ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
B.TECH-COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

INDUCTIONPROGRAM(3weeksduration)

S. No	Course Name	Category	L-T-P-C
1	Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches –career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch—corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills –focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basic Civil and Mechanical Engineering	2	1	0	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
			Total	**10**	**4**	**11**	**19.5**	**320**	**630**	**950**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	PC	23APC0501	Data Structures	2	1	0	3	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
			Total	**09**	**04**	**15**	**20.5**	**320**	**630**	**950**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9913	Discrete Mathematics and Graph Theory	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	PC	23APC0503	Digital Logic and Computer Organization	2	1	0	3	30	70	100
4	PC	23APC0504	Advanced Data Structures and Algorithms Analysis	2	1	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	2	1	0	3	30	70	100
6	PC	23APC0505	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
9	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
			Total	**12**	**06**	**8**	**20**	**270**	**560**	**830**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	BS	23ABS9916	Probability and Statistics	2	1	0	3	30	70	100
3	PC	23APC0510	Operating Systems	2	1	0	3	30	70	100
4	PC	23APC0508	Database Management Systems	2	1	0	3	30	70	100
5	PC	23APC0512	Software Engineering	2	1	0	3	30	70	100
6	PC	23APC0511	Operating Systems Lab	0	0	3	1.5	30	70	100
7	PC	23APC0509	Database Management Systems Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0503	Full Stack Development-1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking and Innovation	0	1	2	2	30	70	100
			Total	**10**	**06**	**10**	**21**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation										

Semester V (Third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	23APC0513	Introduction to Artificial Intelligence	2	1	0	3	30	70	100
2	PC	23APC0515	Introduction to Computer Networks	2	1	0	3	30	70	100
3	PC	23APC0517	Automata Theory and Compiler Design	2	1	0	3	30	70	100
4	PE-I	23APE0501	**Professional Elective-I** Object Oriented Analysis and Design	2	1	0	3	30	70	100
		23APE0502	Soft Computing							
		23APE0503	Microprocessors and Microcontrollers							
		23APE0504	Data Warehousing and Data Mining							
5	**OE-I**		***Open Elective-I**	2	1	0	3	25	75	100
6	PC	23APC0514	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
7	PC	23APC0516	Computer Networks Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	**Skill Enhancement course** Soft skills	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	ES	23AES0504	Introduction To Quantum Technologies and Applications	2	1	0	3	30	70	100
11	PR	23APR0501	Community Service Project	-	-	-	2	100		100
			Total	**12**	**07**	**10**	**26**	**395**	**705**	**1100**

*Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23AOE0101	Green Buildings	CIVIL
2.	23AOE0102	Construction Technology and Management	
3.	23AOE0201	Electrical Safety Practices and Standards	EEE
4.	23AOE0301	Sustainable Energy Technologies	ME
5.	23AOE0401	Electronic Circuits	ECE
6.	23AOE9901	Mathematical Foundations for Machine Learning and AI	Mathematics
7.	23AOE9906	Materials Characterization Techniques	Physics
8.	23AOE9911	Chemistry of Energy Systems	Chemistry
9.	23AOE9915	English for Competitive Examinations	Humanities
10.	23AOEMB01	Entrepreneurship and New Venture Creation	
11.	23AES0504	Quantum Technologies And Applications	CSE & Allied

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester VI (Third year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	23APC0518	Machine Learning	2	1	0	3	30	70	100
2	PC	23APC0520	Cloud Computing	2	1	0	3	30	70	100
3	PC	23APC0521	Cryptography and Network Security	2	1	0	3	30	70	100
4	PE-II	23APE0505	**Professional Elective-II** Software Testing Methodologies	2	1	0	3	30	70	100
		23APE0506	Cyber Security							
		23APE0507	DevOps							
		23APE0508	Embedded Systems Design							
5	**PE-III**	23APE0509	**Professional Elective-III** Software Project Management	2	1	0	3	30	70	100
		23APE0510	Mobile Adhoc Networks							
		23APE0511	Natural Language Processing							
		23APE0512	Distributed Operating System							
6	**OE-II**		***Open Elective-II**	2	1	0	3	25	75	100
7	PC	23APC0519	Machine Learning Lab	0	0	3	1.5	30	70	100
8	PC	23APC0522	Cryptography and Network Security Lab	0	0	3	1.5	30	70	100
9	SC	23ASC0504	**Skill Enhancement Course** Full Stack Development - II	0	1	2	2	30	70	100
10	AC	23AMC9902	**Audit Course** Technical Paper Writing & IPR	2	0	0	-	30	-	30
11	SC	23ASC0505	TECHNICAL WORKSHOP	-	-	-	-	0	0	0
			Total	**14**	**07**	**08**	**23**	**295**	**635**	**930**

NOTE: The workshop can be conducted in either III-I or III-II semester. Participants with 90% or above attendance must submit their participation certificate to the Examination Section before the notification for the III-II regular examinations is issued.

*Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23AOE0103	Disaster Management	CIVIL
2.	23AOE0104	Sustainability In Engineering Practices	
3.	23AOE0202	Renewable Energy Sources	EEE
4.	23APE0322	Automation and Robotics	ME
5.	23AOE0402	Digital Electronics	ECE
6.	23AOE9902	Advanced Operations Research	Mathematics
7.	23AOE9903	Mathematical Foundation of Quantum Technologies	
8.	23AOE9907	Physics Of Electronic Materials and Devices	Physics
9.	23AOE9912	Chemistry Of Polymers and Applications	Chemistry
10	23AOE9916	Academic Writing and Public Speaking	Humanities

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester VII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PC	23APC0523	Deep Learning	2	1	0	3	30	70	100
2	MC-II	23AHMMB02	Business Ethics and Corporate Governance	2	0	0	2	30	70	100
		23AHMMB03	E-Business							
		23AHMMB04	Management Science							
3	PE-IV	23APE0513	Software Architecture and Design Patterns	2	1	0	3	30	70	100
		23APE0514	Blockchain Technology							
		23APE0515	Augmented Reality & Virtual Reality							
		23APE0516	Internet of Things							
4	PE-V	23APE0517	Agile methodologies	2	1	0	3	30	70	100
		23APE0518	Metaverse							
		23APE0519	Computer Vision							
			Cyber Physical Systems							
5	**OE-III**		***Open Elective-III**	2	1	0	3	30	70	100
6	**OE-IV**		***Open Elective-IV**	2	1	0	3	30	70	100
7	SC	23ASC0506	Prompt Engineering	0	1	2	2	30	70	100
8	MC	23AMC9903	Gender Sensitization	2	0	0	-	30		30
9	PR	23APR0502	Industry Internship (Short Term)	-	-	-	2	100		100
			Total	**14**	**06**	**02**	**21**	**340**	**490**	**830**

*Open Elective – III

S.No.	Course Code	Course Name	Offered by the Dept.
1	23AOE0105	Building Materials and Services	CIVIL
2	23APE0103	Environmental Impact Assessment	
3	23AOE0203	Smart Grid Technologies	EEE
4	23AOE0303	3D Printing Technologies	ME
5	23APC0412	Microprocessors and Microcontrollers	ECE
6	23AOE9904	Wavelet transforms and its Applications	Mathematics
7	23AOE9908	Smart Materials and Devices	Physics
8	23AOE9909	Introduction to Quantum Mechanics	
9	23AOE9913	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
10	23AOE9917	Employability Skills	Humanities

*Open Elective – IV

S.No.	Course Code	Course Name	Offered by the Dept.
1	23AOE0106	Geo-Spatial Technologies	CIVIL
2	23AOE0107	Solid Waste Management	
3	23AOE0204	Electric Vehicles	EEE
4	23AOE0304	Total Quality Management	ME
5	23AOE0403	Transducers and Sensors	ECE
6	23AOE9905	Financial Mathematics	Mathematics
7	23AOE9910	Sensors And Actuators For Engineering Applications	Physics
8	23AOE9914	Chemistry Of Nanomaterials and Applications	Chemistry
9	23AOE9918	Literary Vibes	Humanities

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester VIII (Fourth year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	PR	23APR0503	Industry Internship (Long term)	0	0	8	4	100		100
2	PR	23APR0504	Project Work	0	0	16	8	40	160	200
			TOTAL			24	12	140	160	300

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
B.Tech - Department of CSE
(Effective for the batches admitted in 2023-24)

HONOURS IN COMPUTER SCIENCE AND ENGINEERING

Eligibility for Honors Degree Registration:
A student is eligible to register for Honors program in the fourth semester, provided the results of the first three semesters have been declared. The student must have an average CGPA of 7.0 or above, with no backlogs in any of the semesters. Upon meeting these criteria, the student may be allowed to register by the end of the third semester and can take a maximum of two Honor-related subjects per semester from the fourth semester onwards.

Restrictions on Course Selection:
A student shall not be allowed to choose Open Electives, Minor courses that have content substantially similar to those already covered in their primary major program.

Course and Credit Requirements for Honors Degree:
Students may select courses from a list approved by the Board of Studies (BoS), choosing either 3-credit or 4-credit courses based on their availability on the SWAYAM-NPTEL platform. To complete an honor, students must earn a minimum of 18 credits through theory courses by successfully passing the selected courses.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	23AHN0501	Advanced Quantum Mechanics with Applications	12 Weeks	3
2	23AHN0502	Social networks	12 Weeks	3
3	23AHN0503	Algorithmic game theory	12 Weeks	3
4	23AHN0504	Approximation algorithm	12 Weeks	3
5	23AHN0505	Introduction to industry 4.0 and industrial internet of things	12 Weeks	3
6	23AHN0506	Getting started with competitive programming	12 Weeks	3
7	23AHN0507	Human Computer Interaction	12 Weeks	3
8	23AHN0508	Foundations of Virtual Reality	12 Weeks	3
9	23AHN0509	Advanced Computer Architecture	12 Weeks	3
10	23AHN0510	Introduction to Large Language Models	12 Weeks	3
		TOTAL		**18**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
B.Tech-Department of CSE
(Effective for the batches admitted in 2022-23)

MINOR DEGREE IN CLOUD COMPUTING OFFERED TO ECE, EEE, CE & ME

Eligibility for Minor Degree Registration:
A student is eligible to register for Minor program in the fourth semester, provided the results of the first three semesters have been declared. The student must have an average CGPA of 7.0 or above, with no backlogs in any of the semesters. Upon meeting these criteria, the student may be allowed to register by the end of the third semester and can take a maximum of two Minor-related subjects per semester from the fourth semester onwards.

