implementing Runnable)
    b) Write a program illustrating is Alive and join ()
    c) Write a Program illustrating Daemon Threads.
    d) Write a JAVA program Producer Consumer Problem

Course Outcomes:

After completion of the course, students will be able to

CO1: Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.

CO2: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.

CO3: Familiar with commonly used Java Packages and exception handling in real time applications.

CO4: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.

CO5: Proficiently construct multi-threading applications.

Reference Books:

1. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.

2. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition, 2007.

3. Bruce Eckel, "Thinking in Java", Pearson Education, 4th Edition, 2006.

4. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 5th Edition, 2010.

Online Resources:

1. https://java-iitd.vlabs.ac.in/

2. http://peterindia.net/JavaFiles.html

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

II Year II Semester

B. Tech II Year II Semester

23MAT108 DISCRETE MATHEMATICAL STRUCTURES

L	T	P	C
3	0	0	3

Course Prerequisite: 23MAT101

Students should have a solid understanding of high school-level algebra, including Set notions, Relations, Functions, Permutations-Combinations, equations, and inequalities.

Course Description:

Discrete Mathematical Structures is a foundational course designed to introduce students to the essential concepts and structures of discrete mathematics. This course is crucial for students in computer science, information technology, computing, and related fields, providing the mathematical framework necessary for the analysis and design of algorithms, data structures, learning and intelligent systems.

Course Objectives:

This course enables students to

1. Develop a strong foundation in propositional and predicate logic, enabling the analysis and construction of logical arguments and proofs.
2. Master various counting techniques and understand the properties of algebraic structures such as groups and binary operations.
3. Gain a deep understanding of relations, equivalence classes, order relations, lattices, and Boolean algebras.
4. Learn to model and solve problems using sequences and recurrence relations, both homogeneous and nonhomogeneous.
5. Study the fundamental concepts of graph theory, including paths, cycles, trees, and the various types of graphs and their properties.

UNIT I LOGICAL STRUCTURES 9 hours

Introduction- Propositions and Truth Values- Logical Connectives and Truth Tables-Tautologies and Contradictions -Logical Equivalence and Logical Implication -The Algebra of Propositions - Arguments - Formal Proof of the Validity of Arguments -Predicate Logic - Arguments in Predicate Logic (Theory of Inference).

UNIT II COUNTING TECHNIQUES AND ALGEBRAIC STRUCTURES 9 hours

Counting Techniques- Pigeonhole principle- Inclusion-exclusion principle- Binary Operations and Their Properties- Algebraic Structures- Groups in Modular Arithmetic - Cyclic Groups- Groups of Permutations- Substructures-Morphisms.

UNIT III ORDERED STRUCTURES 9 hours

Relations and Their Representations- Equivalence Classes and Partitions- Order Relations- - Hasse Diagrams-Lattices- Properties of Lattices- Boolean Algebras – Properties of Boolean Algebras- Boolean Functions- Minimization of Boolean Expressions.

UNIT IV RECURRENCE RELATIONS 9 hours

Sequences - Recurrence Relations- Applications of Recurrence Relations- Modeling with Recurrence Relations- Solving Linear Recurrence Relations- Solving Linear Homogeneous Recurrence Relations with Constant Coefficients- Linear Nonhomogeneous Recurrence Relations with Constant Coefficients-

Generating Functions- Useful facts about Power Series- Using Generating Functions to Solve Recurrence Relations

UNIT V GRAPH STRUCTURES 9 hours

Graphs-Graph Terminology and Special Types of Graphs-Representing Graphs and Graph Isomorphism-Connectivity-Euler and Hamilton Paths-Shortest-Path Problems-Planar Graphs -Graph Coloring-Introduction to Trees-Spanning Trees-Minimum Spanning Trees.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Evaluate the elementary logical arguments and identify the fallacious reasoning for the syntax of programming languages.

CO2: Utilize counting principles in computing techniques and algorithm analysis, and learn the properties of various algebraic structures.

CO3: Analyze various types of relations, equivalence classes, partitions using Hasse diagrams, and the properties of lattices and Boolean algebra.

CO4: Apply recurrence relations to model and solve many computational problems by generating functions.

CO5: Identify the special types of graphs for analyzing the connectivity models, and also study the properties of trees.

Text Books:

1. Rowan Garnier and John Taylor, Discrete Mathematics (Proof, Structures and Applications), CRC Press, an informa business, 3rd Edition, 2009.

2. Kenneth H. Rosen, Discrete Mathematics and its applications, 6th Edition, Tata McGraw Hill, 2011.

Reference Books:

1. J.P. Trembley and R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill – 13th reprint, 2012.

2. U.S. Gupta, ''Discrete Mathematical Structures'', 1st Edition, Pearson Education India, 2014.

3. Kevin Ferland, ''Discrete Mathematical Structures'', 1st Edition, Cengage Learning, 2009.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CSD103 DIGITAL LOGIC AND COMPUTER ORGANIZATION

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course is to

1. Provide a comprehensive understanding of digital logic design principles and computer organization fundamentals
2. Illustrate Computer Arithmetic Operations and Processor Organization
3. Explain the fundamentals of Memory and Input/output (I/O) systems

UNIT I **9 hours**

Data Representation: Signed and Unsigned Binary Arithmetic – Fixed and Floating Point Binary Number representations – Hamming Code - Error Detection and Correction

Digital Logic & Combinational Circuits: Boolean Algebra, Minimization of Logic expressions, Quine–McCluskey Method - K-Map Simplification - Combinational Circuits: - Adders, Multiplexers, De-Multiplexers, Encoders and Decoders – Code Converters

UNIT II **9 hours**

Digital Logic & Sequential Circuits: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers

Introduction to Computer Architecture: Computer Types, Functional units, Bus structures, Software, Technology, Computer Generations, Von- Neumann Architecture, Eight Great Ideas

UNIT III **9 hours**

Computer Arithmetic: Fixed Point and Floating Point Arithmetic - Addition, Subtraction, Unsigned and Signed Multiplication, Division Algorithms - Floating Point Arithmetic Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction Cycle – CISC and RISC Processors – x86 and ARM Addressing Modes and Instruction set

UNIT IV **9 hours**

Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memory, Elements of Cache – Memory Mapping Techniques, Cache Performance - Redundant Array of Independent Disks.

UNIT V **9 hours**

Pipelining and Parallelism: Pipelining Strategy, Pipeline performance, Pipeline Hazards. Parallel Architecture - Flynn's classification – Multicore Architecture – Clusters – GPU Architecture

Input/output Organization: Data Transfer Schemes: - Programmed I/O, Interrupt Driven I/O, Direct Memory Access.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Demonstrate the fundamental principles of digital system design and design combinational logic circuits.

CO2: Design sequential logic circuits and explain the functional units of computer

CO3: Apply algorithms for Arithmetic Operations and understand Instruction Set Architectures

CO4: Explain memory hierarchy and Concepts of Cache

CO5: Understand the concepts of Pipelining, Parallelism and I/O

Text Books:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill
2. William Stallings, "Computer Organization and Architecture Designing for Performance",11th Edition, Pearson Publications.
3. Digital Design, 6th Edition, M. Morris Mano, Pearson Education.

Reference Books:

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson

Online Learning Resources

1. https://nptel.ac.in/courses/106/103/106103068/

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CSD105 INTRODUCTION TO DATA SCIENCE

L	T	P	C
3	0	0	3

Course Objectives:

From the course the student will learn

1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science;
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

UNIT I **9 hours**

Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT II **9 hours**

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III **9 hours**

NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV **9 hours**

Tools and Applications of Data Science: Introducing **Neo4j**for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V **9 hours**

Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools.
Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Course Outcomes:

After completion of the course, students will be able to

CO1: Understand the fundamental concepts and applications of data science.
CO2: Apply machine learning techniques to solve data science problems.
CO3: Compare and contrast relational and NoSQL databases.
CO4: Utilize graph databases for data analysis.
CO5: Create interactive data visualizations.

Text Books:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016
2. Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, "Data Science From Scratch", OReilly, 2019
2. Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CSD106 DATA ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

1. Explain basic concepts of Data Engineering
2. Discuss bout Data Engineering Life Cycle
3. How to design Good Data Architecture

UNIT I **9 hours**

Introduction to Data Engineering: Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities, Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles

UNIT II **9 hours**

Data Engineering Life Cycle: Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT III **9 hours**

Designing Good Data Architecture: EnterpriseArchitecture,Data Architecture**,** Principles of Good Data Architecture, Major Architecture Concepts.

Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details

UNIT IV **9 hours**

Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.

Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT V **9 hours**

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL

Course Outcomes:

After completion of the course, students will be able to

CO1: Understand data engineering fundamentals, differentiate from data science, and identify key data engineer roles and responsibilities.

CO2: Grasp the data engineering lifecycle, including security, management, and operational aspects.

CO3: Design effective data architectures based on data sources, models, and architectural principles.

CO4: Select optimal storage and ingestion methods for efficient data pipelines.

CO5: Master querying, modeling, and transformation techniques to deliver valuable data products.

Text Books:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc.,June 2022,ISBN: 9781098108304

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech II Year II Semester

23CSD203 DATA SCIENCE LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- The main objective of the course is to inculcate the basic understanding of Data Science and its practical implementation using Python

List of Experiments

1. Creating a NumPy Array
   a. Basic ndarray
   b. Array of zeros
   c. Array of ones
   d. Random numbers in ndarray
   e. An array of your choice
   f. Imatrix in NumPy
   g. Evenly spaced ndarray
2. The Shape and Reshaping of NumPy Array
   a. Dimensions of NumPy array
   b. Shape of NumPy array
   c. Size of NumPy array
   d. Reshaping a NumPy array
   e. Flattening a NumPy array
   f. Transpose of a NumPy array
3. Expanding and Squeezing a NumPy Array
   a. Expanding a NumPy array
   b. Squeezing a NumPy array
   c. Sorting in NumPy Arrays
4. Indexing and Slicing of NumPy Array
   a. Slicing 1-D NumPy arrays
   b. Slicing 2-D NumPy arrays
   c. Slicing 3-D NumPy arrays
   d. Negative slicing of NumPy arrays
5. Stacking and Concatenating Numpy Arrays
   a. Stacking ndarrays
   b. Concatenating ndarrays
   c. Broadcasting in Numpy Arrays
6. Perform following operations using pandas
   a. Creating dataframe
   b. concat()
   c. Setting conditions

   d. Adding a new column
7. Perform following operations using pandas
   a. Filling NaN with string
   b. Sorting based on column values
   c. groupby()
8. Read the following file formats using pandas
   a. Text files
   b. CSV files
   c. Excel files
   d. JSON files
9. Read the following file formats
   a. Pickle files
   b. Image files using PIL
   c. Multiple files using Glob
   d. Importing data from database
10. Demonstrate web scraping using python
11. Perform following preprocessing techniques on loan prediction dataset
   a. Feature Scaling
   b. Feature Standardization
   c. Label Encoding
   d. One Hot Encoding
12. Perform following visualizations using matplotlib
   a. Bar Graph
   b. Pie Chart
   c. Box Plot
   d. Histogram
   e. Line Chart and Subplots
   f. Scatter Plot
13. Getting started with NLTK, install NLTK using PIP
14. Python program to implement with Python Sci Kit-Learn & NLTK

Python program to implement with Python NLTK/Spicy/Py NLPI

Course Outcomes:

After completion of the course, students will be able to

CO1; Master NumPy and Pandas for efficient data manipulation and computation.
CO2; Excel at data import, cleaning, preparation, and web scraping.
CO3: Create effective data visualizations using Matplotlib.
CO4: Grasp foundational machine learning concepts and data preparation techniques.
CO5: Develop a solid understanding of Natural Language Processing (NLP) fundamentals.

Reference Books:

1. https://www.analyticsvidhya.com/blog/2020/04/the-ultimate-numpy-tutorial-for-data-science-beginners/
2. https://www.analyticsvidhya.com/blog/2021/07/data-science-with-pandas-2-minutes-guide-to-key-concepts
3. https://www.analyticsvidhya.com/blog/2020/04/how-to-read-common-file-formats-python
4. https://www.analyticsvidhya.com/blog/2016/07/practical-guide-data-preprocessing-python-scikit-learn
5. https://www.analyticsvidhya.com/blog/2020/02/beginner-guide-matplotlib-data-visualization-exploration-python/6
6. https://www.nltk.org/book/ch01.html

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year II Semester

23CSD204 DATA ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- The main objective of this course is to teach how build data engineering infrastructure and data pipelines

Experiments:

1. Installing and configuring Apache NiFi, Apache Airflow
2. Installing and configuring Elasticsearch, Kibana, PostgreSQL, pgAdmin
3. Reading and Writing files
    a. Reading and writing files in Python
    b. Processing files in Airflow
    c. NiFi processors for handling files
    d. Reading and writing data to databases in Python
    e. Databases in Airflow
    f. Database processors in NiFi
4. Working with Databases
    a. Inserting and extracting relational data in Python
    b. Inserting and extracting NoSQL database data in Python
    c. Building database pipelines in Airflow
    d. Building database pipelines in NiFi
5. Cleaning, Transforming and Enriching Data
    a. Performing exploratory data analysis in Python
    b. Handling common data issues using pandas
    c. Cleaning data using Airflow
6. Building the Data Pipeline
7. Building a Kibana Dash Board
8. Perform the following operations
    a. Staging and validating data
    b. Building idempotent data pipelines
    c. Building atomic data pipelines
9. Version Control with the NiFi Registry
    a. Installing and configuring the NiFi Registry
    b. Using the Registry in NiFi
    c. Versioning your data pipelines
    d. Using git-persistence with the NiFi Registry
10. Monitoring Data Pipelines

a. Monitoring NiFi in the GUI
b. Monitoring NiFi using processors
c. Monitoring NiFi with Python and the REST API

11. Deploying Data Pipelines
    a. Finalizing your data pipelines for production
    b. Using the NiFi variable registry
    c. Deploying your data pipelines
12. Building a Production Data Pipeline
    a. Creating a test and production environment
    b. Building a production data pipeline
    c. Deploying a data pipeline in production

Course Outcomes:

At the end of the course student will be able to:

CO1: Master data engineering fundamentals using NiFi, Airflow, Python, and databases.
CO2: Build robust, efficient, and reliable data pipelines for various data scenarios.
CO3: Utilize cloud-native technologies for data exploration, visualization, and monitoring.
CO4: Implement effective data governance strategies for data versioning, metadata management, and pipeline lifecycle management.
CO5: Optimize data pipeline performance and scalability for handling increasing data volumes and complexity

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech II Year II Semester
Audit Course

23CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Course Objectives:
This course enables students to

1. To make the students to get awareness of the environment.
2. To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3. To save the earth from the inventions by the engineers.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 6 hours

Definition, Scope, and Importance – Need for Public Awareness.
Natural Resources: Energy resources**-** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

UNIT II ECOSYSTEMS 7 hours

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a) Forest ecosystem.
b) Grassland ecosystem
c) Desert ecosystem.
d) Aquatic ecosystems (freshwater - ponds, streams, lakes, rivers, marine ecosystem- oceans, estuaries)

Biodiversity and its Conservation : Introduction, Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Specific case studies.

UNIT III ORDERED STRUCTURES 6 hours

Definition, Cause, effects, and control measures of:
Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards
Pollution case studies - Role of an individual in the prevention of pollution

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes
Disaster management: floods, earthquakes, cyclones and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 5 hours

Sustainable Development Goals, From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rainwater harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6 hours

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.

Field Work: Visit a local area to document environmental assets River/forest grassland/hill/mountain – Polluted site - Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Exploring different types of renewable and non-renewable energy sources.

CO2: Students will learn about the structure and function of different ecosystems.
CO3: Students will learn about different types of pollution (air, water, soil) and their sources, effects, and control measures.
CO4: Exploring the science behind climate change, its evidence, and its impacts on ecosystems and human societies.
CO5: Understanding demographic factors and their environmental implications.

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, Third Edition, 2021.
2. Palaniswamy, “Environmental Studies”, Pearson Education, Second Edition, 2014.
3. S. Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K. Raghavan Nambiar, “Textbook of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd. Second Edition, 2008.
5. A. Koushik & C. P. Koushik, Perspectives in Environmental Studies, New Age International, Fourth Edition, 2006.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications, Second Edition, 2012.
2. M. Anji Reddy, “Textbook of Environmental Sciences and Technology”, BS Publication, Second Edition, 2023.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, Third Edition, 2009.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private Limited, Second Edition, 2004.
5. G.R. Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House, Fourth Edition, 2014.
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private Limited, Third Edition, 2007.