Restrictions on Course Selection:
A student shall not be allowed to choose Open Electives or Honors courses that have content substantially similar to those already covered in their primary major program.

Course and Credit Requirements for Minor Degree:
Students may select courses from a list approved by the Board of Studies (BoS), choosing either 3-credit or 4-credit courses based on their availability on the SWAYAM-NPTEL platform. To complete a Minor, students must earn a minimum of 18 credits—15 credits through theory courses and 3 credits for a Minor project—by successfully passing the selected courses.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	23AMN0501	ADVANCED DISTRIBUTED SYSTEMS	12 Weeks	3
2	23AMN0502	CLOUD COMPUTING	12 Weeks	3
3	23AMN0503	SOFTWARE ENGINEERING	12 Weeks	3
4	23AMN0504	SOFTWARE PROJECT MANAGEMENT	12 Weeks	3
5	23AMN0505	OPERATING SYSTEM FUNDAMENTALS	12 Weeks	3
6	23AMN0506	COMPUTER VISION	12 Weeks	3
7	23AMN0507	ADVANCED COMPUTER NETWORKS	12 Weeks	3
8	23AMN0508	COMPILER DESIGN	12 Weeks	3
9	23AMN0509	INTRODUCTION TO LARGE LANGUAGE MODELS	12 Weeks	3
10	23AMN0510	SOFTWARE TESTING	12 Weeks	3
11	23AMN0511	**MINOR DISCIPLINE PROJECT IN CSE (COMPULSORY)**	-	3
		TOTAL		**18**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester I (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basic Civil and Mechanical Engineering	2	1	0	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and wellness, Yoga and Sports	0	0	1	0.5	50	-	50
			Total	**10**	**4**	**11**	**19.5**	**320**	**630**	**950**

Year: I B.Tech	(Common to all branches)			Semester: I

Subject Code 23AHM9901	Subject Name **COMMUNICATIVE ENGLISH**	L 2	T /CLC 0	P 0	Credit: 2

Pre-Requisites	Communicative English		Semester	**I & II**

Course Outcomes (CO): Student will be able to

CO1: Understand reading / listening texts and to write summaries based on global comprehension of these texts.**(Listening & Reading)**

CO2: Apply grammatical structures to formulate sentences and correct word forms.**(Grammar)**

CO3: Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations.(**Speaking**)

CO4: Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table**(Read & Write)**

CO5: Create a coherent essay, letter writing, report writing and design a resume.**(Writing)**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	reading / listening texts and to write summaries based on global comprehension of these texts.			L2
2	Apply	grammatical structures to formulate sentences and correct word forms			L3
3	Analyze	Analyze discourse markers to speak clearly on a specific topic in formal and informal conversations...			L4
4	Analyze	coherent paragraph interpreting a graphic elements.			L4
5	Create	coherent essay, letter writing, report writing and design a resume			L6

UNIT I

Lesson: HUMAN VALUES: Gift of Magi**(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listening to 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 of information.

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)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the 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

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

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

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

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement.

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

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, Cover letters

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)

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 and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Idiom and phrases & Phrasal verbs

Textbooks:
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.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.
5. SUP | 978-93-92184-99-4 | Communication English (JNTU) - Dr. V. B. Chithra

WEB RESOURCES:
GRAMMAR:
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/
6. https://www.talkenglish.com/grammar/grammar.aspx

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

Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1									2		
CO2								2	2		
CO3									3		
CO4									3		
CO5									3		

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	12	22	3	**Understand**	**L2**	PO9	Thumb Rule	2
2	12	22	3	**Apply**	**L3**	PO8,PO9	Thumb Rule	2,2
3	10	18	**2**	**Analyze**	**L4**	PO9	Thumb Rule	3
4	10	18	**2**	**Analyze**	**L4**	PO9	Thumb Rule	3
5	10	18	**2**	**Create**	**L6**	PO9	Thumb Rule	3

CO1: Understand reading / listening text and to write summaries based on global comprehension of these texts.
Action Verb: Understand (L2)
CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Apply grammatical structures to formulate sentences and correct word forms.
Action Verb: Apply (L3)
CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2) & (2)
CO3: Analyze discourse markers to speak clearly on a specific topic in Formal and informal Conversations.
Action Verb: Analyze (L4)
CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).
CO4: Analyze a coherent paragraph interpreting graphic elements, figure/graph/chart/table
(Read & Write)
Action Verb: Analyze (L4)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).
CO5: Create a coherent essay, letter writing, report writing and design a resume.(Writing)
Action Verb: Create(L6)
CO5 Action Verb Create is of BTL 6. Using Thumb rule, L5 correlates PO6 to PO1 as high (3).

Year: I B.Tech **(**Semester: I **CSE, CIC, CSD& EEE)** (Semester: II **ECE, AI&DS & AI&ML**)

Subject Code: 23ABS9901	**Subject Name:** Chemistry	L	T/CLC	P	Credits:3
		2	1	0	

Course Outcomes (CO): At the end of the course students will be able to
1. **Understand** the interaction of energy levels between atoms and molecules
2. **Apply** the principle of Band diagrams in the conductors and semiconductors
3. **Apply** the electrochemical principles to the construction of batteries, fuel cells and sensors
4. **Analyze** the preparation and mechanism of plastics, Elastomers and conducting polymers
5. **Analyze** the separation of liquid mixtures using instrumental methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the interaction of energy levels		between atoms and molecules	L2
2	**Apply**	principle of Band diagrams	conductors and semiconductors		L3
3	**Apply**	electrochemical principles to the construction of batteries, fuel cells and sensors			L3
4	**Analyze**	preparation and mechanism of plastics, Elastomers and conducting polymers			L4
5	**Analyze**	the separation of liquid mixtures	using instrumental methods		L4

UNIT I: Structure and Bonding Models

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II: Modern Engineering materials

Semiconductors: Introduction, basic concept, application
Super conductors: Introduction basic concept, applications.
Super capacitors: Introduction, Basic Concept-Classification – Applications.
Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon Nano tubes and Graphines nanoparticles.

UNIT III   Electrochemistry and Applications

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, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV   Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.
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), Polyl Lactic Acid (PLA).

UNIT V   Instrumental Methods and Applications

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

Textbooks:
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.

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
4. Seven Hills | 978-93-94122-28-4 | Chemistry (JNTU) - Dr. N. Devenna

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	10	15.6	2	Understand	L2	PO1	PO1: Apply (L3)	2
2	10	17	26.5	3	Apply	L3	PO1	PO1: Apply (L3)	3
3	10	12	18.7	3	Apply	L3	PO2	PO1: Apply (L3)	3
4	10	13	20.3	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
5	10	12	18.7	3	Analyze	L4	PO1	PO2: Analyze (L4)	3

CO1: Understand the fundamentals of Atoms and Molecules
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2: Apply electrochemical principles to construct batteries
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO3: Apply electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors
Action Verb: Apply (L3)
PO2 Verb: Apply (L3)
CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO4: Analyze the preparation and mechanism of polymers
Action Verb: Analyze (L4)
PO2 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO5: Analyze the identification of individual components
Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

	ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI **(Autonomous)** (Effective for the batches admitted from 2023-24)

Year : I **Semester** : I   **Branch of Study :** Common to All

Subject Code: 23ABS9904	Subject Name: Linear Algebra and Calculus	L 2	T/CLC 1	P 0	Credits 3	

Course Outcomes (CO):

Student will be able to

CO1. **Analyze** the matrix algebraic techniques for engineering applications.
CO2. **Understand** the concept of Eigen values, Eigen vectors and quadratic forms.
CO3. **Analyze** the mean value theorems for real time applications.
CO4. **Apply** the concepts of partial differentiation to functions of several variables.
 CO5. **Apply** the multivariable integral calculus for computation of Area and Volume.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Analyze**	the matrix algebraic techniques	for engineering applications.		**L4**
2	**Understand**	the concept of eigen values, eigen vectors and quadratic forms.	-		**L2**
3	**Analyze**	the mean value theorems	for real time applications.		**L4**
4	**Apply**	the concept of Maxima and Minima	to functions of several variables.		**L3**
5	**Apply**	the multivariable integral calculus	for computation of Area and volume.		**L3**

Unit I: Matrices
12hrs

Rank of a matrix by Echelon form, Normal form, Cauchy-Binet formula (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: Eigen values, Eigen vectors and Orthogonal Transformation
9hrs

Eigen values, Eigen vectors 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 canonical forms by Orthogonal Transformation.

Unit III: Calculus
9hrs

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

Unit IV: Partial differentiation and Applications(Multi Variable Calculus)
10hrs

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

Unit V: Multiple Integrals
10hrs

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).
Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

References:
1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass,Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar,Alpha Science International Ltd., 25th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearsonpublishers, 2018, 5 th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearsonpublishers, 9 th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)
6. S | 978-93-91421-57-1 | Linear Algebra & Calculus (JNTU) - Dr. M. C. Raju

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	10	14	2	Analyze	L4	PO2	Analyze	3
2	15	21.4	3	Understand	L2	PO2	Apply	2
3	15	21.4	3	Analyze	L4	PO2	Analyze	3
4	16	22.8	3	Apply	L3	PO1	Apply	3
5	14	20	3	Apply	L3	PO1	Apply	3

CO1: Analyze the matrix algebraic techniques that are needed for engineering applications.
Action Verb: Analyze(L4)
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal toPO2 verb ; Therefore correlation is high (3).

CO2: Understand the concept of eigen values, eigen vectors and quadratic forms.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO2 Action Verb is low level to PO1 verb by one level; Therefore correlation is moderate (2).

CO3: Analyze the mean value theorems for real life problems.
Action Verb: Analyze **(L4)**
PO1 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Apply the concept of Maxima and Minima of functions of several variables.
Action Verb: Apply (L3)
PO2 Verb: Apply (L3)
    CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO5: Apply the multivariable integral calculus for computation of area and volume.
Action Verb: Apply(L3)
PO1 Verb: Apply (L3)
CO5 Action verb is high level to PO1 verb; therefore the correlation is high (3).

Course Code	Year & Sem	Basic Civil and Mechanical Engineering	L	T	P	C
23AES0101	I-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

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

CO2: Apply the methods of surveying in finding the measurements on Earth surface

CO3: Understand the importance of transportation, water resources and environmental engineering

CO4: Understand the applications and role of various materials in Mechanical Engineering.

CO5: Understand the different manufacturing processes and the basics of thermal engineering with its applications.

CO6: Understand the working of different mechanical power transmission systems, power plants and applications of robotics.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Various sub-divisions of Civil Engineering		Role in ensuring better society	L2
CO2	Apply	Methods of surveying	Finding the measurements	On Earth surface	L3
CO3	Understand	Importance of transportation, water resources and environmental engineering			L2
CO4	Understand	applications and role of various materials in Mechanical Engineering			L2
CO5	Understand	different manufacturing processes and the basics of thermal engineering with its applications			L2
CO6	Understand	working of different mechanical power transmission systems, power plants and applications of robotics			L2

BASICS OF CIVIL ENGINEERING (PART-A)

UNIT I

Basics of Civil Engineering:

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: 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: 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 andConveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:
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, Khanna Publishers, 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
6. SPH | 978-93-93196-63-7 | Basic Civil & ME (JNTU) - Dr. S. Krishnaiah

PART-B
BASICS OF MECHANICAL ENGINEERING

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- 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

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

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.

Textbooks:

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, Cengage learning 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.

Mapping of COs to POs

COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2					2						
CO2	3	2				2							
CO3	2	2					2						
CO4	**2**				**2**								
CO5	**2**						**2**						
CO6	**2**				**2**		**2**						

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
2	12/33	34	3	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L3) Thumb Rule	2 2 2
4	9/30	30	3	Understand	L2	PO1 PO6	Identify-L3 Thumb Rule	2 2
5	12/30	40	3	Understand	L2	PO1 PO7	Identify-L3 Thumb Rule	2 2
6	9/30	30	3	Understand	L2	PO1 PO5 PO7	Apply(Identify)-L3 Apply-L3 Thumb Rule	2 2 2

Justification Statements:

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

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO1 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO1 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO1 correlates medium with PO7. Therefore, the correlation is
medium (2)

CO2: Apply the methods of surveying in finding the measurements on Earth surface.

Action Verb: **Apply (L3)**

PO1 Verb: **Apply (L3)**

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Analyze(L4)**

CO2 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO6 Verb: **Thumb Rule**

CO2 correlates medium with PO6. Therefore, the correlation is
medium (2)

CO3: Understand the importance of transportation, water resources and environmental engineering.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO3 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

CO3 Action verb is not same level as PO2 verb. Therefore, the correlation is medium (2)

PO7 Verb: **Thumb Rule**

CO3 correlates medium with PO7. Therefore, the correlation is
medium (2)

CO4: Understand the applications and role of various materials in Mechanical Engineering.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

CO4 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO3 Verb: **Review-L2**

CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO7 Verb: **Thumb Rule**

CO4 correlates moderately with PO6. Therefore, the correlation is medium (2).

CO5: Understand the different manufacturing processes and the basics of thermal engineering with its applications.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO3 Verb: **Review-L2**

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO7 Verb: **Thumb Rule**

CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).

CO6: Understand the working of different mechanical power transmission systems, power plants and applications of robotics.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO3 Verb: **Review-L2**

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO7 Verb: **Thumb Rule**

CO5 correlates moderately with PO6. Therefore, the correlation is medium (2).

Course Code	Year & Sem	INTRODUCTION TO PROGRAMMING	L	T / CLC	P	C
23AES0501	I-I	(Common to All branches of Engineering)	2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO 1: **Understand** the computer Programming concepts and Algorithms.

CO 2: **Analyze** the control structures to implement basic programs.

CO 3: **Understand** the concept of Arrays and string to manipulate the stored data.

CO 4: **Create** the dynamic memory allocation using pointers and structures.

CO 5: **Create** the user defined functions and files for modifying stored data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the computer Programming concepts and Algorithms.			L2
CO2	Analyze	the control structures		to implement basic programs.	L4
CO3	Understand	the concept of Arrays and string		to manipulate the stored data	L2
CO4	Create	the dynamic memory allocation	using pointers and structures.		L6
CO5	Create	user defined functions and files		for modifying stored data.	L6

UNIT - I	Introduction to Programming and Problem Solving	10 Hrs

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 Hrs

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

UNIT - III	Arrays and Strings	9 Hrs

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

UNIT - IV	Pointers & User Defined Data types	9 Hrs

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

UNIT - V	Functions & File Handling	9 Hrs

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

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996.

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition
4. Amaravathi | 978-93-93199-58-4 | Introduction to Programming (JNTU) - Dr. S. V. Raju

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	2									3	

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	19	25%	3	CO1: Understand	L2		PO1 PO2 PO3	PO1: Apply(L3) PO2: Review(L2) PO3:Develop(L3)	2 3 2
2	10	14%	2	CO2: Analyze	L4		PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
3	19	25%	3	CO3: Understand	L2		PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO1: Thumb rule	2 3 2
4	15	20%	2	CO4: Create	L6		PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Create	L6		PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO11: Thumb rule	3 3 3 3
	75	100 %							

Justification Statements :

CO1: Understand the computer Programming concepts and Algorithms.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review (L2)
CO1 Action verb is same as than as PO2 verb by two level. Therefore, the correlation is High (3)
PO3 Verb: Develop (L3)
CO1 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
CO2: Analyze the control structures to implement basic programs.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Some of the flow of control statements knowledge are used to solve various problems. Therefore, the correlation is moderate (2)
CO3: Understand the concept of Arrays and string to manipulate the stored data.
Action Verb: Understand (L2)

PO1: Apply (L3)

CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2: Review (L2)

CO3 Action verb is Same as PO2 verb. Therefore, the correlation is High (3)

PO11: Thumb rule

For some matrix operations array and string concepts were used Therefore, the correlation is moderate (2)

CO4: Create the dynamic memory allocation using pointers and structures.

Action Verb: Create (L6)

PO1: Apply (L3)

CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO2: Review (L2)

CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

For some mathematical operations Pointers and structures are used to manipulate the memory references. Therefore, the correlation is moderate (2)

CO5: Create the user defined functions and files for modifying stored data.

Action Verb: Create (L6)

PO1: Apply (L3)

CO5 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO2: Review (L2)

CO5 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

In today's world file handling techniques were used in most of the areas. Therefore, the correlation is high (3)

Year: I B.Tech	**(Commonto all branches)**	Semester: I
	& II	

Subject Code **23AHM9902**	Subject Name **COMMUNICATIVE ENGLISH LAB**	L 0	T 0	P 2	Credit: 1

Course Outcomes (CO): Student will be able to

CO1: **Understand**-the different aspects of the English language proficiency with emphasis On LSRW skills.

CO2: **Apply** communication skills through various language learning activities.

CO3: **Analyze** the English speech sounds, for better listening and speaking.

CO4: **Evaluate** and exhibit professional is min participating in debates and group discussions.

CO5: **Analyze** the mselves to face interviews in future.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the different aspects of the English language proficiency with emphasis on LSRW skills			L2
2	**Apply**	communication skills through various language learning activities			L3
3	**Analyze**	the English speech sounds, for better listening and speaking.			L4
4	**Evaluate**	and exhibit professionalism in participating in debates and group discussions			L5
5	**Analyze**	themselves to face interviews in future			L4

List of Topics:
1. Vowels & Consonants (CO3)
2. Non Verbal Communication (CO2)
3. Communication Skills(CO2)
4. Role Playor Conversational Practice (CO1,CO2)
5. E-mail Writing (CO1)
6. Just A Minute (CO1,CO2)
7. Group Discussions-methods&practice (CO4)
8. Debates-Methods &Practice (CO4)
9. PPT Presentations/Poster Presentation (CO2)
10. Interviews Skills (CO5)

Suggested Software:
- Walden Infotech
- Young India Films

Reference Books:
1. RamanMeenakshi,Sangeeta-Sharma.*TechnicalCommunication.*OxfordPress.2018.
2. TaylorGrant:*EnglishConversationPractice*,TataMcGraw-HillEducationIndia,2016
3. Hewing's, Martin. Cambridge *AcademicEnglish*(B2).CUP,2012.
4. J.Sethi & P.V.Dhamija. *ACourse in Phonetics and Spoken*

English,(2ndEd),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

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1				Understand	L2	10	Thumb Rule	2
2				Apply	L3	9,10	Thumb Rule	2,2
3				Analyze	L4	10	Thumb Rule	3
4				Evaluate	L5	9,10	Thumb Rule	3,3
5				Analyze	L4	10	Thumb Rule	3

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills
Action Verb: Understand (L2)
CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).
CO2: Apply communication skills through various language learning activities.
Action Verb: Apply (L3)
CO2 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate(2).
CO3: Analyze the English speech sounds, for better listening and speaking.
Action Verb: Analyze (L4)
CO3 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).
CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.
Action Verb: Evaluate (L5)
CO4 Action Verb is Evaluate of BTL 5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).
CO5: Analyze themselves to face interviews in future.
Action Verb: Develop (L4)
CO5 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