Online Resources:

1. Atika Qazi; Fayaz Hussain; Nasrudin ABD. Rahim; Glenn Hardaker; Daniyal Alghazzaw, "Towards sustainable energy: a systematic review of renewable energy sources, technologies, and public opinions," 10.1109/ACCESS.2019.2906402, IEEE Access, vol. 7, pp. 63837-63851, 2019.
2. Gina Garland, Samiran Banerjee, Anna Edlinger, Emily Miranda Oliveira, Chantal Herzog, Raphaël Wittwer, Laurent Philippot, Fernando T. Maestre, Marcel G. A. van der Heijden, "A closer look at the functions behind ecosystem multifunctionality: A review," https://doi.org/10.1111/1365-2745.13511, Journal of Ecology, vol. 109, no. 2, pp. 600-613, 2021.
3. Siddiqua, A, Hahladakis, J.N. and Al-Attiya, “An overview of the environmental pollution and health effects associated with waste landfilling and open dumping,” https://doi.org/10.1007/s11356-022-21578-z, Environmental Science and Pollution Research, 29(39), pp.58514-58536, 2022.
4. Seddon N, Chausson A, Berry P, Girardin C.A, Smith A. and Turner B, “Understanding the value and limits of nature-based solutions to climate change and other global challenges,” https://doi.org/10.1098/rstb.2019.0120, Philosophical Transactions of the Royal Society B, 375(1794), p.20190120, 2020.
5. Hannes Weber and Jennifer Dabbs Sciubba, "The effect of population growth on the environment: evidence from European regions," https://doi.org/10.1007/s10680-018-9486-0, European Journal of Population, vol. 35, pp. 379-402, 2019.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

III Year I Semester

B. Tech III Year I Semester

23CSD107 INTRODUCTION TO MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Programming proficiency in Python, Linear Algebra and Probability & Statistics

Course Description:

This course introduces students to the foundational concepts and techniques of Machine Learning. It covers various learning paradigms including supervised, unsupervised, and Bayesian learning, along with key algorithms for classification, regression, and clustering. The course also focuses on practical aspects such as data preparation, model training, evaluation, and feature engineering. Students will gain the knowledge required to build and apply machine learning models to solve real-world problems across domains.

Course Objectives:

The main objectives of the course is to

1. Introduce the fundamental concepts, types, and applications of Machine Learning.
2. Understand Bayesian and supervised learning methods for classification tasks.
3. Apply regression techniques and assess model assumptions and improvements.
4. Explore unsupervised learning techniques for clustering and pattern discovery.
5. Develop skills in model evaluation and basic feature engineering for improved learning performance.

UNIT I INTRODUCTION TO MACHINE LEARNING & PREPARING TO MODEL **8 hours**

Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT II BAYESIAN CONCEPT LEARNING & SUPERVISED LEARNING: CLASSIFICATION **12 hours**

Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Supervised Learning: Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms-k-Nearest Neighbour(kNN), Decision tree, Random forest model, Support vector machines

UNIT III REGRESSION **6 hours**

Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT IV UNSUPERVISED LEARNING **6 hours**

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K- Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods

DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules

UNIT V MODELLING AND EVALUATION &BASICS OF FEATURE ENGINEERING **13 hours**

Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the fundamentals, types, tools, and issues in machine learning.
CO2: Apply Bayesian and supervised learning methods to classification problems.
CO3: Implement regression models and evaluate their accuracy and limitations.
CO4: Analyze unsupervised learning techniques like clustering and association rules.
CO5: Select and evaluate models, and perform basic feature engineering.

Text Books:

1. Machine Learning, Saik at Dutt, Subramanian Chandra mouli, Amit Kumar Das, Pearson, 2019.
2. Müller, A. C., & Guido, S. (2016). Introduction to machine learning with Python: a guide for data scientists. " O'Reilly Media, Inc.".
3. Aurélien, Géron. "Hands-on machine learning with scikit-learn & tensorflow." Geron Aurelien 134 (2017): 145-150.

Reference Books:

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press
2. VanderPlas, Jake. Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc.", 2016.
3. Yoav Goldberg, Neural Network Methods for Natural Language Processing, Morgan & Claypool Publishers, 2017.

Online Learning Resources

- Andrew Ng, “Machine Learning B.Techning”
- https://www.deeplearning.ai/machine-learning- B.Techning/
- Shai Shalev-Shwartz , Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms” , Cambridge University Press. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CSD108 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Database Management Systems (DBMS)

Course Description:

This course introduces students to the foundational concepts and technologies of Big Data and its analytics. It covers the evolution, characteristics, and challenges of Big Data, along with tools and frameworks like Hadoop, MapReduce, MongoDB, Hive, Pig, and Spark. The course emphasizes the comparison between traditional RDBMS and Big Data frameworks and equips students with the knowledge required to analyze structured, semi-structured, and unstructured data. Students will also learn about NoSQL databases and advanced analytics techniques such as text, web, and link analytics, preparing them for real-world data-intensive problem-solving.

Course Objectives:

The main objectives of the course is to

1. Understand the concepts, characteristics, and importance of Big Data and analytics.
2. Explore MapReduce programming and manage data using the Hadoop ecosystem.
3. Familiarize students with data storage, retrieval, and operations using MongoDB.
4. Provide hands-on experience in developing data processing workflows using Hive and Pig.
5. Analyze large-scale data using Spark, along with text, web, and link analytics techniques.

UNIT I INTRODUCTION TO BIG DATA ANALYTICS 9 hours

Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data,Typical data warehouse and Hadoop environment.

Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools , NoSQL, Hadoop.

UNIT II HADOOP AND MAP REDUCE FRAMEWORK 9 hours

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator).

Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.

UNIT III INTRODUCTION TO MONGODB 9 hours

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

UNIT IV DATA PROCESSING WITH HIVE AND PIG 9 hours

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).

Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

UNIT V SPARK AND ADVANCED BIG DATA ANALYTICS 13 hours

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark.
Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

Course Outcomes:

After completing the course, students will be able to:
CO1: Explain the characteristics and importance of Big Data and its analytical value.
CO2: Implement MapReduce programs and manage datasets using the Hadoop ecosystem.
CO3: Perform data storage and retrieval operations using MongoDB.
CO4: Design and execute data workflows using Hive and Pig for analysis.
CO5: Analyze large datasets using Spark and apply text, web, and link analytics.

Text Books:

1. Seema Acharya and Subhashini Chellappan “Big data and Analytics” Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning”, McGraw Hill Publication, 2019.

Reference Books:

1. Kim H. Pries, Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers”, CRC Press, 2015.
2. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Online Learning Resources

1. https://www.coursera.org/specializations/big-data
2. Free Big Data Tutorial - Big data and Hadoop framework | Udemy

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CSD109 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Programming Fundamentals

Course Description:

This course introduces students to the systematic engineering principles used in the development of high-quality software systems. It covers the complete software development life cycle (SDLC) including requirement gathering, software design methodologies (structured and object-oriented), coding standards, software testing techniques, and quality assurance. The course also addresses project planning, estimation models, software metrics, maintenance strategies, and tools for software development. Students will gain both theoretical insights and practical skills required for building reliable and scalable software systems, preparing them for professional software engineering practices.

Course Objectives:

The main objectives of the course is to

1. To learn the basic concepts of software engineering and life cycle models
2. To explore the issues in software requirements specification and enable to write SRS documents for software development problems
3. To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
4. To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
5. To reveal the basic concepts in software project management

UNIT I BASIC CONCEPTS IN SOFTWARE ENGINEERING AND SOFTWARE PROJECT MANAGEMENT LECTURE **8 hours**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION **8 hours**

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

UNIT III SOFTWARE DESIGN **9 hours**

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

UNIT IV CODING AND TESTING **9 hours**

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

UNIT V SOFTWARE QUALITY, RELIABILITY, AND OTHER ISSUES **9 hours**

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Obtain basic software life cycle activity skills.
CO2: Design software requirements specifications for given problems.
CO3: Implement structure, object oriented analysis and design for given problems.
CO4: Design test cases for given problems.
CO5: Apply quality management concepts at the application level.

Text Books:

1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.
2. Pressman R, “Software Engineering- Practioner Approach”, McGraw Hill.

Reference Books:

1. Somerville, “Software Engineering”, Pearson 2.
2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.
3. Jalote Pankaj, “An integrated approach to Software Engineering”, Narosa

Online Learning Resources

1. https://nptel.ac.in/courses/106/105/106105182/
   http://peterindia.net/SoftwareDevelopment.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23PHY102 INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies.

UNIT I INTRODUCTION TO QUANTUM THEORY AND TECHNOLOGIES 9 hours

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India's Quantum Mission, EU, USA, China

UNIT II THEORETICAL STRUCTURE OF QUANTUM INFORMATION SYSTEMS 9 hours

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

UNIT III BUILDING A QUANTUM COMPUTER – THEORETICAL CHALLENGES AND REQUIREMENTS 9 hours

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

UNIT IV **QUANTUM COMMUNICATION AND COMPUTING – THEORETICAL PERSPECTIVE** **9 hours**

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential

UNIT V **APPLICATIONS, USE CASES, AND THE QUANTUM FUTURE** **9 hours**

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Course Outcomes:

CO1: Explain core quantum principles in a non-mathematical manner.
CO2: Compare classical and quantum information systems.
CO3: Identify theoretical issues in building quantum computers.
CO4: Discuss quantum communication and computing concepts.
CO5: Recognize applications, industry trends, and career paths in quantum technology.

Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

Reference Books:

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.

7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year I Semester

23CSD205 INTRODUCTION TO MACHINE LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Python Programming, Linear Algebra and Statistics

Course Description:

This course provides hands-on experience in implementing key machine learning algorithms and techniques using real-world datasets. Students will explore supervised and unsupervised learning methods, including classification, regression, clustering, and Bayesian models. The course emphasizes understanding algorithmic workflows, evaluating model performance, and applying machine learning to practical problems such as document classification and medical diagnosis. Through programming assignments and experiments, students will gain the practical skills needed to build, test, and analyze machine learning models.

Course Objectives:

The objectives of the course are to

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

List of Experiments:

Note:

a. The programs can be implemented in either JAVA or Python.
b. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
c. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Implement and evaluate Polynomial Regression and Logistic Regression models using appropriate datasets. Visualize the results and compare their performance.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of

clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Projects

1. Predicting the Sale price of a house using Linear regression
2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from image

Course Outcomes:

After completion of the course, Students will be able to

CO1: Understand the Mathematical and statistical prospectives of machine learning algorithms through python programming
CO2: Appreciate the importance of visualization in the data analytics solution.
CO3: Derive insights using Machine learning algorithms

Reference Books:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020.

Online Learning Resources/Virtual Labs:

1. Machine Learning A-Z (Python & R in Data Science Course) | Udemy
2. Machine Learning | Coursera

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year I Semester

23CSD206 BIG DATA ANALYTICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Programming in Java or Python, Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Course Description:

This course provides hands-on experience with Big Data tools and technologies used to store, process, and analyze large-scale datasets. Students will work with the Hadoop ecosystem, including HDFS, MapReduce, Hive, Pig, and Spark, as well as NoSQL databases like MongoDB. The course emphasizes real-world data analysis through scripting and programming in distributed environments. It also introduces basic machine learning tasks using Spark's MLlib and SQL-based analytics tools for deriving insights from unstructured and semi-structured data

Course Objectives:

The objectives of the course are to

1. Introduce students to Big Data tools and distributed computing environments.
2. Enable students to implement MapReduce programs for data processing.
3. Familiarize students with NoSQL operations using MongoDB.
4. Provide hands-on experience in Hive and Pig for analyzing large datasets.
5. Expose students to Spark for performing scalable data analytics and machine learning.

List of Experiments:

1. Install Hadoop and Implement the following file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files and directories.

   Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
2. Develop a MapReduce program to implement Matrix Multiplication.
3. Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.
4. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
5. Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB
6. Write Pig Latin scripts to sort, group, join, project, and filter the data.
7. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
8. Implement a word count program in Hadoop and Spark.
9. Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets.
10. Perform sentiment analysis on a given dataset using Spark's MLlib or Spark SQL to classify reviews as positive or negative. (Dataset: Use the IMDb Movie Reviews Dataset or the Twitter Sentiment Analysis Dataset).

Course Outcomes:

After completion of the course, Students will be able to

CO1: Set up and manage the Hadoop Distributed File System (HDFS).
CO2: Develop MapReduce programs for processing structured and semi-structured data.
CO3: Perform CRUD and aggregation operations using MongoDB.
CO4: Design and execute data processing scripts using Hive and Pig.
CO5: Implement data analytics using Spark and analyze text data for sentiment or pattern recognition

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands-On Approach ",VPT, 2016
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics", John Wiley& sons, 2012
3. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, "Harness the Power of Big Data The IBM Big Data Platform", Tata McGraw Hill Publications, 2012
4. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year I Semester

23ENG901 TECHNICAL PAPER WRITING AND IPR

L	T	P	C
2	0	0	0

Pre-requisite: None

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

UNIT I **9 hours**

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language - highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

UNIT II **9 hours**

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis

UNIT III **9 hours**

Process of research: publication mechanism: types of journals- indexing- seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results-citation rules.

UNIT IV **9 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, ncies and treaties, importance of intellectual property rights

de Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT V **9 hours**

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Identify key secondary literature related to their proposed technical paper writing.
CO2: Explain various principles and styles in technical writing
CO3: Use the acquired knowledge in writing a research/technical paper
CO4: Analyse rights and responsibilities of the holder of Patent, Copyright, Trademark, International Trademark etc.

CO5: Evaluate different forms of IPR available at National & international levels
CO6: Develop skill of making search of various forms of IPR by using dern tools and techniques.

Text Books:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013

2. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practives. Oxford.

Reference Books:

1. R.Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.

2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001

3. P.Naryan, Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.

4. Adrian Wallwork. English for Writing Research Papers Second Edition. Springer Cham Heidelberg New York ,2016

5. Dan Jones, Sam Dragga, Technical Writing Style

Online Learning Resources

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriti ng.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper- journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Mode of Evaluation: Assignments and Mid Term Tests

III Year II Semester

B. Tech III Year II Semester

23CSD110 DEEP LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Basic Probability and Statistics, Python or R Programming, Machine Learning fundamentals

Course Description:

This course provides an in-depth understanding of neural network architectures and deep learning models. It covers the foundational concepts of artificial neural networks, including perceptrons, multilayer networks, and backpropagation. Advanced topics such as regularization techniques, optimization challenges, convolutional neural networks (CNNs), and recurrent neural networks (RNNs) are explored in detail. Through theoretical insights and mathematical formulations, the course equips students with the knowledge required to design, train, and evaluate deep learning models for real-world tasks.

Course Objectives:

The main objectives of the course is to

1. Introduce the fundamentals of neural networks and their biological inspiration.
2. Understand and implement perceptrons and multilayer neural network models.
3. Explore optimization and regularization strategies for effective deep learning.
4. Analyze convolutional neural networks for visual data processing.
5. Understand sequence modeling using recurrent and gated neural networks.

UNIT I INTRODUCTION TO NEURAL NETWORKS AND PERCEPTRON LEARNING **10 hours**

Introduction: What is a Neural Network?, The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, Rosenblatt‟s Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

UNIT II MULTILAYER PERCEPTRONS AND BACKPROPAGATION ALGORITHMS **9 hours**

Multilayer Perceptrons: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Back Propagation and Differentiation.

UNIT III REGULARIZATION AND OPTIMIZATION IN DEEP LEARNING **9 hours**

Regularization for Deep Learning: Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions.

UNIT IV CONVOLUTIONAL NEURAL NETWORKS (CNNs) AND APPLICATIONS **9 hours**

Convolution neural networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs,

Data Types, Efficient Convolution Algorithms, Convolutional Networks and the History of Deep Learning.

UNIT V SEQUENCE MODELING WITH RECURRENT AND RECURSIVE NEURAL NETWORKS **9 hours**

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to- Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain the structure and functioning of artificial neurons and basic network architectures.
CO2: Implement multilayer perceptrons and apply the backpropagation algorithm to solve learning tasks.
CO3: Apply regularization and optimization techniques to improve deep learning performance.
CO4: Analyze convolutional neural networks for feature extraction and image-based tasks.
CO5: Evaluate sequence modeling approaches using RNNs, LSTMs, and encoder-decoder architectures.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016. 2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O’Reilly, Shroff Publishers,2019.

Online Learning Resources

- •https://keras.io/datasets/
- •http://deeplearning.net/tutorial/deeplearning.pdf
- •https://arxiv.org/pdf/1404.7828v4.pdf
- •https://www.cse.iitm.ac.in/~miteshk/CS7015.html
- •https://www.deeplearningbook.org •https://nptel.ac.in/courses/106105215

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSD111 PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Basic Probability and Statistics, Python or R Programming, Machine Learning fundamentals

Course Description:

This course provides an overview of predictive analytics techniques and their real-world applications. Students will learn to prepare data, build and evaluate predictive models using algorithms like decision trees, logistic regression, and ensemble methods. The course also introduces text mining and model deployment through practical case studies.

Course Objectives:

The main objectives of the course is to

1. Introduce the foundational concepts and workflows of Predictive Analytics.
2. Illustrate real-world use cases and applications across different domains.
3. Demonstrate the process of building, evaluating, and deploying predictive models using various algorithms.
4. Explore ensemble techniques and text mining for advanced predictive tasks.
5. Familiarize students with performance metrics and model interpretation techniques.

UNIT I OVERVIEW OF PREDICTIVE ANALYTICS 10 hours

What Is Analytics? What Is Predictive Analytics? Business Intelligence Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Who Uses Predictive Analytics? , Challenges in Using Predictive Analytics, What Educational Background Is Needed to Become a Predictive Modeler?

Setting Up the Problem: Predictive Analytics Processing Steps: CRISP-DM, Business Understanding, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, Case study- Recovering Lapsed Donors, Fraud Detection

UNIT II DATA UNDERSTANDING 9 hours

What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.

Data Preparation: Variable Cleaning, Feature Creation.