Year: I B.Tech   (Common to EEE, ECE, CSE & allied branches) Semester: I &II

Subject Code: 23ABS9906	**Subject Name:** Chemistry Lab	L 0	T 0	P 2	Credits:1

Course Objectives: Students are expected to
Verify the fundamental concepts with experiments.
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: Analyze the UV-Visible spectra of some organic compounds.
CO5: Estimate the unknown solution by volumetric analysis

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Determine**	Cell constant and conductance of solutions**.**			**L4**
2	**Prepare**	advanced polymer Bakelite materials			**L4**
3	**Measure**	Strength of an acid present in secondary batteries**.**			**L4**
4	**Analyze**	UV-Visible spectra of some organic compounds**.**			**L4**
5	**Estimate**	Unknown solution by volumetric analysis.			**L5**

List of Experiments:
1. Measurement of 10Dq by spectrophotometric method(CO1)
2. Conductometric titration of strong acid vs. strong base (CO1)
3. Conductometric titration of weak acid vs. strong base (CO1)
4. Determination of cell constant and conductance of solutions (CO1)
5. Potentiometry - determination of redox potentials and emfs (CO5)
6. Determination of Strength of an acid in Pb-Acid battery (CO3)
7. Preparation of a Bakelite (CO2)
8. Verify Lambert-Beer's law (CO4)
9. Estimation of copper by Iodometry (CO5)
10. Wavelength measurement of sample through UV-Visible Spectroscopy (CO1)
11. Preparation of nanomaterials by precipitation method (CO1)
12. Estimation of Ferrous Iron by Dichrometry (CO5)

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO Experiments may be conducted in virtual mode.
Reference:
- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				**Determine**	**L4**	PO4	PO4: Analyze (L4)	3
2				**Prepare**	**L4**	PO4	PO4: Analyze (L4)	3
3				**Measure**	**L4**	PO4	PO4: Analyze (L4)	3
4				**Analyze**	**L4**	PO4	PO4: Analyze (L4)	3
5				**Estimate**	**L5**	PO4	PO4: Analyze (L5)	3

Justification Statements

CO1: Determine the cell constant and conductance of solutions**.**
Action Verb: Determine **(L4)**
PO4 Verb: Analyze (L4)
CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
CO2: Prepare advanced polymer Bakelite materials**.**
Action Verb: Prepare **(L4)**
PO4 Verb: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
CO3: Measure the strength of an acid present in secondary batteries**.**
Action Verb: Measure **(L4)**
PO4 Verb: Analyze (L4)
CO3 Action Verb is equal to PO4 verb; Therefore, correlation is high (3)
CO4: Analyze the UV-Visible spectra of some organic compounds.
Action Verb: Analyze **(L4)**
PO4 Verb: Analyze (L4)
 CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3)
CO5: Estimate the unknown solution by volumetric analysis**.**
Action Verb: Estimate **(L5)**
 PO4 Verb: Analyze (L4)
CO5 Action Verb is greater than PO4; Therefore correlation is high (3).

Course Code	Year & Sem	Engineering Workshop	L	T	P	C
23AES0302	I-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

    CO1: Apply the wood working skills to prepare different joints.

    CO2: Analyze the sheet metal and fitting operations to prepare various components

    CO3: Apply the basic electrical engineering knowledge for house wiring practice.

    CO4: Apply the Welding process for Lap and Butt Joints.

    CO5: Understand the various plumbing pipe joints

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Apply	the wood working skills to prepare different joints			L3
CO2	Analyze	the sheet metal and fitting operations to prepare various components			L4
CO3	Apply	the basic electrical engineering knowledge for house wiring practice			L3
CO4	Apply	the Welding process for Lap and Butt joints			L3
CO5	Understand	the various plumbing pipe joints			L2

SYLLABUS

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 metalworking, 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 makethe 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 jointswith coupling for same diameter and with reducer for different diameters.

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, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Amaravathi | 978-93-93199-75-1 | Engineering Workshop - Dr. C. N. Reddy

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

| CO | CO | | | | | Program Outcomes (PO) | PO(s): Action Verb and BTL (for PO1 to PO5) | Level of Correlation |
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	-	-	3	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
2	-	-	3	Analyze	L4	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
3	-	-	1	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
4	-	-	2	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	3 3 3 3
5	-	-	2	Understand	L2	PO1 PO2 PO3 PO9	Apply-L3 Review-L2 Develop-L3 Thumb Rule-L3	2 2 2 2

Justification Statements:

CO1: Apply the wood working skills to prepare different joints

Action Verb: **Apply** (L3)

PO1 Verb: **Apply** (L3)

CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Review (L2)**

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Develop (L3)**

CO1 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO1 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO2: Analyze the sheet metal and fitting operations to prepare various components

Action Verb: **Analyse** (L4)

PO1 Verb: **Apply** (L3)

CO2 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Review (L2)**

CO2 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Develop (L3)**

CO2 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **Thumb Rule**

CO2 Action verb is same level (greater) as PO9 verb. Therefore, the correlation is high (3)

CO3: Apply the basic electrical engineering knowledge for house wiring practice

Action Verb: **Apply** (L3)
PO1 Verb: **Apply** (L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Review (L2)**
CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO3 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO9 Verb: **Thumb Rule**
CO3 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO4: Apply the Welding process for Lap and Butt Joints

Action Verb: **Apply** (L3)
PO1 Verb: **Apply** (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Review (L2)**
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO9 Verb: **Thumb Rule**
CO4 Action verb is same level as PO9 verb. Therefore, the correlation is high (3)

CO5: Understand the various plumbing pipe joints.

Action Verb: **Understand (L2)**
PO1 Verb: **Apply** (L2)
CO5 Action verb is less than as PO1 verb. Therefore, the correlation is high (2)
PO2 Verb: **Review (L2)**
CO5 Action verb is less than as PO2 verb. Therefore, the correlation is high (2)
PO3 Verb: **Develop (L3)**
CO5 Action verb is less than as PO3 verb. Therefore, the correlation is high (2)
PO9 Verb: **Thumb Rule**
CO5 Action verb is less than as PO9 verb. Therefore, the correlation is high (2)

Course Code	Year & Sem	COMPUTER PROGRAMMING LAB	L	T	P	C
23AES0502	I-I	**(Common to All Branches of Engineering)**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basic syntax of C program to build applications.

CO2: Create the control structure for solving complex problems.

CO3: Apply the concepts of arrays, functions, basic concepts of pointers to organize the data.

CO4: Apply the concepts of structures, unions and linked list to manage heterogeneous data .

CO5: Create the file applications for storing and accessing data.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basic syntax of C program		to build applications	L2
CO2	**Create**	the control structure		for solving complex problems	L6
CO3	**Apply**	the concepts of arrays, functions, basic concepts of pointers		to organize the data	L3
CO4	**Apply**	the concepts of structures, unions and linked list		to manage heterogeneous data	L3
CO5	**Create**	the file applications		for storing and accessing data	L6

List of Experiments:

Exercise 1: Problem-solving using Computers[CO1]
    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()

Exercise 2: Problem-solving using Algorithms and Flow charts.[CO1]
    i)   Sum and average of 3 numbers
    ii)   Conversion of Fahrenheit to Celsius and vice versa
    iii) Simple interest calculation

Exercise 3: Variable types and type conversions[CO2]
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

Exercise 4: Operators and the precedence and as associativity[CO2]
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
list and perform insertion, deletion, and traversal.

Exercise 5: Branching and logical expressions[CO2]
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.

Exercise 6: Loops, while and for loops[CO2]
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

 iv) Construct a pyramid of numbers.

Exercise 7: 1 D Arrays: searching[CO3]

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.

Exercise 8: 2 D arrays, sorting and Strings[CO3]

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

Exercise 9: Pointers, structures and dynamic memory allocation[CO3]

 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 along with the total.

 v. Write a C program to implement realloc()

Exercise 10: Bitfields, Self-Referential Structures, Linked lists[CO4]

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.

Exercise 11: Functions, call by value, scope and extent[CO2]

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's method

Exercise 12: Recursion, the structure of recursive calls[CO4]

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.

Exercise 13: Call by reference, dangling pointers[CO4]

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.

v)   Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

Exercise 14: File handling[CO5]

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-line arguments.

v)   Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Textbooks:

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

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

Reference Books:

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

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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: understand	L2	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4)	2 3 2 2
2	CO2: Create	L6	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 2
3	CO3: Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2 2
5	CO5: Create	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 3

Justification Statements :

CO1: Understand the basic syntax of C program to build applications.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3: Develop(L3)
CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analyze(L4)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate is (2)

CO2: Create the control structure for solving complex problems.
Action Verb: Create (L6)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (2)

CO3: Apply the concepts of arrays, functions, basic concepts of pointers to organize the data..
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

CO4: Apply the concepts of structures, unions and linked list to manage heterogeneous data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO4 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO4 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (2)

CO5: Create the file applications for storing and accessing data.
Action Verb: Create (L6)
PO1: Apply (L3)
CO5 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L3)
CO5 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

Common to I SEM CSE/CIC/SCD/EEE & II SEM ECE/AI&DS/AI&ML/CE/ME

Course Code: 23AHM9903	**HEALTH AND WELLNESS, YOGA AND SPORTS**	**L** **0**	**T** **0**	**P** **1**	**C** **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.

Course Outcomes: After completion of the course the student will be able to

CO1. **Understand** the health & fitness by diet

CO2. **Understand** the importance of yoga.

CO3. **Apply** The yoga practices including Surya Namaskar

CO4. **Understand** the importance of sports.

CO5. **Analyze** various activities that help enhance their health & Positive Personality

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	Health & fitness by diet			**L2**
2	**Understand**	Importance of yoga.			**L2**
3	**Apply**	yoga practices including Surya Namaskar			**L3**
4	**Understand**	Importance of sports			**L2**
5	**Analyze**	Various activities that help enhance their health & Positive Personality			**L4**

UNIT I

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

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

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.

Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

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, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014

5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, 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 many as 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, totalingto 90 marks.

- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva in the subject

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL		
1					Understand	L2	P06,P07	2
2					Understand	L2	P06,P07	2
3					Apply	L3	P06,P07	2
4					Understand	L2	P06,P07	2
5					Analyze	L4	P06,P07	3

CO-PO mapping justification:

CO1: Understand the health & fitness by diet

Action Verb: Understand (L2)

CO1 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO2: Understand the Importance of yoga

Action Verb: Understand (L2)

CO2 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO3: APPLY

yoga practices including Surya Namaskar

Action Verb: APPLY (L3)

CO3 Action Verb is APPLY of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

CO4: .Understand Importance of sports

Action Verb: Understand (L2)

CO4 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

Action Verb: APPLY (L3)

CO5: Analyze the Various activities that help enhance their health & Positive Personality

Action Verb: Analyze (L4)

CO5 Action Verb is Analyze of BTL 2.Using Thumb rule; L4 correlates PO6 and PO7 as a moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester II (First year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	PC	23APC0501	Data Structures	2	1	0	3	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0502	Data Structures Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
			Total	**09**	**04**	**15**	**20.5**	**320**	**630**	**950**

Course Code	**ENGINEERING PHYSICS**	L	T/CLC	P	C
23ABS9903		**2**	**1**	**0**	**3**
Regulation: **AK23**	Common to I B.Tech ECE, AI&DS, AI&ML, ME, CE (Sem-1) & CSE, CIC, EEE, &CSD (Sem-2)				

Course Outcomes (CO): At the end of the course students will be able to

CO1:**Understand** the intensity variation of light due to interference, diffraction, and polarization.
CO2:**Analyze** the fundamentals of crystallography and X-ray diffraction.
CO3:**Apply** the basic concepts of dielectric and magnetic materials for engineering applications.
CO4:**Analyze** the fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.
CO5:**Analyze** the charge carrier dynamics in semiconductors by implementing the equations of state.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	The intensity variation of light due to interference, diffraction, and polarization.			L2
2	**Analyze**	The fundamentals of crystallography and X-ray diffraction.			L4
3	**Apply**	The basic concepts of dielectric and magnetic materials		for engineering applications.	L3
4	**Analyze**	The fundamentals of Quantum mechanics and interpret the nanomaterials		for engineering problems.	L4
5	**Analyze**	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4

UNIT I   Wave Optics   **10 Hrs**

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

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit (Qualitative) – Diffraction Grating.

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   **8 Hrs**

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 Dielectric and Magnetic Materials   **8 Hrs**

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 - Frequency dependence of polarization-Applications of Dielectric materials.

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 - Applications of magnetic materials.

UNIT IV Quantum Mechanics and Nanomaterials   **12 Hrs**

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.

Nanomaterials: Introduction to Nanomaterials–Significance of nanoscale - Physical, Mechanical, Magnetic, and optical properties of nanomaterials –Synthesis of nanomaterials: Ball Milling, Applications of Nanomaterials.

UNIT V Semiconductors   **10 Hrs**

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 – Applications of semiconductors.

Textbooks:
1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun   Murthy, S. Chand Publications, 11th Edition 2019.
2. K.Thyagarajan "Engineering Physics",-Mc Graw Hill Publishing Company Ltd, 2016.
3. 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).
5. Sun | 978-93-92933-95-0 | Engineering Physics (JNTU) - Dr. K. Ramya

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

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	15	22.3	3	Understand	L2	PO1	PO1: Apply (L3)	2
2	11	16.4	2	Analyze	L4	PO1	PO1: Apply (L3)	3
3	12	17.9	2	Apply	L3	PO1, PO4	PO1, PO4: Apply (L3)	3
4	13	19.4	2	Analyze	L4	PO1	PO1: Apply (L3)	3
5	16	23.8	3	Analyze	L4	PO1, PO4	PO1, PO4: Apply (L3)	3
	67							

CO1: The intensity variation of light due to interference, diffraction, and polarization.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is lesser than PO1 verb by one level; Therefore, correlation is moderate (2).
CO2: The fundamentals of crystallography.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
CO3: Apply the basic concepts of dielectric and magnetic materials for engineering applications.
Action Verb: Apply (L3)
PO1 and PO4 Verbs: Apply (L3)
CO3 Action Verb level is equal to PO1 and PO4 verb; Therefore correlation is high (3).
CO4: The fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
CO5: The charge carrier dynamics in semiconductors by implementing the equations of state.
Action Verb: Analyze (L4)
PO1 and PO4 Verb: Apply (L3)
CO5 Action verb is greater than PO1 verb; therefore, the correlation is high (3).

Year : I	Semester : II	Branch of Study : Common to all

Subject Code: 23ABS9905	Subject Name: Differential Equations and Vector Calculus	L 2	T/CLC 1	P 0	Credits 3

Course Outcomes (CO): Student will be able to

CO1. **Apply** the concepts of ordinary differential equations of first order and first degree.
CO2. **Apply** the methods of linear differential equations related to various engineering problems.
CO3. **Analyze** the solutions of partial differential equations using Lagrange's method.
CO4. **Understand** the different operators and identities in the vector calculus.
CO5. **Evaluate** the surface integral and volume integral in the vector calculus using various theorems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	The concepts of ordinary differential equations.		of first order and first degree	L3
2	Apply	The methods of linear differential equations related to various engineering problems.			L3
3	Analyze	The solutions of partial differential equations.	Using Lagrange's method		L4
4	Understand	different operators and identities in the vector calculus.			L2
5	Evaluate	the surface integral and volume integral in the vector calculus.	Using various theorems		L5

UNIT I: Linear Differential Equations of first Order and first Degree   9hrs
Linear differential equations-Bernoulli's equations-Exat equations and equations reducible to exact form. Applications: Newton's Law of cooling-Law of natural growth and decay-Electrical circuits.

UNIT II: Equations Reducible to Linear Differential Equations and Applications   9 hrs
Definitions, homogeneous and non-homogeneous , 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 hrs

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 hrs

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 hrs
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 applications of these theorems.

Text Books :
1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011.
References:
1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmipublication,2008
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

5. SriKrishna | 978-93-94246-77-5 | Differential Equations & Vector Calculus (JNTU) - Dr. M. S. Reddy

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	14	20.8	3	Apply	L4	PO1	Apply	3
2	15	22.3	3	Apply	L3	PO1	Apply	3
3	14	20.8	3	Analyze	L4	PO2	Analyze	3
4	9	13.4	2	Understand	L2	PO1	Apply	2
5	15	22.3	3	Evaluate	L5	PO2	Analyze	3

CO1: Apply the concepts of ordinary differential equations of first order and first degree.
Action Verb: Apply(L3)
PO1 Verbs: Apply(L3)
CO1 Action Verb is equal to PO1 verb Therefore correlation is high (3).

CO2: Apply the methods of linear differential equations related to various engineering problems.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO3: Analyze the solutions of partial differential equations.
Action Verb: Analyze(L4)
PO2 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Understand the different operators and identities in the vector calculus.
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO4 Action Verb is low level to PO1 to one level; Therefore correlation is moderate (2).

CO5: Evaluate the surface integral and volume integral in the vector calculus.
Action Verb: Evaluate(L5)
PO2 Verb: Analyze (L4)
CO5 Action verb is high level to PO2 verb; therefore the correlation is high (3).

Course Code	Year & Sem	Basic Electrical and Electronics Engineering	L	T/CLC	P	C
23AES0201	I-II		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the fundamental laws of A. C circuits and D. C circuits.

CO2: **Understand** operating principles of motors, generators and measuring instruments.

CO3: **Understand** the fundamentals of power generation, costing and safety measures.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	The fundamentals laws of A. C circuits and D. C circuits.		A. C circuits and D. C circuits	L2
2	Understand	Operating principles of motors, generators and measuring instruments.			L2
3	Understand	The fundamentals of Power generation, costing and safety measures.			L2

PART-A
BASIC ELECTRICAL ENGINEERING

UNIT I: DC & AC Circuits

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

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

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 electricity tariff, 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.

TEXTBOOKS:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition 2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013.
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

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. Mehta, S. Chand Technical Publishers, 2020.
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.

4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.
5. Amaravathi | 978-93-93199-46-1 | Basic Electrical & EE (JNTU) - Dr. K. Gopi

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

PART-B

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

CO4: **Understand** the fundamental concepts of diodes, transistors and its applications.

CO5: **Analyze** the concepts of rectifiers, power supplies and amplifiers in electronics.

CO6: **Analyze** the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
4	Understand	fundamental concepts of diodes, transistors and its applications			L2
5	Analyze	concepts of rectifiers, power supplies and amplifiers in electronics			L4
6	Analyze	concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits			L4

UNIT I: SEMICONDUCTOR DEVICES

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

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

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 Boolean Algebra, 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)

Textbooks:
1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 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.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	2	2				1						2	
CO2	2	1				1						1	
CO3	2	1				2						1	2

CO													
CO4	2	3											
CO5	3	3											
CO6	3	3											

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)**Justification Table:**

CO	CO					Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	08	30	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Identify (L3) PO6: Thumb Rule	2 2 1
2	08	30	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 1
3	10	38	3	**Understand**	**L2**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 2
4	08	30	3	Understand	**L2**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	08	30	3	Analyze	**L4**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	10	38	3	Analyze	**L4**	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	3 3

CO1: Understand the fundamental laws of AC and DC circuits.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Identify (L3)
CO1 Action Verb is Less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO6: Using thumb rule, CO1 correlates PO6 as low (1).
CO2: Understand operating principles of motors, generators, MC and MI instruments.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO2 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6: Using thumb rule, CO2 correlates PO6 as low (1).
CO3: Understand the fundamentals of power generation, costing and safety measures.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO3 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6: Using thumb rule, CO3 correlates PO6 as medium (2).
CO4: Understand the fundamental concepts of diodes, transistors and its applications
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Review (L2)
CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO5: Analyze the concepts of rectifiers, power supplies and amplifiers in electronics.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO6: Analyze the concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Engineering Graphics	L	T	P	C
23AES0301	I-II		1	0	4	3

Course Outcomes:

After studying the course, student will be able to

CO: 1   **Apply** the concepts of engineering curves and scales for technical drawing.