UNIT III ITEM SETS AND ASSOCIATION RULES 9 hours

Terminology, Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules. Descriptive Modelling: Data Preparation Issues with Descriptive Modelling, Principal Component Analysis, Clustering Algorithms.

Interpreting Descriptive Models: Standard Cluster Model Interpretation.

UNIT IV PREDICTIVE MODELLING **9 hours**

Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbour, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms.

Assessing Predictive Models: Batch Approach to Model Assessment, Assessing Regression Models.

UNIT V MODEL ENSEMBLES **9 hours**

Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam's Razor, Interpreting Model Ensembles.

Text Mining: Motivation for Text Mining, A Predictive Modelling Approach to Text Mining, structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modelling with Text Mining Features, Regular Expressions.

Model Deployment: General Deployment Considerations.

Case Studies: Survey Analysis Case Study, Help Desk Case Study.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Visualize and explore data to understand relationships and patterns.
CO2: Understand and explain how ensemble models improve prediction accuracy.
CO3: Organize and structure the predictive modelling pipeline and data preparation workflow.
CO4: Apply suitable predictive models like Decision Trees, Logistic Regression, and Neural Networks.
CO5: Evaluate model performance using appropriate statistical and business metric.

Text Books:

1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.

Reference Books:

1. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
2. Data Analytics using Python Kindle Editionby Bharti Motwani, 202

Online Learning Resources

1. Predictive Analytics: Introduction to Business Forecasting | Udemy

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSD112 DATA VISUALIZATION

L	T	P	C
3	0	0	3

Pre-requisite: Exploratory Data Analysis.

Course Description:

This course introduces the principles and practices of data visualization to enable effective communication of data insights. Students will learn to abstract, map, and visualize data using statistical charts, multivariate techniques, and interactive dashboards. The course covers scalar, vector, temporal, and spatial data visualization, and includes hands-on experience with industry-standard tools like Tableau and Power BI. It emphasizes analytical thinking, visual storytelling, and dashboard design for domains such as finance, healthcare, and marketing.

Course Objectives:

The main objectives of the course is to

1. Introduce the fundamentals of data visualization and visual encoding techniques.
2. Explore various visualization techniques for structured, unstructured, and temporal data.
3. Understand multivariate and analytical visualizations using trees, maps, and networks.
4. Develop skills in creating effective visualizations using Tableau and Power BI.
5. Apply storytelling principles to design dashboards for domain-specific decision-making.

UNIT I INTRODUCTION TO DATA VISUALIZATION AND STATISTICAL CHARTS **9 hours**

Overview of data visualization, Data Abstraction and Task Abstraction, Dimensions and Measures, Four levels for analytical validation, Statistical charts and their use cases: Bar chart, stacked bar chart, line chart, histogram, pie chart, box plot, scatter plot, frequency polygon, regression curves, Types of visualization tools

UNIT II VISUALIZATION TECHNIQUES AND DATA TYPES **9 hours**

Scalar and point-based visualization techniques, Vector visualization techniques, Multidimensional visualization techniques, Cluster visualization: K-means and Hierarchical clustering, Visualizing: Time-series data, Text data
Spatial data.

UNIT III VISUAL ANALYTICS AND MULTIVARIATE DATA VISUALIZATION **9 hours**

Networks and trees, Heat maps and treemaps, Manipulating view using map color and channels, Visual attributes for effective interpretation, Multivariate techniques: Geometric projection, Pixel-oriented and icon-based techniques, Scatterplot matrix, hyperbox, parallel coordinates, trellis displays

UNIT IV DATA VISUALIZATION WITH TABLEAU AND POWER BI **9 hours**

Introduction to Visualization Tools, Tableau essentials: Marks, channels, arranging tables, facets, Power BI essentials: Workspace, Power Query, fields, charts, visuals, Design principles in visualization: choosing the right chart, layout, interactivity, and optimization.

UNIT V DASHBOARD DESIGN AND DATA STORYTELLING 9 hours

Designing interactive dashboards, Dashboard taxonomies and organizational functions, User interaction and protection, Common mistakes in dashboard design, Use case–based dashboard development for: Finance, Marketing, Healthcare, Insurance , Storytelling with Data and using Power BI Q&A for narrative insights

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explain core concepts in data abstraction and statistical chart design.

CO2: Apply appropriate visualization techniques for scalar, vector, temporal, and text data.

CO3: Analyze and interpret multivariate data using visual analytics.

CO4: Develop interactive data visualizations using Tableau and Power BI.

CO5: Design and evaluate storytelling dashboards for real-world datasets.

Text Books:

1. Cole Nussbaumer Knaflic, Storytelling with data, Wiley .
2. Ben Jones, Communicating Data with Tableau, O'Reilly

Reference Books:

1. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Reilly.
2. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
3. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

Online Learning Resources

1. Data Analysis and Visualization Foundations | Coursera
2. Data Visualization | Coursera

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23CSD207 DEEP LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Python Programming and libraries like NumPy, Pandas, and Matplotlib, Linear Algebra and Probability, Machine Learning Fundamental

Course Description:

This lab course offers hands-on experience in building and evaluating neural networks and deep learning models. Students will implement architectures like DNNs, CNNs, RNNs, autoencoders, and sequence models using real-world datasets. The course emphasizes practical skills in model training, regularization, use of pre-trained models, and performance evaluation for tasks such as classification, prediction, and NLP.

Course Objectives:

The objectives of the course are to

1. Implement fundamental neural network architectures for various data types.
2. Explore deep learning models like CNNs, autoencoders, and RNNs for image, text, and sequence data.
3. Apply regularization techniques and pre-trained models to improve performance and reduce overfitting.
4. Experiment with advanced architectures like encoder-decoder models with attention.
5. Evaluate deep learning models using real-world datasets and metrics like accuracy, precision, and recall.

List of Experiments:

1. Design and implement a neural based network for generating word embedding for words in a document corpus.
2. Write a program to demonstrate the working of a deep neural network for classification task.
3. Design and implement a Convolutional Neural Network (CNN) for classification of image dataset.
4. Build and demonstrate an autoencoder network using neural layers for data compression on image dataset.
5. Design and implement a deep learning network for classification of textual documents.
6. Design and implement a deep learning network for forecasting time series data.
7. Write a program to enable pre-train models to classify a given image dataset.
8. Write a program to read a dataset of text reviews. Classify the reviews as positive or negative.
9. Design and evaluate a deep learning model using dropout and L2 regularization to prevent overfitting.
10. Implement an Encoder-Decoder architecture with attention mechanism for machine translation.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Implement basic neural networks and word embedding models.

CO2: Develop deep learning models such as CNNs, RNNs, and autoencoders.

CO3: Use pre-trained models and regularization techniques to optimize performance.

CO4: Apply deep learning models to solve real-world problems in text, image, and time-series domains.

CO5: Evaluate deep learning models using appropriate performance metrics and explain results.

Text Books:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016. 2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O’Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O’Reilly, Shroff Publishers,2019.

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year II Semester

23CSD208 PREDICTIVE ANALYTICS AND VISUALIZATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite:

Course Description:

This laboratory course provides practical exposure to statistical analysis and modern data visualization techniques using SPSS, Python, Tableau, and Power BI. Students will gain hands-on experience with data preprocessing, inferential statistics, multivariate analysis, predictive modeling, and interactive dashboard development. The course emphasizes both quantitative data interpretation and effective storytelling through dashboards, enabling students to transform complex data into actionable insights.

Course Objectives:

The objectives of the course are to

1. Familiarize students with advanced statistical tools (SPSS) for data preprocessing, hypothesis testing, and multivariate analysis.
2. Perform statistical techniques such as factor analysis, regression, time series forecasting, and decision tree classification.
3. Develop skills in Python for visualizing structured and semi-structured data interactively.
4. Create professional dashboards using Tableau and Power BI for different business use cases.
5. Enable domain-specific storytelling through sales, healthcare, marketing, and time series dashboards.

PART 1

List of Experiments:

1. Introduction to SPSS, Sorting File, Split File, Compute File, Recode File and Select Cases

2 Chi- Square Test (Parametric and Non-Para

3 Exploratory Factor Analysis

4 Cluster Analysis

5 Logistic Regression

6 Discriminant Analysis

7 Confirmatory Factor Analysis

8 Conjoint Analysis

9 Time Series

10 MANOVA

11 Decision Tree Analysis

PART 2

List of Experiments:

1. Connecting to the data
2. Formatting and insertion of data
3. Creating worksheets, navigating the sheets, applying filters, aggregating the data
4. Organize the data into dashboards
5. Create story
6. Develop interactive plots in Python
7. Create Time series Data Visualization in Python
8. Visualization of Semi-Structured data
9. Create Sales Growth Dashboard – for the tracking of sales teams progress
10. Design Social media Dashboard – find how well your sponsored social activating are performing, monitor your PPC campaigns
11. Develop Healthcare Data Dashboard – Allows hospital administrators to manage and identify patient hazards from a single screen.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Perform statistical data analysis and hypothesis testing using SPSS.
CO2: Apply multivariate techniques such as factor analysis, regression, and decision trees.
CO3: Develop visualizations using Python for structured and semi-structured data.
CO4: Build and publish dashboards using Tableau and Power BI for different business domains.
CO5: Design effective visual stories that communicate insights from real-world datasets.

Text Books:

1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.
2. Cole Nussbaumer Knaflic, Storytelling with data, Wiley .

Reference Books:

3. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
4. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

Online Learning Resources/Virtual Labs:(Part 1)

1.Predictive Analytics: Introduction to Business Forecasting | Udemy

Online Learning Resources/Virtual Labs:(Part 2)

1.Data Visualization with Tableau | Coursera

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

B. Tech III Year I Semester

23ECE501 TINKERING LABORATORY

L	T	P	C
0	0	2	1

Course Description:

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge. These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

Course Objectives:

1. Encourage Innovation and Creativity
2. Provide Hands-on Learning and Impart Skill Development
3. Foster Collaboration and Teamwork
4. Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5. Impart Problem-Solving mind-set

List of Experiments:

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Design and 3D print a Walking Robot
3. Design and 3D Print a Rocket.
4. Temperature & Humidity Monitoring System (DHT11 + LCD)
5. Water Level Detection and Alert System
6. Automatic Plant Watering System
7. Bluetooth-Based Door Lock System
8. Smart Dustbin Using Ultrasonic Sensor
9. Fire Detection and Alarm System
10. RFID-Based Attendance System
11. Voice-Controlled Devices via Google Assistant
12. Heart Rate Monitoring Using Pulse Sensor
13. Soil Moisture-Based Irrigation
14. Smart Helmet for Accident Detection
15. Milk Adulteration Detection System
16. Water Purification via Activated Carbon
17. Solar Dehydrator for Food Drying

18. Temperature-Controlled Chemical Reactor
19. Ethanol Mini-Plant Using Biomass
20. Smart Fluid Flow Control (Solenoid + pH Sensor)
21. Portable Water Quality Tester
22. AI Crop Disease Detection
23. AI-based Smart Irrigation
24. ECG Signal Acquisition and Plotting
25. AI-Powered Traffic Flow Prediction
26. Smart Grid Simulation with Load Monitoring
27. Smart Campus Indoor Navigator
28. Weather Station Prototype
29. Firefighting Robot with Sensor Guidance
30. Facial Recognition Dustbin
31. Barcode-Based Lab Inventory System
32. Growth Chamber for Plants
33. Biomedical Waste Alert System
34. Soil Classification with AI
35. Smart Railway Gate
36. Smart Bin Locator via GPS and Load Sensors
37. Algae-Based Water Purifier
38. Attendance via Face Recognition

Note: The students can also design and implement their own ideas, apart from the list of experiments mentioned above.

Note: A minimum of 8 to 10 experiments must be completed by the students.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Apply the principles of design thinking to identify real-world problems and develop feasible solutions.

CO2: Demonstrate proficiency in using basic tools, components, and digital fabrication technologies (e.g., Arduino, sensors, 3D printing, etc.).

CO3: Develop functional prototypes through iterative design, fabrication, and testing.

CO4: Collaborate effectively in multidisciplinary teams to brainstorm, plan, and execute tinkering projects.

CO5: Document the development process, evaluate outcomes, and communicate project results clearly using oral, visual, and written formats.

Reference Books:

1. "Make: Getting Started with Arduino" by Massimo Banzi, Maker Media Publications.

Online Resources:

1. https://aim.gov.in/pdf/equipment-manual-pdf.pdf

2. https://atl.aim.gov.in/ATL-Equipment-Manual/

3. https://aim.gov.in/pdf/Level-1.pdf

4. https://aim.gov.in/pdf/Level-2.pdf

5. https://aim.gov.in/pdf/Level-3.pdf

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

OPEN ELECTIVE – I

Open Elective – I

23HUM301 INDIAN KNOWLEDGE SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. To introduce the scope, significance, and interdisciplinary nature of Indian Knowledge Systems and their relevance in the modern world.
2. To explore the philosophical and epistemological foundations of Indian Knowledge Systems, including key concepts like Pramāṇa, Dharma, and Rta.
3. To examine the scientific contributions of ancient India in fields such as mathematics, astronomy, medicine, and engineering.
4. To understand Indian perspectives on society, governance, literature, and aesthetics through classical texts and traditions.
5. To appreciate the cultural richness, ethical values, and traditional educational systems that shaped Indian civilization.

UNIT I INDIAN KNOWLEDGE SYSTEM: AN INTRODUCTION 9 hours

Indian Knowledge System: An Overview- Historical evolution and contemporary Relevance-Interdisciplinary approach and integration in education-The Vedic Corpus, The Four Vedas and their components, Oral transmission and cultural continuity--Philosophical Systems, Orthodox (Āstika) and Heterodox (Nāstika) schools, Logic, metaphysics, and epistemology in Indian philosophy -Wisdom through the Ages- Scientific and Mathematical Contributions, Ayurveda, Astronomy, Metallurgy, Mathematics, Key scholars: Charaka, Sushruta, Aryabhata, Bhaskaracharya

UNIT II FOUNDATIONAL CONCEPTS IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Shaping India's intellectual traditions- Ancient Indian linguistics, highlighting phonetics, grammar, and language philosophy-traditional number systems, units of measurement, and their practical applications in science and trade -indigenous frameworks for organizing and classifying knowledge, offering insights into how Indian scholars approached learning, epistemology, and the systemic cultivation of wisdom across disciplines.

UNIT III SCIENCE AND TECHNOLOGY IN INDIAN KNOWLEDGE SYSTEMS 9 hours

India’s classical achievements in mathematics, astronomy, architecture, and science. Learners explore ancient texts and applications—highlighting concepts like zero, planetary motion, and structural design. integration of science with philosophy and sustainability. Through notable scholars and indigenous techniques, how Indian scientific thought continues to influence contemporary innovations-offering wisdom for solving modern challenges.

UNIT IV HUMANITIES AND SOCIAL SCIENCES IN INDIAN KNOWLEDGE SYSTEMS 9 hours

Indian insights on leadership, wellbeing, and governance through ancient texts like the Srimad Bhagavad Gita. Topics include holistic management principles, psychological well-being, ethical governance, and traditional administrative models—emphasizing their relevance to modern society, personal growth, and nation-building.

UNT V CULTURAL, EDUCATIONAL, AND ETHICAL DIMENSIONS OF INDIAN KNOWLEDGE SYSTEMS **9 hours**

Art, Architecture, and Aesthetics-Temple architecture and sculpture-Music, dance, and literary traditions-**Education Systems and Institutions,** Gurukula system and pedagogical practices, Ancient universities: Nalanda, Takshashila-**Ethics and Values in Indian Thought**-Dharma, Karma, Moksha — principles of righteous living, Sustainability, harmony, and spiritual ecology-**Contemporary Relevance and Global Influence,** Indian knowledge systems in modern science and culture, Resurgence through NEP 2020 and academic initiatives

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Learners will be able to **describe** the scope and interdisciplinary relevance of Indian Knowledge Systems in contemporary contexts.

CO2: Learners will be able to **analyze** foundational philosophical concepts such as *Pramāṇa*, *Dharma*, and *Rta* within Indian epistemology.

CO3: Learners will be able to **apply** ancient Indian scientific principles to understand traditional practices in mathematics, astronomy, and medicine.

CO4: Learners will be able to **evaluate** classical Indian texts to interpret perspectives on governance, society, and aesthetics.

CO5: Learners will be able to **design** culturally informed ethical frameworks and educational models inspired by traditional Indian systems.

Reference Books:

1. Introduction to Indian knowledge system: concepts and applications
   By B. Mahadevan , Nagendra Pavana , Vinayak Rajat Bhat, PHI publications
2. Bhagavad Gita: As It Is" by A.C. Bhaktivedanta Swami Prabhupada Published by The Bhaktivedanta Book Trust
3. "Indian Philosophy, Volume 1 and 2 by S. Radhakrishnan Published by Oxford university press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102

Course Description:

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis.

Course Objectives:

The main objectives of the course is to

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations.
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 9 hours

Errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial. Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS 9 hours

LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.

UNIT III INTERPOLATION & NUMERICAL CALCULUS 9 hours

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature.

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.

UNIT V NUMERICAL SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS **9 hours**

Laplace and Poisson equations (five-point formula), Finite difference methods for one-dimensional Heat and Wave equations.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Solve the system of algebraic and transcendental equations.

CO2: Apply the numerical techniques to find the solution to system of equations.

CO3: Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.

CO4: Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.