CO: 2   **Understand** the quadrant system to locate the position of points, lines and planes.

CO: 3   **Analyze** the projection of solids located in quadrant system.

CO: 4   **Analyze** the sectional views and development of surfaces of regular solids.

CO: 5   **Apply** orthographic and isometric projections concepts to construct the given object

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the concepts of engineering curves and scales	for technical drawing		L3
CO2	Understand	the quadrant system to locate the position of points, lines and planes			L2
CO3	Analyze	the projection of solids	located in quadrant system		L4
CO4	Analyze	the sectional views and development of surfaces	of regular solids		L4
CO5	Apply	orthographic and isometric projections concepts to construct the given object			L3

Unit I: 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

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

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

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

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. **Computer graphics**: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

Text Books:

1. K. L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers

2. N. D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers

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, Tata McGraw Hill, 2017.
4. SPHPL | 978-93-94155-83-1 | Engineering Graphics (JNTU) - Dr. C. N. Reddy

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Engineering Graphics	CO1	3		3							3		2	2
	CO2	2		2							3		2	2
	CO3	2		2							3		2	2
	CO4	3		3							3		2	2
	CO5	3		3							3		2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation Matrix

CO	CO					Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1	18	24	3	Apply	L3	PO1	Apply (L3)	3
						PO2	Develop (L3)	3
						PO10	Thumb Rule	3
2	15	20	2	Understand	L2	PO1	Apply (L3)	2
						PO2	Develop (L3)	2
						PO10	Thumb Rule	3
3	15	20	2	Analyze	L4	PO1	Apply (L3)	3
						PO2	Develop (L3)	3
						PO10	Thumb Rule	3
4	15	20	2	Analyze	L4	PO1	Apply (L3)	3
						PO2	Develop (L3)	3
						PO10	Thumb Rule	3
5	12	16	2	Apply	L3	PO1	Apply (L3)	3
						PO2	Develop (L3)	3
						PO10	Thumb Rule	3

Justification Statements:
CO1: Apply the concepts of engineering curves and scales for technical drawing.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3) PO2 Verb: **Develop (L3)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3) PO10 Verb: Thumb Rule (TR)
CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas,concepts and specifications. Therefore, the correlation is high (3)
CO2: Understand the quadrant system to locate the position of points, lines and planes.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO2: Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2) PO2 Verb: **Develop (L3)**
CO2: Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
PO10 Verb: Thumb Rule (TR)

CO2: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO3: Analyze the projection of solids located in quadrant system.

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO3: Action verb is same level as PO1 verb. Therefore, the correlation is high (3) PO2 Verb: **Develop (L3)**

CO3: Action verb is same level as PO2 verb. Therefore, the correlation is high (3) PO10 Verb: Thumb Rule (TR)

CO3: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO4: Analyze the sectional views and development of surfaces of regular solids

Action Verb: Analyze (L4)

PO1 Verb: **Apply (L3)**

CO4: Action verb is same level as PO1 verb. Therefore, the correlation is high (3) PO2 Verb: **Develop (L3)**

CO4: Action verb is same level as PO2 verb. Therefore, the correlation is high (3) PO10 Verb: Thumb Rule (TR)

CO4: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO5: Apply orthographic and isometric projections concepts to construct the given object**.**

Action Verb: Apply (L3)

PO1 Verb: **Apply (L3)**

CO5: Action verb is same level as PO1 verb. Therefore, the correlation is high (3) PO2 Verb: **Develop (L3)**

CO5: Action verb is same level as PO2 verb. Therefore, the correlation is high (3) PO10 Verb: Thumb Rule (TR)

CO5: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

Course Code	Year & Sem	IT workshop	L	T	P	C
23AES0503	I-II	(Common to CSE, CIC, CSE(DS) & EEE)	0	0	2	1

Course Outcomes:

After studying the course, student will be able to

CO1: Understand The Process of Software Installation & Hardware troubleshooting.

CO2: Analyze the network configurations for customizing web pages and search engines.

CO3: Apply the basic editing function, formatting text & objects on a required content.

CO4: Apply the formulas, functions and visualizations to manage the data.

CO5: Understand the libraries and models of chatGPT to generate information.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Process of Software Installation & Hardware troubleshooting.			L2
CO2	Analyze	the network configurations		for customizing web pages and search engines	L4
CO3	Apply	The basic editing function, formatting text & objects		on a required content	L3
CO4	Apply	the formulas, functions and visualizations		to manage the data	L3
CO5	Understand	The libraries and models of chatGPT		to generate information	L2

List of Experiments

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.[CO1]

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.[CO1]

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.[CO1]

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.[CO1]

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.[CO1]

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. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is
 no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.[CO2]

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.[CO2]

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. [CO2]

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. [CO2]

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. [CO3]

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. [CO3]

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. [CO3]

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. [CO3]

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. [CO4]

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text[CO4]

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, [CO4]

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting[CO4]

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. [CO4]

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts. [CO4]

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. [CO4]

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. [CO5]
• 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[CO5]
• 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. [CO5]
• Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

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 Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3										1	
CO2	3	3	3	3	3								
CO3	3	3	3	2	3						3	2	

CO4	3	3	3	2	3						3		2
CO5	2	2											1

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2 3 3
5	CO5: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Identify (L3)	2 2

Justification Statements :
CO1: Understand The Process of Software Installation & Hardware troubleshooting
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
CO2: Analyze the network configurations for customizing web pages and search engines
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
CO 3: Apply The basic editing function, formatting text & objects on a required content.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO3 Action verb is less than as PO2 verb. Therefore, the correlation is high(3)
PO3: Develop(L3)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than as PO4 verb. Therefore, the correlation is moderate (2)
PO5: Apply (L3)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

CO 4: Apply the formulas, functions and visualizations to manage the data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than as PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply (L3)
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)
CO 5: Understand the libraries and models of chatGPT to generate information.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Identify(L3)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI (AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Data Structures	L	T/CLC	P	C
23APC0501	I-II	(Common to CSE, CIC, CSE(DS), AIML & AIDS)	2	1	0	3

Course Outcomes:

After studying the course, student will be able to

  CO 1: Understand the concepts of Linear Data Structures to sort the data

  CO 2: Apply the Linked list concepts to perform operations on data.

  CO 3: Apply the stacks features to manage the memory

  CO 4: Analyse various operations of queues, dequeues and their applications.

  CO 5: Understand binary search trees and hash tables to facilitate indexed search

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts of Linear Data Structures		to sort the data	L2
CO2	Apply	The Linked list concepts		to perform operations on data.	L3
CO3	Apply	The stacks features		to manage the memory	L3
CO4	Analyse	various operations of queues, dequeues and their applications.			L4
CO5	Understand	The Binary Search Trees and hash tables		to facilitate indexed search	L2

UNIT – I		9 Hrs
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 Hrs
Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists		
UNIT – III		9 Hrs
Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.		
UNIT – IV		9 Hrs
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 – V		9 Hrs
Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal **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		

Textbooks:

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 Peter Sanders

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 David Ranum

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

6. STP | 978-93-93162-18-2 | Data Structures (JNTU) - Dr. S. Vasundra

Online Learning Resources:

www.nptel.ac.in

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	18	24%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	14	19%	2	CO2: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 1
3	15	20%	2	CO3: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Analysis (L4) PO11: Thumb rule	3 3 2 2
4	13	18%	2	CO4: Analyse	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 2
5	14	19%	2	CO5: Understand	L2	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: review(L2) PO3: develop(L3) PO4: Interpret(L2) PO11: Thumb rule	2 3 2 3 2
	74	100 %						

Justification Statements :

CO1: Understand the concepts of Linear Data Structures to sort the data
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review (L2)
CO1 Action verb is same level as PO2. Therefore, the correlation is high (3)
CO2: Apply the Linked list concepts to perform operations on data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For some of Linear Data Structure applications, array and structure concepts are used to write programs store the data. Therefore, the correlation is low (1)

CO3: Apply the stacks features to manage the memory
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L3)
CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For some of Data Structure applications, stacks concepts are used to write programs to manage programs. Therefore, the correlation is low (1)
CO4: Analyse various operations of queues, dequeues and their applications.
Action Verb: Analyse (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO4: Analysis (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is moderate (2)
CO5: Understand binary search trees and hash tables to facilitate indexed search
Action Verb: Create (L6)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb by three levels. Therefore, the correlation is high (3)
PO2: Review (L6)
CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4: Interpret (L2)
CO5 Action verb is greater than PO4 verb by two levels. Therefore, the correlation is high (3)
PO11S: Thumb rule
For some of data manipulations Sorting and File Organization methods are used to solve storage problems. Therefore, the correlation is low (3)

Subject Code: 23ABS9908	Subject Name: **Engineering Physics Lab**	L 0	T 0	P 2	Credits: 1

Course Outcomes

CO1: **Analyze** the properties of light for engineering problems.
CO2: **Evaluate** the crystallite size using X-ray diffraction.
CO3: **Analyze** the basic properties of dielectric and magnetic behavior of the given material.
CO4: **Determine** the mechanical behavior of a given material.
CO5: **Evaluate** the basic parameters of a given semiconductor material.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	The properties of light		for engineering problems.	L4
2	Evaluate	The crystallite size using X-ray diffraction.			L5
3	Analyze	The basic properties of dielectric and magnetic behavior of the given material.			L4
4	Determine	The mechanical behavior of a given material.			L5
5	Evaluate	The basic parameters of a given semiconductor material.			L5

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings – CO1.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration – CO1.
3. Study the variation of B versus H by magnetizing the magnetic material (B-H curve) – CO3.
4. Determination of wavelength of Laser light using diffraction grating – CO1.
5. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method – CO3.
6. Determination of energy gap of a semiconductor using p-n junction diode – CO5.
7. Determination of the resistivity of semiconductors by four probe methods – CO5.
8. Determination of the crystallite size using X-Ray Diffraction spectra – CO2.
9. Determination of the numerical aperture of a given optical fiber and angle of acceptance – CO1.
10. Verification of Brewster's law – CO1.
11. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum – CO4.
12. Determination of rigidity modulus of the material of the given wire using Torsional pendulum – CO4.
13. Determination of temperature coefficients of a thermistor – CO5.
14. Determination of dielectric constant using charging and discharging method – CO3.
15. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect – CO5.
16. Sonometer: Verification of laws of stretched string – CO4.
17. Determination of magnetic susceptibility by Kundt's tube method – CO3.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment – CO4.