CO5: Compute the solutions for engineering problems represented by partial differential equations.

Text Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. E. Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 23MAT101, 23MAT102, 23MAT104

Course Description:

Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:

The main objectives of the course is to

1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to apply the game theory and project management techniques to find the solutions to the complex problems.
5. Understand the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV GAME THEORY AND PROJECT MANAGEMENT 9 hours

Formulation of games, Two Person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT).

UNIT V QUEUING MODELS 9 hours

Introduction to queuing system, Birth and Death processes, Single and multiple server queueing models, Little's formula - Finite Calling Population Queuing Models – Multi-Phase Service Queuing Model.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understood the importance of unconstrained and constrained optimization to solve engineering problems.

CO2: Get an idea about the linear programming techniques.

CO3: Solve transportation and assignment problems in engineering situations.

CO4: Analyze the problems of network analysis for project management and game theory.

CO5: Apply the Queuing system models to solve problems in engineering & industry.

Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.

2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.

2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.

3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.

4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2nd edition.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY301 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:

Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

The main objectives of the course is to

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules**;** *Atomic lasers*: He-Ne laser, Argon Ion laser**;** *Molecular Lasers*: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only)

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.

CO2: Estimate stability requirements in producing laser light by different types of sources

CO2: CO3: Differentiate or list the various types of lasers and their means of excitation.

CO4: Assess (Identify) which laser would best meet the need for a particular industrial or research task.

CO5: Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text Books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books:

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY302 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

The main objectives of the course is to

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS 8 hours

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES 10 hours

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS 8 hours

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films

UNIT IV CHARACTERIZATION OF THIN FILMS 10 hours

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS 9 hours

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.

CO2: Asses the relation between deposition technique, film structure, and film properties.

CO3: Know the typical thin film applications.

CO4: Motivate selection of deposition techniques for various applications.

Text Books:

1. Thin Film Deposition: Principles and Practice, *Donald L. Smith*, McGraw Hill, Singapore, 2001.

2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / *Kasturi L. Chopra,* New York: McGraw-Hill, c1969.

2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.

3. An introduction to physics and technology of thin films / *Alfred Wagendristel*, *Yuming Wang*, Singapore: World Scientific, c1994.

4. Thin film processes, *John L Vossen, Werner Kehn* editors, Academic Press, New York, 1978.

5. Thin film physics / *O.S. Heavens*, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23PHY303 WASTE TO SUSTAINABLE ENERGY AND ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of Physics and chemistry at the intermediate (10+2) level is sufficient

Course Description:

This course covers waste-to-energy conversion and energy storage technologies, including thermal, biological, and chemical methods. It introduces relevant policies, case studies, and trends to help students design sustainable energy solutions aligned with the circular economy and climate goals.

Course Objectives:

The main objectives of the course is to

1. Understand various methods of energy generation from waste.
2. To explore thermal, biological, and chemical conversion technologies.
3. To examine modern energy storage devices and their integration with waste-to-energy systems.
4. To analyse the techno-economic feasibility of these systems for sustainable development.
5. To develop interdisciplinary skills in waste-to-energy technologies, enhancing student employability in sustainable energy and environmental sectors.

UNIT I INTRODUCTION TO WASTE PROCESSING, TRANSPORT, AND MANAGEMENT 9 hours

Types of Wastes, Agricultural Residues, and Wastes Including Animal Wastes, Industrial Wastes, Municipal Solid Wastes and Characterization. Waste Processing Types and Composition of Various Types of Wastes- Industrial Waste and Biomedical Waste- Waste Collection and Transportation- Waste Processing- Size Reduction, Separation- Waste Management Hierarchy- Waste Minimization and Recycling of Municipal Solid Waste.

UNIT II THERMAL WASTE CONVERSION TECHNOLOGIES 9 hours

Combustion, incineration, pyrolysis, gasification, Process parameters, design considerations, Emission control, energy recovery, and Case studies of WTE (Waste to Energy) plants in India and abroad

UNIT III BIOLOGICAL AND CHEMICAL CONVERSION 9 hours

Bio gasification: Biomethanation process, biogas digester types. Chemical Conversion: Hydrolysis & hydrogenation; solvent extraction of hydrocarbons; solvolysis of wood, bio crude, biodiesel production via chemical process; transesterification methods; Chemicals from biomass.

UNIT IV ENERGY STORAGE SYSTEMS 9 hours

Introduction to Energy Storage Systems - Types of energy storage- electrical, mechanical, chemical, thermal; Batteries (Li-ion, lead-acid, flow batteries), Supercapacitors and hybrid storage, Hydrogen storage and fuel cells.

UNIT V WASTE MANAGEMENT AND ENERGY RECOVERY 9 hours

Characteristics and Perspectives of Waste, Unit Operations & Transformation Technologies, Waste Disposal, Hazardous Waste Management & Waste Recycling

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: To understand various methods of energy recovery from waste.

CO2: To explore thermal conversion technologies.

CO3: To explore biological and chemical conversion technologies

CO4: To examine modern energy storage devices and their integration with waste-to-energy systems.

CO5: To analyse the techno-economic feasibility of these systems for sustainable development.

Text Books:

1. Waste-to-Energy. Technologies and Project Implementation by Marc J. Rogoff And Francois Screve (Auth.) Publisher: William Andrew, 2011/2019
2. Robert C. Brown Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, John Wiley and Sons, 2019.
3. Sergio Capareda, Introduction to Biomass Energy Conversions, CRC Press, 2013.
4. Fundamentals of Energy Storage, J. Jensen, B. Squrensen, John Wiley, NY
5. Techobanoglous, Theisen, and Vigil, "Integrated Solid Waste Management", 2d Ed. McGraw-Hill, New York, 1993.

Reference Books:

1. Industrial and Urban Waste Management in India, TERI Press
2. B. Lal and M. Patwardhan, "Wealth from Waste: Trends and Technologies", TERI Press
3. Municipal Solid Waste to Energy Conversion Processes: Processes Technical, and Renewable comparisons, by Gary C. Young, ISBN:9780470539675, Publisher: John Wiley & Sons, Publication Date: June 2010.
4. Parker Colin, and Roberts, "Energy from Waste – An Evaluation of Conversion Technologies", Elsevier Applied Science, London, 1985.
5. La Grega, M., et al., "Hazardous Waste Management", McGraw-Hill, c. 1200 pp., 2nd ed.,2001

Journals & Reviews:

1. Updated Journals and Reviews of the last 5 Years
2. Home (https://swayam.gov.in) > Courses (https://swayam.gov.in/explorer) > Waste to Energy Conversion, By Prof. P. Mondal | IIT Roorkee

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE301 CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. To understand the basic principles of polymers
2. To understand natural polymers and their applications.
3. To impart knowledge to the students about synthetic polymers, their preparation and importance.
4. To enumerate the applications of hydogel polymers
5. To enumerate applications of conducting and degradable polymers in engineering.

UNIT I POLYMERS-BASICS AND CHARACTERIZATION:- 9 hours

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

UNIT II NATURAL POLYMERS & MODIFIED CELLULOSICS 9 hours

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

UNIT III SYNTHETIC POLYMERS 9 hours

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

UNIT IV HYDROGELS OF POLYMER NETWORKS 9 hours

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

UNIT V CONDUCTING AND DEGRADABLE POLYMERS: 9 hours

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer

CO2: Describe the physical and chemical properties of natural polymers and Modified cellulosics.

CO3: Differentiate Bulk, solution, Suspension and emulsion polymerization, describe fibers and elastomers, Identify the thermosetting and thermo polymers.

CO4: Identify types of polymer networks, describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,

CO5: Explain classification and mechanism of conducting and degradable polymers.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

Reference Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

The main objectives of the course is to

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Course Outcomes:

Upon completion of this course the students should:

CO1: Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
CO2: Understand and apply catalysis for developing eco-friendly processes.
CO3: Be in a position to use environmental benign solvents where ever possible.
CO4: Have knowledge of current trends in alternative energy sources.
CO5: Apply green chemistry principles in practicing green Nanoscience.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

Online Learning Resources

1. https://nptel.ac.in/courses/104105124

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CHE303 CHEMISTRY OF ENERGY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Objectives:

1. To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2. To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3. To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4. Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5. To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

UNIT I ELECTROCHEMICAL SYSTEMS 9 hours

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications**.**

UNIT II FUEL CELLS 9 hours

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT III PHOTO AND PHOTO ELECTROCHEMICAL CONVERSIONS 9 hours

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT IV SOLAR ENERGY 9 hours

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT V HYDROGEN STORAGE 9 hours

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer

CO2: Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell

CO3: Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages

of photoelectron catalytic conversion.

CO4: Apply the photo voltaic technology, Demonstrate about solar energy and prospects Illustrate the Solar cells, Discuss about concentrated solar power

CO5: Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures
Describe the liquification methods.

Text Books:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CE301 DISASTER MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Description:

The goal of this course is to expose the undergraduate students to different types of disasters and the preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical, and emerging hazards and risks that may cause property loss, loss of lives, and livestock. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

1. To make the students aware of disasters and their impact on living beings.
2. To ensure the students understand vulnerability, disasters, disaster prevention, and risk reduction.
3. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes available in the country for disaster risk mitigation.
5. To make the students aware of development activities and case studies.

UNIT I INTRODUCTION 8 hours

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention, and mitigation.

UNIT II TYPES OF DISASTERS 10 hours

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS 9 hours

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES 9 hours

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization, etc.), sustainable and environmental friendly recovery; reconstruction and development methods. Different GIS software, basic data types and coordinate systems. Case studies.

Course Outcomes:

The students after completing the course will be able to:

CO1: Explain various disaster concepts
CO2: Differentiate between categories of disasters
CO3: Analyze the impact of various types of disasters
CO4: Select disaster risk mitigation measures
CO5: Identify the impact of development activities

Text Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster Management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23CE302 GREEN BUILDINGS

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Description:

The course covers various aspects of bioclimatic architecture like climate-sensitive design, passive solar architecture, Water management, green building materials and construction techniques

Course Objectives:

1. To introduce concepts of sustainability and bioclimatic design in planning, Construction and life of buildings.
2. To equip students with technical knowledge of energy-efficient Green Buildings.
3. To guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. To initiate students in basics of functional design and drawing of the various buildings using the above concepts.
5. To understand different evaluation criteria with various green building rating systems

UNIT I GREEN BUILDING CONCEPTS 9 hours

Introduction to bioclimatic architecture- Sustainability in building science and Functional planning- Orientation- Elements of building design and drawing- Building regulations and by-laws
Traditional and Vernacular Architecture- Climate zones- Design Charts- sun path diagram- Solar angles- Indices of thermal comfort- Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction- various steps in Site planning- Plan for Building envelope- Land form-Topography-vegetation- water bodies; Orientation- S/V ratio- P/A ratio- Walls, Fenestration- Roof and floors- Active and passive solar strategies- Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

Calculation of thermal conductance- Heat flow through different building elements- Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties- Energy efficiency using various materials- emerging new materials, Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building- operation and maintenance- Green building rating system- Evaluation criteria of LEED- TERI - GRIHA case studies- Case studies in different climate zones.

Course Outcomes:

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

CO1: Use various regulations and by-laws for green building construction.
CO2: Do site planning, active and passive for Green Building.
CO3: Compute thermal flow through different building elements.
CO4: Identify energy efficient building materials and construction techniques for building components.
CO5: Compute cost of building/operation and maintenance, evaluation criteria for different case studies.

Text Books:

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol II). New Delhi: The Energy and Resources Institute (TERI) Press

Reference Books:

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of Buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijay an. Building Design and Drawing. Calicut: Spades Publishers, 2008
5. Szokolay, S. V. (2008). Introduction to Architectural Science- The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing, New Delhi, Charothar Publishing House

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME301 MATERIALS SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: 23PHY101 ENGINEERING PHYSICS

Course Objectives:

This course is designed to:

1. Understand the fundamental classification and properties of engineering materials.
2. Explore the structure, properties, and applications of metals and alloys.
3. Gain knowledge on composite materials and their relevance in engineering fields.
4. Learn about the structure and characteristics of ceramics and polymers.
5. Develop an appreciation of smart and advanced materials for modern technologies.

UNIT I CLASSIFICATION OF MATERIALS **9 hours**

Introduction to materials science, Classification: Metals, Ceramics, Polymers, Composites, Semiconductors, Biomaterials, Properties: Mechanical, Electrical, Thermal, Optical, Magnetic, Atomic structure and bonding, Crystal structures and defects, Structure–property relationships, Materials selection charts for engineering design.

UNIT II METALS AND ALLOYS **9 hours**

Types of metals: Ferrous and non-ferrous, Microstructure of metals, Phase diagrams (binary alloys), Heat treatment of steels, Corrosion and prevention methods, Mechanical behavior and testing: Stress-strain, hardness, fatigue, Common engineering alloys and their applications.

UNIT III COMPOSITES **9 hours**

Definition and classification: Particle-reinforced, fiber-reinforced, structural composites, Matrix materials: Polymer, metal, and ceramic matrix, Manufacturing techniques: Hand lay-up, pultrusion, Powder Metallurgy, Slurry Infiltration and Sintering, Properties and performance, Applications in aerospace, automotive, construction, and electronics.

UNIT IV CERAMICS AND POLYMERS **9 hours**

Structure and types of ceramics: Crystalline and amorphous, Properties: Thermal resistance, brittleness, conductivity, Processing of ceramics: Sintering, slip casting, hot pressing, Types of polymers: Thermoplastics, thermosets, elastomers, Polymerization processes: Addition and condensation, Mechanical and thermal properties, Applications in electronics, biomedical, and structural sectors.

UNIT V SMART AND ADVANCED MATERIALS **9 hours**

Definition and need for smart materials, Shape memory alloys, piezoelectric materials, magnetostrictive materials, Electroactive polymers, self-healing materials, photonic crystals, Nanomaterials and carbon-based materials (graphene, CNTs), Biomaterials and biocompatibility, Materials for electronics, aerospace, and green energy systems, Emerging trends and future directions.

Course Outcomes:

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

CO1: Identify and classify materials based on their properties and structure.
CO2: Understand the behaviour and applications of metals and alloys in engineering.
CO3: Compare the types and uses of composites in structural and functional applications.
CO4: Understand the processing and properties of ceramics and polymers.
CO5: Identify the emerging applications of smart and advanced materials in multidisciplinary domains.

Text Books:

1. Callister, W. D., & Rethwisch, D. G. (2020). Materials science and engineering: An introduction (10th ed.). Wiley.
2. Smith, W. F., Hashemi, J., & Prakash, R. (2021). Materials science and engineering (6th ed., SI units). McGraw Hill Education.
3. Upadhyaya, G. S., & Upadhyaya, A. (2022). Materials science and engineering (Revised ed.). Viva Books.

Reference Books:

1. Raghavan, V. (2018). Materials science and engineering (6th ed.). Prentice Hall of India.
2. C. Barry Carter and M. Grant Norton, Ceramic Materials: Science and Engineering, Springer, 3rd Edition, 2023.
3. Bhattacharya, D. (2023). Smart materials and structures (2nd ed.). Oxford University Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective – I

23ME302 SUSTAINABLE ENERGY TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

This course is designed to:

1. Introduce the global and national energy scenario and emphasize the importance of sustainability in energy systems.
2. Explain the principles and technologies associated with solar and wind energy systems.
3. Familiarize students with hydropower, wave, and tidal energy generation systems and their real-world applications.
4. Describe bioenergy and geothermal systems, including design considerations and environmental implications.
5. Evaluate the economics of renewable energy projects and explore integration techniques including storage and smart grids.

UNIT I INTRODUCTION TO SUSTAINABLE ENERGY SYSTEMS 9 hours

Energy demand and supply scenario – global and Indian context, Environmental impacts of conventional energy sources, Concept of sustainability and carbon footprint, Overview of renewable energy sources, Policy frameworks and SDGs.

UNIT II SOLAR AND WIND ENERGY TECHNOLOGIES 9 hours

Solar radiation basics, types of solar collectors (thermal and photovoltaic), Photovoltaic cell operation, efficiency factors, MPPT basics, Solar thermal applications: water heating, drying, Wind resource assessment, turbine types and operation, Onshore vs offshore wind power.

UNIT III HYDROPOWER, WAVE, AND TIDAL ENERGY 9 hours

Types of hydropower plants, turbine types, site selection, Ocean energy: wave and tidal principles, design concepts, Challenges in marine energy utilization, Case studies from India and abroad.

UNIT IV BIOENERGY AND GEOTHERMAL TECHNOLOGIES 9 hours

Biomass types, anaerobic digestion, biodiesel, bioethanol, Biogas plant design and efficiency, Geothermal energy basics, types of geothermal systems, Environmental and economic impacts.

UNIT V ECONOMICS AND INTEGRATION OF RENEWABLE ENERGY 9 hours

Economic analysis: LCOE, payback, IRR, Energy storage technologies: batteries, pumped hydro, Grid integration issues and smart grids, Future trends: hybrid systems, microgrids, hydrogen. Concept of waste to wealth.

Course Outcomes:

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

CO1: Explain the global and Indian energy scenario, sustainability concepts, and the role of renewable energy in achieving SDGs. (L2)

CO2: Analyze the working principles, components, and efficiency factors of solar and wind energy systems. (L3)

CO3: Illustrate the operation and site requirements of hydropower, wave, and tidal energy systems

with relevant case studies. (L2)

CO4: Apply basic design and performance analysis for bioenergy and geothermal energy systems considering environmental aspects. (L3)

CO5: Evaluate the techno-economic feasibility of renewable energy systems and their integration into smart grids with energy storage. (L3)

Text Books:

1. Boyle, G. (2021). Renewable energy: Power for a sustainable future (4th ed.). Oxford University Press.
2. Twidell, J., & Weir, T. (2021). Renewable energy resources (4th ed.). Routledge.
3. Kothari, D. P., Singal, K. C., & Ranjan, R. (2020). Renewable energy sources and emerging technologies (3rd ed.). PHI Learning.

Reference Books:

1. Sorensen, B. (2019). Renewable energy: Physics, engineering, environmental impacts, economics & planning (5th ed.). Academic Press.
2. Kalogirou, S. A. (2022). Solar energy engineering: Processes and systems (3rd ed.). Academic Press.
3. Lund, H. (2021). Renewable energy systems: A smart energy systems approach to the choice and modeling of 100% renewable solutions (4th ed.). Academic Press.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective - I

23EEE301 ELECTRICAL SAFETY PRACTICES AND STANDARDS

	L	T	P	C
Pre-requisite: 23EEE101	**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the fundamentals of electrical safety, hazards of electric shock, arc, blast, and failure causes.
2. To explain the function and importance of electrical safety components, voltage classification, and protection devices.
3. To impart knowledge on grounding systems, bonding, and arc hazard categorization to ensure workplace safety.
4. To develop awareness about safety practices across various environments including residential, industrial, and special installations.
5. To familiarize students with relevant electrical safety standards, statutory regulations, and compliance requirements.

UNIT I INTRODUCTION TO ELECTRICAL SAFETY: **9 hours**

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II SAFETY COMPONENTS **9 hours**

Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment‘s - Fire extinguishers for electrical safety.

UNIT III GROUNDING **9 hours**

General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.

UNIT IV SAFETY PRACTICES **9 hours**

General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations-swimming pools, external lighting installations, medical locations-Case studies.

UNIT V STANDARDS FOR ELECTRICAL SAFETY **9 hours**

Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate.

Course Outcomes:

CO1: Understand the fundamental principles of electrical safety and the physiological effects of electric shock-L2

CO2: Apply knowledge of electrical safety components and protective devices to mitigate over-voltages and static hazards -L3

CO3: Analyze equipment grounding, system grounding, and arc flash hazard categories in practical installations -L4

CO4: Implement appropriate safety procedures in varied environments such as homes, public spaces, and medical areas- L4

CO5: Evaluate the applicability and compliance of electrical systems with respect to national and international safety standards-L5

Text Books:

1. Massimo A.G.Mitolo, ―Electrical Safety of Low-Voltage Systems‖, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, ―Electric Safety - Practice and Standards‖, CRC Press, USA, 2014.

Reference Books:

1. Kenneth G.Mastrullo, Ray A. Jones, ―The Electrical Safety Program Book‖, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., ―Electrical Safety Engineering‖, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, ―Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Open Elective-I

23EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite 23EEE101

Course Objectives:

This course enables students to

1. To provide foundational knowledge on MEMS, its historical development, working principles, and scaling effects.
2. To understand the operation of micro sensors and actuators, and their integration into MEMS structures.
3. To explore MEMS materials and comprehend various microfabrication and micromachining techniques.
4. To develop competency in modeling MEMS devices using simulation methods such as FEM for sensor and actuator behavior.
5. To examine various applications of MEMS in different domains including RF, optical, microfluidic, and robotics systems.

UNIT I INTRODUCTION 9 hours

Overview – History and industry perspectives – Working principles – Mechanics and dynamics Scaling law

UNIT II MICRO SENSORS & ACTUATORS 9 hours

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING 9 hours

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS 9 hours

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS 9 hours

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Explain the history, structure, operating principles, and scaling challenges of MEMS – L2

CO2: Describe the working of micro sensors and actuators and their roles in MEMS – L2

CO3: Analyze the materials and various microfabrication techniques used in MEMS manufacturing – L4

CO4: Apply modeling techniques like FEM to simulate MEMS device behavior such as gyroscopes and piezoelectric sensors – L3

CO5: Evaluate MEMS applications in RF, fluidics, optics, and robotics through real-world case studies – L5

Text Book(s)

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,'Micro and Smart Systems', Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000

2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.

3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective – I

23ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

Course Outcomes:
Upon successful completion of the course, students will be able to

CO1: Understand the applications of biological transducers in medical field.

CO2: Analyze the design of bio-electrodes and bio-amplifiers.

CO3: Apply suitable measuring instruments to measure various medical parameters.

CO4: Understand and test various imaging techniques used in bio-medical diagnosis.

CO5: Analyze the applications of artificial medical aids.

Text Books:

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.
2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw - Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – I

23ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Realize the concepts of digital building blocks using MOS transistor.

CO2: Design combinational MOS circuits and power strategies

CO3: Design and construct Sequential Circuits and Timing systems.

CO4: Design arithmetic building blocks and memory subsystems.

CO5: Apply and implement FPGA design flow and testing.

Text Books:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.

2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.

2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

PROFESSIONAL ELECTIVES

Professional Elective - II

23CSD401 SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: **Fundamentals of data analysis, Python programming**

Course Objectives:

The main objectives of the course is to

1. Discuss the characteristics of different social networks
2. Demonstrate the functioning of different social networks

UNIT I **9 hours**

Hacking on Twitter data, Micro formats: Semantic Markup and common sense collide.

UNIT II **9 hours**

Mailboxes: Oldies but Goodies, Titter: Friends, Followers and Set wise operations.

UNIT III **9 hours**

Twitter: The Tweet, the Whole Tweet, and Nothing but the Tweet.

UNIT IV **9 hours**

LinkedIn: Clustering your professional network for Fun (and profit).

UNIT V **9 hours**

Face book: The All-in-one Wonder

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Explore the functionality of different social networks
CO2: Analyze social networks

Text Books:

1. Matthew A. Russel, Mining the Social Web, O'Reilly, 2013

Reference Books:

1. Social Network Analysis: A Introduction with an Extensive Implementation to a Large Scale Online Network using Pajek, SeifedineKadry, Mohammed Taie, 2014.
2. An Introduction to Social Network Data Analytics, Charu C. Aggarwal, IBM T. J. Watson Research Center.

Online Learning Resources

1. Social Network Analysis | Coursera

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSD402 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite: Computer Organization and Architecture

Course Objectives:

The main objectives of the course is to

1. Understand the basic concepts of Computer Networks.
2. Introduce the layered approach for design of computer networks
3. Expose the network protocols used in Internet environment
4. Explain the format of headers of IP, TCP and UDP
5. Familiarize with the applications of Internet
6. Elucidate the design issues for a computer network

UNIT I COMPUTER NETWORKS AND THE INTERN 9 hours

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT II THE DATA LINK LAYER, ACCESS NETWORKS, AND LANS 9 hours

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and - Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks Link Virtualization: A Network as a Link Layer.

UNIT III THE NETWORK LAYER 9 hours

Routing Algorithms, Internetworking, The Network Layer in the Internet (Textbook 1)

UNIT IV THE TRANSPORT LAYER 9 hours

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V PRINCIPLES OF NETWORK APPLICATIONS 9 hours

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Identify the software and hardware components of a computer network.
CO2: Design software for a computer network.
CO3: Develop new routing, and congestion control algorithms.
CO4: Assess critically the existing routing protocols.
CO5: Explain the functionality of each layer of a computer network.
CO6: Choose the appropriate transport protocol based on the application requirements.

Text Books:

1. Andrew S.Tanenbaum, David J.Wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. 1Forouzan, Data communications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, ShakilAkthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.htmlhttps://nptel.ac.in/courses/106105183/3

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSD403 RECOMMENDER SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite:

Course Objectives:

The main objectives of the course is to

1. To provide students with basic concepts and its application in various domain
2. To make the students understand different techniques that a data scientist needs to know for analysing big data
3. To design and build a complete machine learning solution in many application domains.

UNIT I AN INTRODUCTION TO RECOMMENDER SYSTEMS, NEIGHBORHOOD-BASED COLLABORATIVE FILTERING **9 hours**

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain Specific Challenges in Recommender Systems. Advanced Topics and Applications. Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood- Neighborhood-Based Collaborative Filtering: Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, Graph Models for Neighborhood-Based Methods, A Regression Modelling View of Neighborhood Methods.

UNIT II MODEL-BASED COLLABORATIVE FILTERING, CONTENT-BASED RECOMMENDER SYSTEMS **9 hours**

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models. Content-Based Recommender Systems: Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering, Summary.

UNIT III KNOWLEDGE-BASED RECOMMENDER SYSTEMS, ENSEMBLE BASED AND HYBRID RECOMMENDER SYSTEMS **9 hours**

Introduction, Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems, Summary. Introduction, Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Meta-Level Hybrids, Feature Combination Hybrids, Summary.

UNIT IV EVALUATING RECOMMENDER SYSTEMS, CONTEXT-SENSITIVE RECOMMENDER SYSTEMS **9 hours**

Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures, Limitations of Evaluation Measures. Introduction, The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Pre-filtering: A Reduction-Based Approach, Contextual Modelling.

UNIT V TIME- AND LOCATION-SENSITIVE RECOMMENDER SYSTEMS **9 hours**

Introduction, Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Location-Aware Recommender Systems Location-Aware Recommender Systems, Summary.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Aware of various issues related to Personalization and Recommendations.
CO2: Design and implement a set of well-known Recommender System approaches used in E commerce and Tourism industry.
CO3: Develop new Recommender Systems for a number of domains especially, Education, Health-care.

Text Books:

1. Charu C. Aggarwal, "Recommender Systems", Springer,2016.

Reference Books:

1. Francesco Ricci, LiorRokach, "Recommender Systems Handbook", 2nd ed., Springer, 2015 Edition

Online Learning Resources

1. Recommendation System -Understanding The Basic Concepts (analyticsvidhya.com)
2. Recommender Systems | Coursera.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - II

23CSD404 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: Python Programming, Machine Learning Basics

Course Objectives:

The main objectives of the course is to

1. Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
2. Discuss approaches to syntax and semantics in NLP.
3. Examine current methods for statistical approaches to machine translation.
4. Teach machine learning techniques used in NLP.

UNIT I INTRODUCTION TO NATURAL LANGUAGE 9 hours

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT II GRAMMARS AND PARSING 9 hours

Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayees Rule, Shannon game, Entropy and Cross Entropy.

UNIT III GRAMMARS FOR NATURAL LANGUAGE 9 hours

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT IV SEMANTIC INTERPRETATION 9 hours

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

UNIT V MACHINE TRANSLATION 9 hours

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Multilingual Information Retrieval: Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
CO2: Apply the various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.
CO3: Understand the fundamentals of CFG and parsers and mechanisms in ATN's.
CO4: Apply Semantic Interpretation and Language Modelling.
CO5: Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.

Text Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Online Learning Resources

1. https://nptel.ac.in/courses/106/105/106105158/
2. http://www.nptelvideos.in/2012/11/natural-language-processing.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSD405 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: Software Engineering

Course Objectives:

The main objectives of the course is to,

This course is designed to enable the students to understand the fundamental principles of Software Project management & will also have a good knowledge of the responsibilities of a project manager and how to handle them.

UNIT I **9 hours**

Conventional Software Management: The waterfall model, conventional software Management performance

Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation

Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality, Peer Inspections.

UNIT II **9 hours**

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases. **Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT III **9 hours**

Work Flows of the process: Software process workflows, Inter Trans workflows. **Checkpoints of the Process:** Major Mile Stones, Minor Milestones, Periodic status assessments. **Iterative Process Planning:** work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT IV **9 hours**

Process Automation: Automation Building Blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators **Tailoring the Process:** Process discriminates. Managing people and organizing teams.

UNIT V **9 hours**

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Future Software Project Management: Modern Project Profiles, Next generation Software economics, modern process transitions.

Case Study: The Command Center Processing and Display System-Replacement (CCPDS-R)

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Describe the fundamentals of Project Management.
CO2: Recognize and use Project Scheduling Techniques.
CO3: Familiarize with Project Control Mechanisms.
CO4: Understand Team Management.
CO5: Recognize the importance of Project Documentation and Evaluation.

Text Books:

1. Software Project Management, Walker Royce, Pearson Education, 2012
2. Bob Hughes, Mike Cotterell and Rajib Mall "Software Project Management", 6th Edition, McGraw Hill Edition, 2017

Reference Books:

1. PankajJalote, "Software Project Management in practice", 5th Edition, Pearson Education, 2017. 2. Murali K. Chemuturi, Thomas M. Cagley Jr." Mastering Software Project Management: Best Practices, Tools and Techniques", J. Ross Publishing, 2010 3. Sanjay Mohapatra, "Software Project Management", Cengage Learning, 2011

Online Learning Resources

1. http://nptel.ac.in/courses/106101061/29

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSD406 COMPUTER VISION

L	T	P	C
3	0	0	3

Pre-requisite: Machine Learning, Deep Learning

Course Objectives:

The main objectives of the course is to

The objective of this course is to understand the basic issues in computer vision and major approaches to address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

UNIT I LINEAR FILTERS **9 hours**

Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT II EDGE DETECTION **9 hours**

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT III TEXTURE **9 hours**

Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes,

UNIT IV SEGMENTATION BY CLUSTERING **9 hours**

What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves.

UNIT V RECOGNIZATION BY RELATIONS BETWEEN TEMPLATES **9 hours**

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
CO2: Describe known principles of human visual system,
CO3: Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
CO4: Suggest a design of a computer vision system for a specific problem
CO5:

Text Books:

1. David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.

Reference Books:

1. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer;1 edition,2001by Sommer.
2. Digital Image Processing and Computer Vision,1/e,bySonka.
3. Computer Vision and Applications: Concise Edition (WithCD) by Jack Academy Press, 2000.

Online Learning Resources

1. https://nptel.ac.in/courses/106105216

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Professional Elective - III

23CSD407 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. To explain the evolving computer model called cloud computing.
2. To introduce the various levels of services that can be achieved by cloud.
3. To describe the security aspects in cloud.

UNIT I BASICS OF CLOUD COMPUTING 9 hours

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT II HADOOP AND PYTHON 9 hours

Hadoop MapReduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

UNIT III PYTHON FOR CLOUD COMPUTING 9 hours

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

UNIT IV BIG DATA, MULTIMEDIA AND TUNING 9 hours

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.

Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.

Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

UNIT V APPLICATIONS AND ISSUES IN CLOUD 9 hours

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare & Education: Cloud Computing for Healthcare, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education. **Migrating into a Cloud:** Introduction, Broad Approaches to migrating into the cloud, the seven step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Ability to create cloud computing environment.
CO2: Ability to design applications for Cloud environment.
CO3: Design & develop backup strategies for cloud data based on features.
CO4: Use and Examine different cloud computing services.
CO5: Apply different cloud programming model as per need.

Text Books:

1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

Reference Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O ‘Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

Online Learning Resources

1. Cloud computing - Course (nptel.ac.in)

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

SKILL ENHANCEMENT COURSES

B. Tech II Year I Semester
Skill Enhancement Course - I

23CSD601 PYTHON PROGRAMMING

L	T	P	C
1	0	2	3

Course Objectives:

The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Learn to solve problems using Python conditional and loops.
3. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
4. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications.
5. Demonstrate to do input/output with files in Python.

UNIT I DATA TYPES, EXPRESSIONS AND CONTROL FLOW STATEMENTS — 6 hours

Introduction: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a program to swap two numbers without using a temporary variable.
3. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operatorsviii) Identity Operators

UNIT II LISTS & DICTIONARIES — 6 hours

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Sample Experiments:

4. Write a program to perform the given operations on a list:
   i. Addition ii. Insertion iii. slicing
5. Write a program to perform any 5 built-in functions by taking any list.
6. Write a program to sum all the items in a given dictionary.

UNIT III TUPLES AND SETS 6 hours

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

7. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
8. Write a program to count the number of vowels in a string (No control flow allowed).
9. Write a program to check if a given key exists in a dictionary or not.

UNIT IV FUNCTIONS & STRINGS 6 hours

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Sample Experiments:

10. Write a program to define a function with multiple return values.
11. Write a program to define a function using default arguments.
12. Write a program to find the length of the string without using any library functions.

UNIT V FILES HANDLING IN PYTHON 6 hours

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Sample Experiments:

13. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
14. Implement a Python program to print each line of a file in reverse order.
15. Write a Python program to compute the number of characters, words and lines in a file.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Understand to adept command of Python syntax, deftly utilizing variables, data types, and control structures.
CO2: Interpret Strings, functions, modules, exception handling to engineer robust and efficient code solutions.
CO3: Apply Python programming concepts like Lists and Dictionaryto solve a variety of computational problems.
CO4: Build and manipulate fundamental data structures such as tuples and sets.
CO5: Demonstrate file handling concepts in python.

Text Books:

1. Gowri 191hankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024.

Reference Books:

1. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
2. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.

Online Resources:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year II Semester
Skill Enhancement Course - II

23CSD602 EXPLORATORY DATA ANALYSIS USING PYTHON

L	T	P	C
0	1	2	2

Course Objectives:

- This course introduces the fundamentals of Exploratory Data Analysis
- It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods

UNIT I **6 hours**

Exploratory Data Analysis Fundamentals: Understanding data science, The significance of EDA, Steps in EDA, Making sense of data, Numerical data, Categorical data, Measurement scales, Comparing EDA with classical and Bayesian analysis, Software tools available for EDA, Getting started with EDA.