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

Experiments may be conducted in virtual mode.

References: A Textbook of Practical Physics - S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017.

URL: www.vlab.co.in **Mapping of COs to POs and PSOs**

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	9	25	3	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
2	6	16	2	**Evaluate**	**L5**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
3	9	25	3	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	6	16	2	**Determine**	**L5**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	6	16	2	**Evaluate**	**L5**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
	36							

CO1: Analyze the properties of light for solving engineering problems.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
> CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
> CO1 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

CO2: Evaluate the crystallite size using X-ray diffraction.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)

> CO2 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
> CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

CO3: Analyze the basic properties of dielectric and magnetic behavior of the given material.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
> CO3 Action Verb level is greater than PO1 action verb by one level; Therefore correlation is high (3).
> CO3 Action Verb level is equal to PO4 action verb; Therefore correlation is high (3).

CO4: Determine the mechanical behavior of a given material using dynamic methods.
Action Verb: Determine (L5)
PO1 Verbs: Apply (L3)
PO4 Verb: Analyze (L4)
> CO4 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
> CO4 Action Verb is greater than PO4 verb by one level; Therefore correlation is high (3).

CO5: Evaluate the basic parameters of a given semiconductor material.
Action Verb: Evaluate (L5)
PO1 and PO4 Verb: Apply (L3)
> CO5 Action Verb is greater than PO1 verb by two levels; Therefore correlation is high (3).
> CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

Course Code	Year & Sem	Electrical and Electronics Engineering Workshop	L	T	P	C
23AES0202	I-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the Electrical circuit design, measurement of resistance, power, and power factor.

CO2: **Apply** suitable methods to measure Resistance, power, energy and power factor.

CO3: **Design** suitable methods for magnetization characteristics of D. C shunt generator.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Electrical circuit design; measurement of resistance, power, power factor			L2
CO2	Apply	Suitable methods to measure Resistance, power, energy and power factor.			L3
CO3	Design	Suitable methods for magnetization characteristics of D. C shunt generator.			L6

SYLLABUS:

PART A
ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of Kirchhoff's current law and Voltage law-(CO1).
2. Verification of Superposition theorem-(CO1).
3. Measurement of Resistance using Wheat stone bridge-(CO1).
4. Measurement of Power and Power factor using Single-phase watt-meter-(CO2).
5. Measurement of Earth Resistance using Megger-(CO2).
6. Calculation of Electrical Energy for Domestic Premises-(CO2).
7. Magnetization Characteristics of DC shunt Generator-(CO3).

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
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, Third Edition

Note: Minimum Six Experiments to be performed.

PART B
ELECTRONICS ENGINEERING LAB

COURSE OUTCOMES:

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

CO4: **Understand** the V-I Characteristics of diodes and its applications.

CO5: **Analyze** the input and output characteristics of BJT and its applications.

CO6: **Analyze** the truth tables of all logic gates and f/f's using IC's.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO4	Understand	V-I Characteristics of diodes and its applications.			L2
CO5	Analyze	input and output characteristics of BJT and its applications			L4
CO6	Analyze	Truth tables of all logic gates and f/f's using IC's.			L4

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias. (CO4)
2. Plot VI characteristics of Zener Diode and its application as voltage Regulator. (CO4)
3. Implementation of half wave and full wave rectifiers (CO4)

4. Plot Input & Output characteristics of BJT in CE and CB configurations (CO5)
5. Frequency response of CE amplifier. (CO5)
6. Simulation of RC coupled amplifier with the design supplied. (CO5)
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs. (CO6)
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs. (CO6)

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

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 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.

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

Mapping of course outcomes with program outcomes

Mapping of Course outcomes with Program outcomes

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

Levels of correlation,viz.,1.Low,2.Moderate,3.High

Justification Table:

CO	COs		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	**Understand**	**L2**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4: Analyze (L4) PO9: Thumb Rule	2 1 1 1
2	**Apply**	**L3**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4: Analyze(L4) PO9: Thumb Rule	3 2 2 1
3	**Design**	**L6**	PO2, PO4, PO9	PO2: Analyze(L4) PO4: Design (L6) PO9: Thumb Rule	3 3 1
4	Understand	**L2**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	2 3
5	Analyze	**L4**	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
6	Analyze	**L4**	PO1, PO2	PO1:Apply(L3) PO2:Review (L2)	3 3

CO1: Understand the Electrical circuit design, measurement of resistance, power, and power factor.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action Verb is Less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO1 Action Verb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO4: Analyze (L4)
CO1 Action Verb is Less than PO4 verb by two level; Therefore, correlation is low (1).
PO9: Using Thumb Rule, CO1 correlates to PO9 as low (1).

CO2: Apply suitable methods to measure Resistance, power, energy and power factor.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action Verb is same as PO1 verb; Therefore, correlation is high (3).
PO2: Analyze (L4)
CO2 Action Verb is Less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO4: Analyze (L4)
CO2 Action Verb is Less than PO4 verb by one level; Therefore, correlation is moderate (2).
PO9: Using Thumb Rule, CO2 correlates to PO9 as low (1).

CO3: Design suitable methods for magnetization characteristics of D. C shunt generator.
Action Verb: Design (L6)
PO2: Analyze (L4)
CO3 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).
PO4: Design (L6)
CO3 Action Verb is same as PO4 verb; Therefore, correlation is high (3).
PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).

CO4: Understand the V-I Characteristics of diodes and its applications.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2)
PO2 Verbs: Review (L2)
CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO5: Analyze the input and output characteristics of BJT and its applications.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO6: Analyze the truth tables of all logic gates and f/f's using IC's.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO6 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO6 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

Course Code	Year & Sem	Data Structures Lab	L	T	P	C
23APC0502	I-II	**(Common to CSE, CIC, CSE(DS), AIML & AIDS)**	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Apply the sorting and searching techniques using Arrays

CO 2: Develop linked list operations for efficient access to data.

CO 3: Develop stacks and queues to solve real time applications.

CO 4: Develop binary search tree operations using linked list

CO 5: Apply the hashing techniques to organise the data in hash table.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	sorting and searching algorithm	using arrays		L3
CO2	**Develop**	linked list operations		for efficient access to data.	L6
CO3	**Develop**	stacks and queues		to solve real time applications.	L6
CO4	**Develop**	binary search tree operations	using linked list		L6
CO5	**Apply**	the hashing techniques		to organise the data in hash table.	L3

List of Experiments:

Exercise 1: Array Manipulation[CO1]

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[CO2]

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[CO2]

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[CO2]

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[CO3]

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[CO3]

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[CO3]

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 Search Tree CO4]

i)   Implementing a BST using Linked List.

ii)   Traversing of BST.

Exercise 9: Hashing [CO5]

i)   Implement a hash table with collision resolution techniques.

ii)   Write a program to implement a simple cache using hashing.

Textbooks:
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 Peter Sanders
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 David Ranum
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.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 3
2	CO2: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
3	CO3: Develop	L6	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Develop (L3) PO4: Design (L6) PO11: Thumb rule	3 3 3 3
4	CO4: Develop	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6) PO4: Analysis(L4) PO11: Thumb rule	3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO4: Analysis(L4) PO11: Thumb rule	3 3 2 3

Justification Statements :
CO1: Apply the sorting and searching techniques using Arrays
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
CO2: Develop linked list operations for efficient access to data.
Action Verb: Develop (L6)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Develop (L6)
CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3)

PO4: Design (L6)

CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (3)

CO3: Develop stacks and queues to solve real time applications

Action Verb: Develop (L6)

PO1: Apply (L3)

CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)

PO2: Develop (L3)

CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3)

PO4: Design (L6)

CO3 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Data Structure applications, stacks concepts are used to manage data in the memory. Therefore, the correlation is high (3)

CO4: Develop binary search tree operations using linked list

Action Verb: Develop (L6)

PO1: Apply(L3)

CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO2: Review (L2)

CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L6)

CO4 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

PO4: Analysis (L4)

CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)

PO11: Thumb rule

For some of Real Time problems Data Structure applications, queues concepts are used to write programs and evaluation the memory operations. Therefore, the correlation is high (3)

CO5:Apply the hashing techniques to organise the data in hash table.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO5 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)

PO2: Review (L2)

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO4: Analysis (L4)

CO5 Action verb less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO11: Thumb rule

For some of data manipulations tree and graphs concepts are used to solve data storage problems. Therefore, the correlation is high (3)

Course Code	Year & Sem	NSS/NCC/Scouts & Guides/Community Service	L	T	P	C
23AHM9904	I-II		0	0	1	0.5

Course Outcomes: After studying the course, students will be able to

CO1: **Understand** the importance of discipline, character and service motto of community.
CO2: **Analyze** the activities need to be done for nature protection
CO3: **Analyze** the social issues in a community and address it through the base camps.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the importance of discipline, character and service motto		of community	L1
CO2	Analyze	the activities need to be done for nature protection			L4
CO3	Analyze	the social issues in a community and address it through the base camps			L4

UNIT-I

Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.
Activities:
  i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
  ii) Conducting orientations programs for the students –future plans-activities-releasing road 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
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) Organizing 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
Activities:
  i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
  ii) Mental health, Spiritual Health, HIV/AIDS,
  iii) Conducting consumer Awareness. Explaining various legal provisions etc.
  iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
  v) Any other programmes in collaboration with local charities, NGOs etc.
  vi) Conducting awareness programs on Health-related issues such as General Health,

CORRELATION OF COS WITH THE POS & PSOS:

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-POMAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s):Action Verb and BTL(forPO1 to PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 2 2
2	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3
3	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3

Justification Statements:

CO1: Understand the importance of discipline, character and service motto of community.
Action Verb: Understand (L2)
> CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
> CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
> CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO10 as moderate (2).