Sample Experiments:

1. a) Download Dataset from Kaggle using the following link : https://www.kaggle.com/datasets/sukhmanibedi/cars4u
   b) Install python libraries required for Exploratory Data Analysis (numpy, pandas, matplotlib,seaborn)
2. Perform Numpy Array basic operations and Explore Numpy Built-in functions.
3. Loading Dataset into pandas dataframe
4. Selecting rows and columns in the dataframe

UNIT II **6 hours**

Visual Aids for EDA: Technical requirements, Line chart, Bar charts, Scatter plot using seaborn, Polar chart, Histogram, Choosing the best chart

Case Study:EDA with Personal Email, Technical requirements, Loading the dataset, Data transformation, Data cleansing, Applying descriptive statistics, Data refactoring, Data analysis

Sample Experiments:

5. Apply different visualization techniques using sample dataset
a) Line Chart b) Bar Chart c) Scatter Plots d)Bubble Plot
6. Generate Scatter Plot using seaborn library for iris dataset
7. Apply following visualization Techniques for a sample dataset
a) Area Plot b) Stacked Plot c) Pie chart d) Table Chart
8. Generate the following charts for a dataset.
a) Polar Chart b)Histogram c)Lollipop chart
9. Case Study: Perform Exploratory Data Analysis with Personal Email Data

UNIT III **6 hours**

Data Transformation: Merging database-style dataframes, Concatenating along with an axis, Merging on index, Reshaping and pivoting, Transformation techniques, Handling missing data, Mathematical operations with NaN, Filling missing values, Discretization and binning, Outlier detection and filtering, Permutation and random sampling, Benefits of data transformation, Challenges

Sample Experiments:

10. Perform the following operations
    a) Merging Dataframes
    b) Reshaping with Hierarchical Indexing
    c) Data Deduplication
    d) Replacing Values
11. Apply different Missing Data handling techniques

a)NaN values in mathematical Operations
    b) Filling in missing data
    c) Forward and Backward filling of missing values
    d) Filling with index values
    e) Interpolation of missing values

12. Apply different data transformation techniques
    a) Renaming axis indexes

b)Discretization and Binning
    c) Permutation and Random Sampling
    d) Dummy variables

UNIT IV **6 hours**

Descriptive Statistics: Distribution function, Measures of central tendency, Measures of dispersion, Types of kurtosis, Calculating percentiles, Quartiles, Grouping Datasets, Correlation, Understanding univariate, bivariate, multivariate analysis, Time Series Analysis

Sample Experiments:

13. Study the following Distribution Techniques on a sample data
    a) Uniform Distribution
    b) Normal Distribution
    c) Gamma Distribution
    d) Exponential Distribution
    e) Poisson Distribution
    f) Binomial Distribution
14. Perform Data Cleaning on a sample dataset.
15. Compute measure of Central Tendency on a sample dataset
    a) Mean b)Median c)Mode
16. Explore Measures of Dispersion on a sample dataset
    a) Variance b) Standard Deviation c) Skewness d) Kurtosis

17. a) Calculating percentiles on sample dataset
    b) Calculate Inter Quartile Range(IQR) and Visualize using Box Plots
18. Perform the following analysis on automobile dataset.
    a) Bivariate analysis b)Multivariate analysis
19. Perform Time Series Analysis on Open Power systems dataset

UNIT V **6 hours**

Model Development and Evaluation: Unified machine learning workflow, Data preprocessing, Data preparation, Training sets and corpus creation, Model creation and training, Model evaluation, Best model selection and evaluation, Model deployment

Case Study:EDA on Wine Quality Data Analysis

Sample Experiments:

20. Perform hypothesis testing using statsmodels library
    a) Z-Test b)T-Test
21. Develop model and Perform Model Evaluation using different metrics such as prediction score, R2 Score, MAE Score, MSE Score.
22. Case Study: Perform Exploratory Data Analysis with Wine Quality Dataset

Course Outcomes:

At the end of the course student will be able to:

CO1; Enumerate the fundamentals of Exploratory Data Analysis.

CO2: Visualize the data using basic graphs and plots.

CO3: Apply different Data Transformation Techniques.

CO4: Summarize the data using descriptive statistics.

CO5: Evaluate the Models and select the best model

Text Books:

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020

Reference Books:

1. Ronald K. Pearson, Exploratory Data Analysis Using R, CRC Press, 2020

2. RadhikaDatar,HarishGarg, Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages, Ist Edition, Packt Publishing, 2019

Online Resources:

1. https://github.com/PacktPublishing/Hands-on-Exploratory-Data-Analysis-with-Python
2. https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/#h-conclusion
3. https://github.com/PacktPublishing/Exploratory-Data-Analysis-with-Python-Cookbook

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Oriented Course II

23CSD603 DevOps

L	T	P	C
1	0	2	2

Pre-requisite : Software Testing, Web Development Basics, Cloud Computing

Course Description:

The DevOps Lab is an immersive hands-on course that equips students with practical experience in applying DevOps principles and tools. Through guided exercises and real-world projects, students will learn to implement version control with Git, automate web testing using Selenium, build CI/CD pipelines, provision infrastructure with IAC tools, utilize Docker and Kubernetes for containerization, and master monitoring solutions. Ideal for software developers, DevOps engineers, and IT professionals, this lab empowers participants to enhance software delivery efficiency and quality.

Course Objectives:

This course enables students

1. To learn DevOps principles and methodologies.
2. To gain hands-on experience in DevOps tools like Git, Selenium, Docker, and Kubernetes.
3. To implement automated web testing using Selenium.
4. To build and optimize CI/CD pipelines for efficient software delivery.
5. To enhance collaboration and efficiency between development and operations teams.

UNIT I INTRODUCTION **6 hours**

Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples.

1. Implementing Continuous Integration with Version Control
2. Setting Up a Scrum or Kanban Board for Task Management

UNIT II SOFTWARE DEVELOPMENT MODELS AND DEVOPS **6 hours**

DevOps Lifecycle for Business Agility, DevOps and Continuous Testing. DevOps influence on Architecture**:** Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

1. Implementing Continuous Testing in the DevOps Lifecycle
2. Microservices Architecture and Resilience in DevOps

UNIT III INTRODUCTION TO PROJECT MANAGEMENT **6 hours**

The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

1. Create a new Git repository and add a README file to it. Commit the changes and push them to the remote repository.
2. Create a new branch called "MITS" and make some changes to a file. Commit the changes and merge the branch with the main branch.
3. Use Git log to view the commit history of a repository and find the commit hash of a specific commit.
4. Clone a Git repository from a remote repository.
5. Push the changes from the local repository to the remote repository.

UNIT IV INTRODUCTION TO SELENIUM AND AUTOMATED WEB TESTING 6 hours

Overview of Automated Web Testing - Setting up the Selenium Environment - Inspecting Web Elements with Selenium - Facebook Login Automation with Selenium- Automated Testing of Google Homepage

1. Open an edge browser and inspect any one web element in Google homepage using selenium.
2. Open a Facebook login page in edge browser and authenticate your account details and display your facebook homepage using selenium.
3. Open a Google home page in edge browser and test all the web elements present in the homepage using selenium.

UNIT V TESTING AND DEVELOPMENT 6 hours

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker

1. Basic Dockers Commands
2. Build and run an HTML webpage displaying "Hello, World!" using Dockers.
3. Build a Dockers image based on the official alpine image that installs the Nano text editor. Run a container from this image and verify that you can use Nano inside the container.
4. Build a Dockers image that pulls MySQL image and execute it with simple query in terminal.
5. Build a Dockers image that pulls MySQL image and create a database using phpmyadmin..

Course Outcomes:

After completing this course, students will be able

CO1: To understand the key principles and practices of DevOps.

CO2: To demonstrate proficiency in using essential DevOps tools like Git, Selenium, Docker, and Kubernetes.

CO3: To successfully implement automated web testing using Selenium for web applications.

CO4: To create and optimize CI/CD pipelines for streamlined software delivery.

CO5: To foster collaboration and efficiency within development and operations teams to improve software development processes..

Text Book(s)

1. "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations" by Gene Kim, Patrick Debois, John Willis, and Jez Humble.IT Revolution Press. 2016

Reference Books

1. "Selenium WebDriver Recipes in Python: The problem-solving guide to Selenium WebDriver in Python" by Zhimin Zhan. Leanpub Publishing, 2018

2. "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation" by Jez Humble and David Farley.Addison-Wesley, 2010

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course II

23CSD604 FULL STACK DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite: JAVA

Course Objectives:

The objectives of the course are to

1. Make use of HTML elements and their attributes for designing static web pages
2. Build a web page by applying appropriate CSS styles to HTML elements
3. Experiment with JavaScript to develop dynamic web pages and validate forms

UNIT I: HTML Fundamentals – Lists, Links, Tables, Forms, and Frames

Lists: Ordered, Unordered, Definition, Nested,Hyperlinks and Images,Tables with formatting ,HTML Forms,Frames and Layout Management

Experiments:

1. Create an HTML page demonstrating all types of lists, including nested and definition lists.
2. Design a web page using hyperlinks (<a> tag) with href and target attributes.
3. Create a gallery with thumbnail images linking to full-size versions.
4. Build a timetable using HTML tables with rowspan, colspan, and caption.
5. Design a student registration form using different input types and proper layout with tables.
6. Construct a webpage using frames to display an image, a paragraph, and a hyperlink in three distinct areas. Use the noframes tag for compatibility.

UNIT II: HTML5 and CSS Styling

HTML5 Semantic Tags: <article>, <section>, <header>, etc.,Audio & Video embedding,CSS Types: Inline, Internal, External,CSS Selectors: Simple, Combinators, Pseudo-classes/elements, Attribute selectors

Experiments:

1. Develop a page using HTML5 tags like <main>, <nav>, <aside>, <figure>, etc.
2. Embed audio and video files in a web page.
3. Apply all three types of CSS to style HTML elements.
4. Demonstrate various selector types (simple, combinators, pseudo-classes/elements, attribute selectors) in a single web page.

UNIT III: Advanced CSS – Layouts, Box Model and Visual Styling

Color and Background Styling,Font and Text Styling,CSS Box Model,Positioning and Background Effects

Experiments:

1. Demonstrate different color definitions in CSS (hex, RGB, names).
2. Use CSS to place a background image fixed at the center and repeat horizontally.
3. Style text with font size, weight, style, alignment, transformation, and decoration.
4. Illustrate the CSS Box Model using content, padding, border, and margin differences.

UNIT IV: JavaScript – Basics, I/O, Data Types and Logic

Embedding JavaScript (Internal & External),Input and Output,Type Conversion,Conditional Statements & Loops,JavaScript Objects: Pre-defined and User-defined

Experiments:

1. Create web pages with both internal and external JavaScript.
2. Write programs to demonstrate different methods of input and output.
3. Create a voting eligibility checker using prompt, conditional logic, and table output.
4. Use window, document, math, array, string, date, and regex objects in different programs.
5. Validate registration form fields (Name, Mobile, Email) using JavaScript.
6. Perform logic checks using JavaScript:
    - Armstrong number
    - Denomination breakdown of an amount
    - Displaying weekdays using switch
    - Print 1 to 10 using different loops

UNIT V: JavaScript Functions, Events & Database Connectivity

JavaScript Functions and Event Handling,Functional Programming Examples,DOM Manipulation,Intro to Server-side JavaScript with Node.js,Connecting to Databases (MySQL, MongoDB)

Experiments:

1. Create reusable JavaScript functions for:
    - Factorial
    - Fibonacci
    - Prime numbers
    - Palindrome check
2. Design a single-page application with text input and buttons for each of the above functions using event handlers.
3. Use for-in, for-of, and forEach loops to print object data.
4. Introduction to Node.js environment – Setup and sample console.log() app.
5. Connect a sample JavaScript app to MySQL or MongoDB and perform basic CRUD operations (optional/demonstration-based if not in lab scope).

Course Outcomes:

After completion of the course, Students will be able to

CO1: Design Websites.

CO2: Apply Styling to web pages.

CO3: Make Web pages interactive.

CO4: Design Forms for applications.

CO5: Choose Control Structure based on the logic to be implemented.

Text Books:

1. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.

Reference Books:

1. Programming the World Wide Web, 7thEdition, Robet W Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Online Learning Resources:

1. https://www.w3schools.com/html
2. https://www.w3schools.com/css
3. https://www.w3schools.com/js/
4. https://www.w3schools.com/nodejs
5. https://www.w3schools.com/typescript

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Skill Enhancement Course – III

23CSD605 MLOps

L	T	P	C
1	0	2	2

Pre-requisite: Nil

1. Knowledge of Linux Operating system, installation and configuration of services and command line basics.
2. Basics of Machine Learning.
3. Knowledge Development Life cycle, development frameworks and DevOps.

Course Objectives:

The main objectives of the course is to

1. The objective of this course is to understand the fundamentals of MLOps and its significance in the ML lifecycle.
2. Students will Learn various tools and technologies used in MLOps to design and build scalable ML
3. pipelines.
4. Students will get exposure to deploy ML models.
5. Students will learn techniques for monitoring, debugging, and optimizing ML systems.
6. Finally, students will explore methods for reproducibility, version control, and model governance .

UNIT I **6 hours**

Introduction to Machine Learning Operations Overview of MLOps and its importance, Understanding the challenges in deploying and managing ML models, ML development lifecycle, Role of MLOps in the ML development lifecycle, Introduction to DevOps and its application to ML, MLOps in Practice.

Experiment 1: Exploring the ML Lifecycle and MLOps Workflow

Create a visual representation (flowchart or diagram) of the Machine Learning lifecycle and mark the stages where MLOps practices are applied. Explain the role of MLOps in each stage (e.g., data handling, model training, deployment, monitoring).

Experiment 2: Setting Up Version Control for an ML Project Using Git

Create a new Git repository for a sample machine learning project. Add a basic Python script (e.g., a simple data loading or print statement), commit your changes, and push the project to GitHub. Demonstrate basic Git commands: init, add, commit, push, and branch.

UNIT II **6 hours**

Data Management, Model Development and Training for MLOps Model Development and Training for MLOps, Data versioning and reproducibility, Data preprocessing and feature engineering pipelines, Data validation and monitoring, Data quality assurance and governance, Model versioning and tracking, Model training pipelines and automation, Hyperparameter tuning and model selection, Model evaluation and validation techniques.

Experiment 3: Data Versioning and Preprocessing with DVC

Download a sample dataset (e.g., Iris or Titanic), initialize a Git repository, and set up DVC to track the dataset. Perform basic preprocessing tasks like removing null values and encoding categorical features. Use DVC to version control the raw and processed data files.

Experiment 4: Model Training and Tracking with MLflow

Using the preprocessed dataset, train a simple machine learning model (e.g., Decision Tree or Logistic Regression) using scikit-learn. Set up MLflow to track parameters (e.g., max_depth), metrics (e.g., accuracy), and save the trained model. Visualize and compare multiple runs in the MLflow UI.

UNIT III **6 hours**

Model Deployment and Serving, Continuous Integration and Delivery (CI/CD) for ML Model packaging and containerization (e.g., Docker), Infrastructure provisioning and orchestration (e.g., Kubernetes), Deploying models as scalable services, managing model endpoints and versioning, Version control and collaboration (e.g., Git), Building reproducible ML pipelines, Automated testing and code quality checks, Continuous integration and deployment strategies.

Experiment 5: Containerizing and Deploying a Machine Learning Model Using Docker

Train a simple ML model (e.g., logistic regression or decision tree) using scikit-learn. Save the model and build a Flask-based API to serve predictions. Containerize the entire application using Docker by writing a Dockerfile, and run it as a container to test the deployment.

Experiment 6: Building a CI/CD Pipeline for an ML Project Using GitHub Actions

Create a GitHub repository for a sample ML project. Set up a GitHub Actions workflow to automatically run a test script and lint your code (using pytest and flake8) every time new code is pushed.

UNIT IV **6 hours**

Monitoring and Performance Optimization Monitoring model performance and behavior, Real-time and batch monitoring techniques, Logging and error tracking in ML systems, Performance optimization and scalability considerations.

Experiment 7: Real-Time Model Monitoring with Prometheus and Grafana

Deploy a simple ML model (served via Flask). Integrate Prometheus to collect metrics like request count, response time, and errors. Use Grafana to visualize these metrics in real-time dashboards.

Experiment 8: Monitoring Data Drift and Model Performance with Evidently AI

Use the Evidently AI library to compare the training data and incoming test data for a deployed model. Generate a data drift report and a performance dashboard.

UNIT V **6 hours**

Cloud Platforms and Infrastructure for MLOps Introduction to cloud platforms (e.g., AWS, Azure, GCP), Deploying ML models on cloud infrastructure, managing resources and scaling ML workloads, Cost optimization strategies for ML systems.Infrastructure as Code (IaC) for ML: Use tools like Terraform or AWS CloudFormation to manage ML infrastructure. Experiment with provisioning and automating the setup of ML environments.

Experiment 9: Deploying a Machine Learning Model on AWS Using SageMaker

Train a simple machine learning model (e.g., regression or classification) locally, and deploy it using Amazon SageMaker as a hosted endpoint.

Experiment 10: Automating ML Infrastructure with Terraform (Infrastructure as Code)

Use Terraform to provision a basic cloud infrastructure for running an ML model on AWS (e.g., EC2 instance with S3 bucket and IAM role).

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Automate the deployment of ML models into the core software system or as a service component.
CO2: Deploy machine learning models in a production environment.
CO3: Implement model monitoring and performance evaluation.
CO4: Manage and scale machine learning infrastructure.
CO5: Apply industry best practices for MLOps and DevOps in data science.

Text Books:

1. Noah Gift , "Practical MLOps: A Guide to Building Real-World Machine Learning Systems", O'Reilly, First Edition, September 2021.
2. Mark Treveil, Nicolas Omont, “Introducing MLOps: How to Scale Machine Learning in the Enterprise”, O'Reilly Media, First Edition, January 5, 2021.
3. Emmanuel Raj, “Engineering MLOps: Rapidly build, test, and manage production-ready machine learning life cycles at scale”, Packt Publishing Limited, 1st edition, 19 April 2021.

Reference Books:

1. Hannes Hapke and Catherine Nelson, "Building Machine Learning Pipelines: Automating Model Life Cycles with TensorFlow", O’Reilly, First Edition, 19 July 2020.
2. Chris Fregly, Antje Barth, "Data Science on AWS: Implementing End-to-End Continuous Machine Learning Pipelines", O’Reilly, First Edition, 9 May 2021.
3. Sridhar Alla, Suman Kalyan Adari, “Beginning MLOps with MLFlow: Deploy Models in AWS SageMaker, Google Cloud, and Microsoft Azure”, Apress publication, 1st edition, 8 December 2020.

Online Learning Resources

1. Coursera: "Machine Learning Engineering for Production (MLOps)" by deeplearning.ai. This course provides a comprehensive introduction to MLOps, covering topics like data and model versioning, deployment, monitoring, and more.
2. Udacity: "Machine Learning Deployment" by Google Cloud. This course focuses on deploying and

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Skill Enhancement Course – IV

23ENG601 SOFT SKILLS

L	T	P	C
1	0	2	2

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking and problem-solving skills
3. To develop leadership skills and organizational skills through group activities
4. To function effectively with heterogeneous teams

UNIT I SOFT SKILLS & COMMUNICATION SKILLS 6 hours

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace. **Non-verbal communication –** Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT II CRITICAL THINKING 6 hours

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III PROBLEM SOLVING & DECISION MAKING 6 hours

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT IV EMOTIONAL INTELLIGENCE & STRESS MANAGEMENT 6 hours

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V LEADERSHIP SKILLS 6 hours

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Memorize various elements of effective communicative skills.
CO2: Interpret people at the emotional level through emotional intelligence.
CO3: Apply critical thinking skills in problem solving.
CO4: Analyse the needs of an organization for team building.
CO5: Judge the situation and take necessary decisions as a leader.
CO6:Develop social and work-life skills as well as personal and emotional well-being.

Text Books:

1. Personality Development and Soft Skills (English, Paperback, MitraBarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr ShikhaKapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr.Usha Jain Publisher: Vayu Education of India

Online Learning Resources

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor in Computer Science and Engineering (Data Science)
(Applicable to CE, ECE, EEE, ME)

Minor

23MDCSD101 PREDICTIVE ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Basic Probability and Statistics,Python or R Programming,Machine Learning fundamentals

Course Description:

This course provides an overview of predictive analytics techniques and their real-world applications. Students will learn to prepare data, build and evaluate predictive models using algorithms like decision trees, logistic regression, and ensemble methods. The course also introduces text mining and model deployment through practical case studies.

Course Objectives:

The main objectives of the course is to

1. Introduce the foundational concepts and workflows of Predictive Analytics.
2. Illustrate real-world use cases and applications across different domains.
3. Demonstrate the process of building, evaluating, and deploying predictive models using various algorithms.
4. Explore ensemble techniques and text mining for advanced predictive tasks.
5. Familiarize students with performance metrics and model interpretation techniques.

UNIT I OVERVIEW OF PREDICTIVE ANALYTICS 10 hours

What Is Analytics? What Is Predictive Analytics? Business Intelligence Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics, Predictive Analytics vs. Data Mining, Who Uses Predictive Analytics? , Challenges in Using Predictive Analytics, What Educational Background Is Needed to Become a Predictive Modeler?

Setting Up the Problem: Predictive Analytics Processing Steps: CRISP-DM, Business Understanding, Defining Data for Predictive Modelling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modelling Out of Order, Case study- Recovering Lapsed Donors, Fraud Detection

UNIT II DATA UNDERSTANDING 9 hours

What the Data Looks Like, Single Variable Summaries, Data Visualization in One Dimension, Histograms, Multiple Variable Summaries, Data Visualization, Two or Higher Dimensions, The Value of Statistical Significance, Pulling It All Together into a Data Audit.

Data Preparation: Variable Cleaning, Feature Creation.

UNIT III ITEM SETS AND ASSOCIATION RULES 9 hours

Terminology, Parameter Settings, How the Data Is Organized, Measures of Interesting Rules, Deploying Association Rules, Problems with Association Rules, Building Classification Rules from Association Rules.

Descriptive Modelling: Data Preparation Issues with Descriptive Modelling, Principal Component Analysis, Clustering Algorithms.

Interpreting Descriptive Models: Standard Cluster Model Interpretation.

UNIT IV PREDICTIVE MODELLING **9 hours**

Decision Trees, Logistic Regression, Neural Networks, K-Nearest Neighbour, Naïve Bayes, Regression Models, Linear Regression, Other Regression Algorithms.

Assessing Predictive Models: Batch Approach to Model Assessment, Assessing Regression Models.

UNIT V MODEL ENSEMBLES **9 hours**

Motivation for Ensembles, Bagging, Boosting, Improvements to Bagging and Boosting, Model Ensembles and Occam's Razor, Interpreting Model Ensembles.

Text Mining: Motivation for Text Mining, A Predictive Modelling Approach to Text Mining, structured vs. Unstructured Data, Why Text Mining Is Hard, Data Preparation Steps, Text Mining Features, Modelling with Text Mining Features, Regular Expressions.

Model Deployment: General Deployment Considerations.

Case Studies: Survey Analysis Case Study, Help Desk Case Study.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Visualize and explore data to understand relationships and patterns.

CO2: Understand and explain how ensemble models improve prediction accuracy.

CO3: Organize and structure the predictive modelling pipeline and data preparation workflow.

CO4: Apply suitable predictive models like Decision Trees, Logistic Regression, and Neural Networks.

CO5: Evaluate model performance using appropriate statistical and business metric.

Text Books:

1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.

Reference Books:

1. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
2. Data Analytics using Python Kindle Editionby Bharti Motwani, 202

Online Learning Resources

1. Predictive Analytics: Introduction to Business Forecasting | Udemy

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCSD102 DATA VISUALIZATION

L	T	P	C
3	0	0	3

Pre-requisite: Exploratory Data Analysis.

Course Description:
This course introduces the principles and practices of data visualization to enable effective communication of data insights. Students will learn to abstract, map, and visualize data using statistical charts, multivariate techniques, and interactive dashboards. The course covers scalar, vector, temporal, and spatial data visualization, and includes hands-on experience with industry-standard tools like Tableau and Power BI. It emphasizes analytical thinking, visual storytelling, and dashboard design for domains such as finance, healthcare, and marketing.

Course Objectives:
The main objectives of the course is to

1. Introduce the fundamentals of data visualization and visual encoding techniques.
2. Explore various visualization techniques for structured, unstructured, and temporal data.
3. Understand multivariate and analytical visualizations using trees, maps, and networks.
4. Develop skills in creating effective visualizations using Tableau and Power BI.
5. Apply storytelling principles to design dashboards for domain-specific decision-making.

UNIT I INTRODUCTION TO DATA VISUALIZATION AND STATISTICAL CHARTS **9 hours**

Overview of data visualization, Data Abstraction and Task Abstraction, Dimensions and Measures, Four levels for analytical validation, Statistical charts and their use cases:Bar chart, stacked bar chart, line chart, histogram, pie chart, box plot, scatter plot, frequency polygon, regression curves, Types of visualization tools

UNIT II VISUALIZATION TECHNIQUES AND DATA TYPES **9 hours**

Scalar and point-based visualization techniques, Vector visualization techniques, Multidimensional visualization techniques, Cluster visualization: K-means and Hierarchical clustering, Visualizing:Time-series data, Text data
Spatial data.

UNIT III VISUAL ANALYTICS AND MULTIVARIATE DATA VISUALIZATION **9 hours**

Networks and trees, Heat maps and treemaps,Manipulating view using map color and channels, Visual attributes for effective interpretation, Multivariate techniques:Geometric projection, Pixel-oriented and icon-based techniques, Scatterplot matrix, hyperbox, parallel coordinates, trellis displays

UNIT IV DATA VISUALIZATION WITH TABLEAU AND POWER BI **9 hours**

Introduction to Visualization Tools,Tableau essentials: Marks, channels, arranging tables, facets,Power BI essentials: Workspace, Power Query, fields, charts, visuals,Design principles in visualization: choosing the right chart, layout, interactivity, and optimization.

UNIT V DASHBOARD DESIGN AND DATA STORYTELLING **9 hours**

Designing interactive dashboards, Dashboard taxonomies and organizational functions, User interaction and protection, Common mistakes in dashboard design, Use case–based dashboard development for:Finance, Marketing, Healthcare, Insurance ,Storytelling with Data and using Power BI Q&A for narrative insights

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Explain core concepts in data abstraction and statistical chart design.
CO2: Apply appropriate visualization techniques for scalar, vector, temporal, and text data.
CO3: Analyze and interpret multivariate data using visual analytics.
CO4:Develop interactive data visualizations using Tableau and Power BI.
CO5:Design and evaluate storytelling dashboards for real-world datasets.

Text Books:

1. Cole Nussbaumer Knaflic, Storytelling with data, Wiley .
2. Ben Jones, Communicating Data with Tableau, O'Reilly

Reference Books:

1. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Reilly.
2. Andy Kirk, Data Visualization: A Successful Design Process, PAKT.
3. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

Online Learning Resources

1. Data Analysis and Visualization Foundations | Coursera
2. Data Visualization | Coursera

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCSD201 PREDICTIVE ANALYTICS AND VISUALIZATION LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite:

Course Description:

This laboratory course provides practical exposure to statistical analysis and modern data visualization techniques using SPSS, Python, Tableau, and Power BI. Students will gain hands-on experience with data preprocessing, inferential statistics, multivariate analysis, predictive modeling, and interactive dashboard development. The course emphasizes both quantitative data interpretation and effective storytelling through dashboards, enabling students to transform complex data into actionable insights.

Course Objectives:

The objectives of the course are to

1. Familiarize students with advanced statistical tools (SPSS) for data preprocessing, hypothesis testing, and multivariate analysis.
2. Perform statistical techniques such as factor analysis, regression, time series forecasting, and decision tree classification.
3. Develop skills in Python for visualizing structured and semi-structured data interactively.
4. Create professional dashboards using Tableau and Power BI for different business use cases.
5. Enable domain-specific storytelling through sales, healthcare, marketing, and time series dashboards.

PART 1

List of Experiments:

1. Introduction to SPSS, Sorting File, Split File, Compute File, Recode File and Select Cases
2. Chi- Square Test (Parametric and Non-Para
3. Exploratory Factor Analysis
4. Cluster Analysis
5. Logistic Regression
6. Discriminant Analysis
7. Confirmatory Factor Analysis
8. Conjoint Analysis
9. Time Series
10. MANOVA
11. Decision Tree Analysis

PART 2

List of Experiments:

1. Connecting to the data
2. Formatting and insertion of data

3. Creating worksheets, navigating the sheets, applying filters, aggregating the data
4. Organize the data into dashboards
5. Create story
6. Develop interactive plots in Python
7. Create Time series Data Visualization in Python
8. Visualization of Semi-Structured data
9. Create Sales Growth Dashboard – for the tracking of sales teams progress
10. Design Social media Dashboard – find how well your sponsored social activating are performing, monitor your PPC campaigns
11. Develop Healthcare Data Dashboard – Allows hospital administrators to manage and identify patient hazards from a single screen.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Perform statistical data analysis and hypothesis testing using SPSS.

CO2: Apply multivariate techniques such as factor analysis, regression, and decision trees.

CO3: Develop visualizations using Python for structured and semi-structured data.

CO4:Build and publish dashboards using Tableau and Power BI for different business domains.

CO5: Design effective visual stories that communicate insights from real-world datasets.

Text Books:

1. Dean Abbott, Applied Predictive Analytics, Published by Jhon Wiley &Sons, Inc,2014.
2. Cole Nussbaumer Knaflic, Storytelling with data, Wiley .

Reference Books:

3. Eric Siegel, Predictive Analytics, Published by Jhon Wiley & Sons, inc,2013.
4. Scott Murray, Interactive Data Visualization for Web, O'Reilly.

Online Learning Resources/Virtual Labs:(Part 1)

1.Predictive Analytics: Introduction to Business Forecasting | Udemy

Online Learning Resources/Virtual Labs:(Part 2)

1.Data Visualization with Tableau | Coursera

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Minor

23MDCSD103 DATA ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

The main objectives of the course is to

1. Explain basic concepts of Data Engineering
2. Discuss bout Data Engineering Life Cycle
3. How to design Good Data Architecture

UNIT I INTRODUCTION TO DATA ENGINEERING 9 hours

Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,

Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

UNIT II DATA ENGINEERING LIFE CYCLE: 9 hours

Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

UNIT III DESIGNING GOOD DATA ARCHITECTURE 9 hours

Enterprise Architecture,Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts. Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details

UNIT IV 9 hours

Storage: Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse. Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

UNIT V 9 hours

Queries, Modeling and Transformation: Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing. Dept. of Computer Science and Engineering (Data Science)

Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand data engineering fundamentals, differentiate from data science, and identify key data engineer roles and responsibilities

CO2: Grasp the data engineering lifecycle, including security, management, and operational aspects.

CO3: Design effective data architectures based on data sources, models, and architectural principles.

CO4: Select optimal storage and ingestion methods for efficient data pipelines..

CO5: Master querying, modeling, and transformation techniques to deliver valuable data products.

Text Books:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc.,June 2022,ISBN: 9781098108304

Reference Books:

1. Paul Crickard , Data Engineering with Python,Packt Publishing, October 2020
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, 1st Edition, 2021

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCSD104 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: Python Programming, Machine Learning Basics

Course Objectives:

The main objectives of the course is to

1. Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
2. Discuss approaches to syntax and semantics in NLP.
3. Examine current methods for statistical approaches to machine translation.
4. Teach machine learning techniques used in NLP.

UNIT I INTRODUCTION TO NATURAL LANGUAGE 9 hours

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT II GRAMMARS AND PARSING 9 hours

Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayees Rule, Shannon game, Entropy and Cross Entropy.

UNIT III GRAMMARS FOR NATURAL LANGUAGE 9 hours

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT IV SEMANTIC INTERPRETATION 9 hours

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

UNIT V MACHINE TRANSLATION 9 hours

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Multilingual Information Retrieval: Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
CO2: Apply the various Parsing techniques, Bayes Rule, Shannon game, Entropy and Cross Entropy.
CO3: Understand the fundamentals of CFG and parsers and mechanisms in ATN's.
CO4: Apply Semantic Interpretation and Language Modelling.
CO5: Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.

Text Books:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Online Learning Resources

1. https://nptel.ac.in/courses/106/105/106105158/
2. http://www.nptelvideos.in/2012/11/natural-language-processing.html

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Minor

23MDCSD202 DATA ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Course Objectives:

1. Optimize business decisions and create competitive advantage with Big Data analytics
2. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
3. Introducing Java concepts required for developing map reduce programs
4. Derive business benefit from unstructured data
5. Introduce programming tools PIG & HIVE in Hadoop echo system.
6. Developing Big Data applications for streaming data using Apache Spark

List of Programs:

1. (i) Perform Setting Up And Installing Hadoop In Its Two Operating Modes: Pseudo Distributed, And Fully Distributed.

(ii) Use Web Based Tools To Monitor Your Hadoop Setup.

2. (i) Implement the following file management tasks in Hadoop:
   1. Adding files and directories
   2. Retrieving files
   3. Deleting files

ii) Benchmark and stress test an Apache Hadoop cluster

3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
   1. Find the number of occurrence of each word appearing in the input file(s)
   2. Performing a MapReduce Job for word search count (look for specific keywords in a file)

4. Stop word elimination problem:
   a. Input:
      i. A large textual file containing one sentence per line
      ii. A small file containing a set of stop words (One stop word per line)
   b. Output:
      i. A textual file containing the same sentences of the large input file without the words appearing in the small file.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: https://github.com/tomwhite/hadoop- book/tree/master/input/ncdc/all.

1. Find average, max and min temperature for each year in NCDC data set?

2. Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

6. Purchases.txt Dataset

a. Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores

i. What is the value of total sales for the following categories?

1. Toys
2. Consumer Electronics

b. Find the monetary value for the highest individual sale for each separate store

7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)

9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO1: Preparing for data summarization, query, and analysis.

CO2:Applying data modelling techniques to large data sets

CO3: Creating applications for Big Data analytics

CO4: Building a complete business data analytic solution

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A Hands-On Approach “,VPT, 2016
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics”, John Wiley& sons, 2012

Reference Books:

1. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, “Harness the Power of Big Data The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012
2. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.
3. Kim H. Pries, Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers”, CRC Press, 2015.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

HONORS

Honors

23HDCSD101 DATA SCIENCE FOR BUSINESS

L	T	P	C
3	0	0	3

Pre-requisite: Basic Data Handling Skills, Fundamentals of Programming

Course Description:

This course introduces the principles and applications of data science in solving business problems and driving data-informed decision-making. It equips students with the ability to frame business challenges as data problems, apply relevant data analytics techniques, and interpret insights to support strategic actions. Topics include data wrangling, exploratory data analysis, predictive modeling, and data visualization, all contextualized within various business domains such as marketing, finance, operations, and customer analytics. The course bridges the gap between technical data science skills and practical business applications.

Course Objectives:

The main objectives of the course is to

1. Expose with the basic rudiments of business intelligence system
2. Expose with different data analysis tools and techniques

UNIT I **9 hours**

Introduction – Business problems and Data Science Solutions, Introduction to Predictive modeling: From Correlation to Supervised Segmentation

UNIT II **9 hours**

Fitting the Data- Fitting a Model to Data, Overfitting and its Avoidance.

UNIT III **9 hours**

Similarity, Neighbors, and Clusters, Decision Analytic Thinking: What is a Good model.

UNIT IV **9 hours**

Representing and Mining text, Decision Analytic Thinking II: Toward Analytic Engineering.

UNIT V **9 hours**

Other Data Science Tasks and Techniques, Data Science and Business Strategy.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the fundamentals of business intelligence.
CO2: Applying link to data mining with business intelligence.
CO3: Apply various modelling techniques.
CO4: Understand the data analysis and knowledge delivery stages.
CO5: Apply business intelligence methods to various situations and decide on appropriate technique.

Text Books:

1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013.

Reference Books:

1. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.
2. Larissa T. Moss, S. Atre, "Business Intelligence Roadmap: The Complete ProjectLifecycle of Decision Making", Addison Wesley, 2003.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for DecisionMaking", Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Manager'sGuide", Second Edition, 2012.

Online Learning Resources

1. Edx: IBM Data Warehousing and BI Analytics

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSD102 SOFTWARE PROJECT MANAGEMENT USING AGILE

L	T	P	C
3	0	0	3

Pre-requisite: Software Engineering Fundamentals

Course Description:

This course provides a comprehensive understanding of software project management practices with a focus on Agile methodologies. It introduces the principles of Agile development, iterative planning, and adaptive project control. Students will learn how to manage project scope, time, cost, quality, communication, and risks in dynamic software environments.

Course Objectives:

The main objectives of the course is to

1. Teach how to manage a Project
2. Discuss Agile method of handling projects

UNIT I INTRODUCTION, THE AGILE BUSINESS CASE 9 hours

History, Background, and the Manifesto, Traditional Lifecycle, Agile Lifecycle, Scaling for Enterprise Agile, Four Agile Methodologies. The Agile Business Case: The Business Case, Business Value Models, Project Balance Sheet, Building the Business Case by Levels.

UNIT II QUALITY IN THE AGILE SPACE 9 hours

Quality Values and Principles, Thought Leaders and Agile Quality, Sampling for Quality Validation, Agile in the Waterfall: First Principles and Requisite Conditions, The Black Box, Interfaces, and Connectivity, Governing.

UNIT III SCOPE AND REQUIREMENTS 9 hours

Developing the Scope and Requirements: Agile Scope, Envisioning, Requirements, Planning at a Distance Planning and Scheduling: Planning in the Enterprise Context, Scheduling, Other Plans in the Enterprise Agile Project.

UNIT IV ESTIMATING COST AND SCHEDULE 9 hours

The Nature of Estimates, Drivers on Cost and Schedule, Building Estimates Teams Are Everything: The Social Unit, Principle and Values Guide Teams, Teams Are Building Blocks, Some Teams Work; Others Do Not, Matrix Management in the Agile Space.

UNIT V GOVERNANCE, MANAGING VALUE 9 hours

Governance Is Built on Quality Principles, Governance Verifies Compliance Managing Value: Defining and Accounting for Value, Burn-down Charts and Value Scorecards.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Apply Agile methodology for software development.
CO2: Critically analyze quality of software.
CO3: Estimate the software cost.
CO4: Develop and manage scope and requirements in Agile projects.
CO5: Implement governance and value management practices in Agile projects.

Text Books:

1. John C. Goodpasture, PMP, “Project Management the Agile Way”, Second Edition, J. Ross Publishing 2016.

Reference Books:

1. KalpeshAshar, Agile Essentials you always wanted to know, Vibrant publishers, 2020
2. Jutta Eckstein, Agile Software development in the large: Diving into the Deep, Jutta Eckstein Publisher, 2022

Online Learning Resources

1. Coursera: Agile Project Management offered by Google .
2. Coursera: Alex Cowan, Agile Development Specialization .

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

Honors

23HDCSD201 DATA SCIENCE FOR BUSINESS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Basic Data Handling Skills, Fundamentals of Programming

Course Description:

This laboratory course focuses on applying data science techniques to solve business problems using real-world datasets. Students will explore business-relevant tasks such as customer segmentation, sales forecasting, churn prediction, and marketing analysis. The lab emphasizes data preprocessing, visualization, modeling, and interpretation using tools such as Python, Excel, Power BI, and Tableau. By the end of the course, students will be able to build actionable insights and communicate findings for business decision-making.

Course Objectives:

The objectives of the course are to:

1. Enable students to apply data science concepts in business scenarios.
2. Provide hands-on experience in data cleaning, visualization, and interpretation.
3. Implement supervised and unsupervised learning methods for business use cases.
4. Analyze and interpret model performance using appropriate metrics.
5. Communicate business insights through dashboards and storytelling.

List of Experiments:

1. Load a real-world dataset (e.g., Titanic or Iris), explore basic descriptive statistics, correlations, and visualize feature relationships.
2. Implement a decision tree classifier to predict a target (e.g., survival in Titanic dataset) and visualize the tree structure.
3. Analyze feature correlations using Pearson/Spearman coefficients and use logistic regression for prediction with evaluation (accuracy, confusion matrix).
4. Implement a simple linear regression model on a dataset (e.g., house prices) and visualize best-fit line.
5. Show underfitting, good fit, and overfitting by fitting polynomial regression models of different degrees.
6. Use k-fold cross-validation to evaluate model performance and demonstrate regularization techniques (L1/L2).
7. Build a KNN model and vary k values to understand impact on accuracy (e.g., classifying digits or wine quality).
8. Implement K-means clustering on a dataset (e.g., customer segmentation or iris) and visualize the clusters.
9. Use confusion matrix, ROC-AUC, precision-recall curve to compare multiple classification models.
10. Load a sample document or dataset (e.g., SMS spam), tokenize, clean, and plot most frequent words using NLTK or spaCy.
11. Implement a spam classifier using CountVectorizer + Naive Bayes model on an SMS/email dataset.
12. Use TF-IDF vectorization and cosine similarity to find document similarity (e.g., for search/recommendation).
13. Train both models on the same dataset and compare their accuracies, tree depth, and feature importances.

14. Use a telecom churn dataset to predict customer churn using logistic regression or XGBoost with business interpretation.
15. Deploy any one model using Flask or Streamlit to demonstrate business integration.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Analyze business datasets using statistical techniques and visual tools.

CO2: Implement machine learning models for classification, regression, and clustering in business contexts.

CO3: Evaluate model performance using metrics relevant to business outcomes.

CO4: Develop dashboards and visual reports for business decision support.

CO5: Translate model outputs into actionable business recommendations.

Text Books:

1. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly, 2013.

Reference Books:

1. Efraim Turban, Ramesh Sharda, DursunDelen, "Decision Support and Business Intelligence Systems", 9 th Edition, Pearson 2013.

Online Learning Resources:

1. https://www.harvardonline.harvard.edu/course/data-science-business

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination

Honors

23HDCSD103 HEALTH CARE ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Fundamentals of AI and Machine Learning

Course Objectives:

The main objectives of the course is to

1. Discuss the role of data analytics in healthcare and the available resources.
2. Describe the components and challenges of EHR data in health care organizations.
3. Enable the learners to develop skills required for biomedical image and signal analysis.
4. Familiarize the learner with data mining techniques for clinical text.
5. Identify data analytics techniques for pervasive health.

UNIT I INTRODUCTION TO HEALTHCARE DATA ANALYTICS 9 hours

Introduction, Healthcare Data Sources and Basic Analytics, Advanced Data Analytics for Healthcare, Applications and Practical Systems for Healthcare, Resources for Healthcare Data analytics.

UNIT II ELECTRONIC HEALTH RECORDS 9 hours

Introduction, History of HER, Components of EHR, Coding Systems, Benefits of EHR, Barriers to Adopting EHR, Challenges of Using EHR Data.

UNIT III BIOMEDICAL IMAGE AND SIGNAL ANALYSIS 9 hours

Biomedical Image Analysis: Introduction, Biomedical Imaging Modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction.
Biomedical Signal Analysis: Types of Biomedical Signals, ECG Signal Analysis, Multivariate Biomedical Signal Analysis.

UNIT IV DATA MINING FOR CLINICAL TEXT 9 hours

Information Extraction, Current Methodologies -Rule Based Approaches, Pattern Based Algorithms, Clinical Text Corpora and Evaluation Metrics, Challenges of Processing Clinical Reports, Clinical Applications.

UNIT V DATA ANALYTICS FOR PERVASIVE HEALTH 9 hours

Introduction, Supporting Infrastructure and Technology-Body Area Networks(BAN),Dense/Mesh Sensor, Basic Analytic Techniques, Applications-Continuous Monitoring, Assisted Living.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1: Understand the role of data analytics in health care.
CO2: Analyze the components and challenges of EHR data in health care organizations.
CO3: Identify methods for biomedical image and signal analysis.
CO4: Use effective data mining techniques for clinical text.
CO5: Apply the appropriate data analytics techniques in pervasive healthcare.

Text Books:

1. "Healthcare data analytics (Vol. 36)" by Reddy, C. K., & Aggarwal, C. C. (Eds.), CRC Press, 2015.

Reference Books:

1. "Healthcare Analytics for Quality and Performance Improvement" by Trevor L. Strome John, Wiley & Sons, 2013.

Online Learning Resources

1. https://www.coursera.org/courses?query=healthcare%20data%20analytics

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23HDCSD104 SOFTWARE DEFINED DATA CENTER

L	T	P	C
3	0	0	3

Pre-requisite: Computer Network,Operating Systems,Cloud Computing

Course Description:

This course provides a comprehensive understanding of the evolution and architecture of modern data centers with a focus on software-defined components. Students will learn about trends in software-defined compute, storage, networking, and security, and how these technologies support agility, scalability, and cost efficiency in IT infrastructure. Topics include hyperconvergence, virtualization, orchestration, DevOps practices, and the transition toward future data centers using flash storage, containers, and open-source tools. The course emphasizes aligning IT infrastructure with dynamic business needs through modern technologies.

Course Objectives:

The main objectives of the course is to

1. Introduce conventional Data Centers followed by Modern Data Centers
2. To discuss various software elements of modern data centers
3. Explain Virtualization concepts for Data Centers
4. Discuss Compute, Storage and Network virtualization

UNIT I INTRODUCTION 9 hours

Data Center evolution, A history of Modern Data Center, Focus on cost reduction, Focus on Customer service in the business, Flattening of the IT organization, IT as an operational Expense, Monolithic Storage Array rise and fall, Move From Disk to Flash, Emergence of Convergence, The Role of Cloud computing.

UNIT II EMERGING DATA CENTER TRENDS 9 hours

Emergence of SDCC, Commoditization of Hardware, Software Defined – Compute, Storage, Networking and Security, Software Defined Storage (SDS), Hyperconvergence, Hyper Converged Infrastructure(HCI) and SDS relationship, Flash in Hyperconvergence, Modern IT business Requirements.

UNIT III DATA CENTER AGILITY 9 hours

Principles and Strategies, Transform Data Center, Align Data Center and Business Needs, Server virtualization, VDI, Eliminate and Implement Monolithic to Hyperconvergence, Full Stack Management.

UNIT IV VHYPER CONVERGED INFRASTRUCTURE 9 hours

Software Defined Storage, SDS comparison to Traditional Storage, SDS requirements, SDS in Hyperconverged, Hyperconvergence Design Model, Virtual Storage appliances, Appliance vs. Software/Reference Architecture,

UNIT V FUTURE DATA CENTERS 9 hours

Data growth, Storage capacity, flash storage deployment, Deployment Experiences SDS and HCI, IT transformations- Automation, Orchestration, DevOps, Open Standards and Interoperability, Performance Benchmarking Standards, Future Trends, Containers Instead of virtual machines, Open Source tools, Beyond Today's Flash, Pooling of Resources.

Course Outcomes:

At the end of this course students will demonstrate the ability to

CO1:Understanding of difference between Conventional Data Center Vs Modern Data Centers.
CO2: Differentiate Cloud computing and Software Defined Data Centers.
CO3: Differentiate Virtualization with conventional techniques.
CO4: Explore the techniques of Software Defined Compute, Storage and Networking components.
CO5: Able Manage Software Defined Data Centers and Develop the techniques for future Data Centers.

Text Books:

1. Building a Modern Data Center, Principles and Strategies of Design, Scott D.Lowe, James Green, David Davis. Actual Tech Media, 2016.

Reference Books:

1. Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center, Second Edition, HwaiyuGeng P.E.,2021 John Wiley & Sons.

Online Learning Resources

1. https://www.coursera.org/learn/sdn

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech III Year II Semester

23HDCSD202 HEALTH CARE ANALYTICS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Python Programming, Machine Learning Basics

Course Description:

This lab course enables students to explore the application of data science techniques in healthcare contexts. Through hands-on experiments, students will work with structured and unstructured healthcare data, such as electronic health records (EHRs), biomedical signals, medical images, and clinical notes. They will perform tasks including cleaning, visualization, modeling, feature extraction, and anomaly detection. The lab focuses on practical skills to solve healthcare problems such as disease prediction, patient monitoring, clinical NLP, and medical image processing.

Course Objectives:

The objectives of the course are to

1. To explore and preprocess real-world healthcare datasets for analysis.
2. To apply statistical and machine learning models to predict disease risks and patient outcomes.
3. To analyze medical signals and biomedical images for clinical pattern recognition.
4. To process and extract information from unstructured clinical text.
5. To simulate and monitor patient health trends using wearable and sensor data.

List of Experiments:

1. Explore a Public Healthcare Dataset:Dataset: UCI Diabetes / Heart Disease dataset
   Load, clean, explore missing values, visualize trends (age vs. risk), and perform statistical summaries.
2. Perform analysis like patient admission trends, average length of stay, readmission rates using synthetic hospital visit logs.
3. Create a simple logistic regression model to predict disease risk (e.g., diabetes) from patient features.
4. Simulate or use de-identified EHR data to process patient demographics, visualize diagnosis frequency using bar charts and histograms.
5. Implement a lookup for ICD-10 code mapping in a patient record dataset and summarize diagnosis categories.
6. Detect duplicates, missing data, and inconsistent formats in a sample EHR file; generate a cleaning report.
7. Load a biomedical image (e.g., X-ray or MRI from MedMNIST), apply thresholding, edge detection, and segment regions of interest.
8. Extract features like histogram of gradients (HoG), texture, or shape features from an image dataset and plot feature maps.
9. Load an ECG signal file (e.g., MIT-BIH dataset), filter noise, detect R-peaks, and calculate heart rate variability using scipy or neurokit2.
10. Tokenize, remove stopwords, lemmatize a set of clinical notes. Visualize most common terms using word cloud or frequency distribution.
11. Write custom rules to extract drug names, dosage, symptoms using regular expressions or spaCy from simulated prescription notes.
12. Convert clinical notes into TF-IDF vectors and classify them into diagnosis types using Naive Bayes.

13. Simulate or use sample Body Area Network (BAN) data (e.g., temperature, ECG, accelerometer), preprocess and visualize trends for patient monitoring.
14. Implement a threshold-based or unsupervised anomaly detection method (e.g., Isolation Forest) on continuous wearable data.
15. Simulate patient activity logs (e.g., sleep, steps, medication) and build a rule-based alert system for deviations from normal behavior.

Course Outcomes:

After completion of the course, Students will be able to

CO1: Preprocess and analyze structured healthcare data for trends and clinical insights.
CO2: Apply machine learning techniques to classify diseases and predict patient risk.
CO3: Extract and interpret patterns from medical images and physiological signals.
CO4: Perform clinical text processing to extract meaningful health information using NLP techniques.
CO5: Implement anomaly detection and patient monitoring systems using wearable sensor data.

Text Books:

1. "Healthcare data analytics (Vol. 36)" by Reddy, C. K., & Aggarwal, C. C. (Eds.), CRC Press, 2015.

Reference Books:

2. "Healthcare Analytics for Quality and Performance Improvement" by Trevor L. Strome John, Wiley & Sons, 2013.

Online Resources:

1. https://www.coursera.org/courses?query=healthcare%20data%20analytics

Mode of Evaluation: Continuous Internal Evaluation, Model Test and End Semester Examination