CO2: Analyze the activities need to be done for nature protection
Action Verb: Analyze (L4)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).
CO2 Action Verb is same as PO2 verb, Therefore correlation is High (3)
CO2 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

CO3: Analyze the social issues in a community and address it through the base camps
Action Verb: Analyze (L4)
CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2).
CO3 Action Verb is same as PO2 verb, Therefore correlation is High (3)
> CO3 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	BS	23ABS9913	Discrete Mathematics and Graph Theory	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	PC	23APC0503	Digital Logic and Computer Organization	2	1	0	3	30	70	100
4	PC	23APC0504	Advanced Data Structures and Algorithms Analysis	2	1	0	3	30	70	100
5	PC	23APC0506	Object-Oriented Programming Through JAVA	2	1	0	3	30	70	100
6	PC	23APC0505	Advanced Data Structures and Algorithms Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0507	Object-Oriented Programming Through JAVA Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
9	MC	23AMC9901	Environmental Science	2	0	0	-	30	-	30
			Total	**12**	**06**	**8**	**20**	**270**	**560**	**830**

Course Code	Year & Sem	Discrete Mathematics and Graph Theory	L	T/ CLC	P	C
23ABS9913	II-I	**(Common to CSE,CIC,CSD,AI&DS, AI&ML)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: **Apply** the concepts of mathematical logic in various engineering fields.

CO2: **Understand** the concepts related to set theory and algebraic structures.

CO3: **Analyze** the theory of elementary combinatorics by using binomial and multinomial theorems.

CO4: **Evaluate** the solutions of homogeneous and inhomogeneous recurrence relations.

CO5: **Apply** the graph theory in solving computer science problems and finite difference approximation**.**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Apply	the concepts of mathematical logic	in various engineering fields		L3
CO2	Understand	the concepts related to set theory and algebraic structures.			L2
CO3	Analyze	the theory of elementary combinatorics	by using binomial and multinomial theorems		L4
CO4	Evaluate	The solutions of homogeneous and in homogeneous recurrence relations.			L5
CO5	Apply	The graph theory solving computer science problems.		and finite difference approximati on.	L3

UNIT – I: Mathematical Logic	9Hrs

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus

UNIT – II: Set theory	9Hrs

The Principle of Inclusion-Exclusion, Pigeon hole principle and its application, Functions : composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties.

Algebraic structures: Algebraic systems-Examples and General Properties, Semi groups , Monoids, groups, sub groups, homomorphism, Isomorphism.

UNIT – III: Elementary Combinatorics	9Hrs

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

UNIT – IV: Recurrence Relations	9Hrs

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous Recurrence Relations.

UNIT – V: Graphs	9Hrs

Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi graphs and Euler Circuits, Hamiltonian Graphs.

Textbooks

1.J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.

2.Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited

Reference Books

1.Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2.Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.
3.Dr.J.Rajendra Prasad,T.Rama Rao and A.Madana Mohan Rao, Mathematical Foundation of Computer Science

Online Learning Resources:

http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										
CO2	2										
CO3		3									
CO4		3									
CO5	3										

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Apply	L3	PO1	Apply (L3)	3
2				Understand	L2	PO1	Apply (L3)	2
3				Analyze	L4	PO2	Analyze (L4)	3
4				Evaluate	L5	PO2	Analyze (L4)	3
5				Apply	L3	PO1	Apply (L3)	3

CO1: .Apply the concepts of mathematical logic in various engineering fields
Action Verb: Apply (L3)
PO1 Verbs: **Apply** (L3)
CO1 Action Verb is equal to PO1 verb . Therefore correlation is high (3).
CO2: Understand the concepts related to set theory and algebraic structures
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO2 Action Verb is one level below to PO1 verb; Therefore correlation is moderate (2).
CO3: . Analyze the theory of elementary combinatorics by using binomial and multinomial theorems.
Action Verb: Analyse (L4)
PO2 Verb: **Analyse** (L4)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO4: Evaluate the solutions of homogeneous and inhomogeneous recurrence relations.
Action Verb: Evaluate (L5)
PO2 Verb: Analyze (L4)
CO4 Action Verb is one level high to PO2 verb; Therefore correlation is high (3).
CO5: Apply the graph theory in solving computer science problems and finite difference approximation.
Action Verb: Apply(L3)
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

Course Code	Year & Sem	Universal Human Values	L	T/ CLC	P	C
23AHM9905	II-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1:**Understand** the essentials of human values, self-exploration, happiness and prosperity for value added education.
CO2:**Analyze** the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.
CO3:**Apply** the nine universal human values in relationships for harmony in the family and orderliness in the society.
CO4:**Evaluate** the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.
CO5:**Apply** the holistic understanding of harmony on professional ethics through augmenting universal human order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the essentials of human values, self-exploration, happiness and prosperity for value added education.			**L2**
2	Analyze	the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.			**L4**
3	Apply	the nine universal human values in relationships for harmony in the family and orderliness in the society.			**L3**
4	Evaluate	the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.			**L5**
5	Apply	the holistic understanding of harmony on professional ethics through augmenting universal human order.			**L3**

UNIT – I:	6 lectures and 3 tutorials for practice session

Introduction to Value Education (6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: 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:	6 lectures and 3 tutorials for practice session

Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
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:	6 lectures and 3 tutorials for practice session

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
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:	4 lectures and 2 tutorials for practice session
Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)	
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:	6 lectures and 3 tutorials for practice session
Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)	
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	

Textbooks
a. The Textbook
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
b. The Teacher's Manual
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%202023.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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

CO	Lesson Plan (Hrs)	%	Correlation	Verb	BTL	Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
1	7	19.4	2	Understand	2	PO8,PO11	Thumb Rule	2,2
2	8	22.2	3	Analyze	4	PO7,PO8	Thumb Rule	3,3
3	7	19.4	2	Apply	3	PO6,PO7,PO8	Thumb Rule	2,2,2
4	8	22.2	3	Evaluate	5	PO6,PO7,PO8,PO11	Thumb Rule	3,3,3,3
5	7	19.4	2	Apply	3	PO6,PO7,PO8,PO11	Thumb Rule	2,2,2,2

Justification Statements:

CO1: Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.
Action Verb: Understand (L2)
CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.
Action Verb: Analyze (L4)
CO2 Action Verb is Analyze of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).

CO3: Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.
Action Verb: Apply (L3)
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

CO4: Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.
Action Verb:Evaluate (L5)
CO4 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

CO5: Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.
Action Verb: Apply (L3)
CO5 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

Course Code	Year & Sem	DIGITAL LOGIC and COMPUTER ORGANIZATION (Common to CSE & CIC)	L	T/ CLC	P	C
23APC0503	II-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the number system concepts, number conversions, logic gates using binary numbers

CO2: Understand the sequential circuits, flip-flops, registers and computer fundamentals to store data.

CO3: Evaluate the Arithmetic operations for understanding execution process

CO4: Analyze the hardware requirements of primary and secondary memories to store the data.

CO5: Apply Input/Output devices and Interfaces to connect multiple devices.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the number system concepts, number conversions, logic gates		using binary numbers	L2
CO2	Understand	the sequential circuits, flip-flops, registers and computer fundamentals			L2
CO3	Evaluate	the Arithmetic operations		for understanding execution process	L5
CO4	Analyze	the hardware requirements of primary and secondary memories		to store the data	L4
CO5	Apply	Input/Output devices and Interfaces			L3

UNIT – I	9Hrs

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Character representation.

Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers, dumping.

UNIT – II	9Hrs

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

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Addressing modes, subroutines.

UNIT – III	12Hrs

Computer Arithmetic : Addition and Subtraction of Signed Numbers, Ripple carry adder, Ripple carry multiplier, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Forms of Parallel Processing

UNIT – IV	9Hrs

The Memory Organization: Memory hierarchy, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Cache mappings, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V	9Hrs

Input /Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Synchronous and Asynchronous bus, Interface Circuits, Standard I/O Interfaces

Textbooks

1. Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 6th edition, McGraw Hill, 2023.

2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.

3. Computer Organization and Architecture, William Stallings, 11thEdition, Pearson, 2022.

Reference Books

1. Computer Systems Architecture, M.Moris Mano, 3rdEdition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5thEdition, Thomson, 2003.
4. Computer Organization & Architecture,William Stallings,11th Edition, Pearson, 2022

Online Learning Resources:

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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO11: Thumb rule	2 1 2 1
2	9	20	2	CO2 : Understand	L2	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2:Review(L2) PO3: Develop (L3) PO11: Thumb rule	2 3 2 1
3	9	20	2	CO3 : Evaluate	L5	PO1 PO2 PO3 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 3 2 1 1
4	9	20	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Develop (L3)	3 3 3 3
5	9	20	2	CO5 : Apply	L3	PO1 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO4: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 2 3 2 2
	45	100						

Justification Statements:

CO1: Understand the number system concepts, number conversions, logic gates using binary numbers

Action Verb: Understand(L2)

PO1 Verb: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)

PO3: Develop (L3)

CO1 Action verb is less than PO3 verb . Therefore, the correlation is moderate (2)

PO11: Thumb rule

updating the logical circuits and combinational circuits. Therefore, the correlation is low (1)

CO2: **Understand** the sequential circuits, flip-flops, registers and computer fundamentals to store data.

Action Verb: Understand(L2)

PO1: Apply(L3)

CO2 Action verb is greater than level PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2: Review(L2)

CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO2 Action verb is less than PO3 verb . Therefore, the correlation is moderate (2)

PO11: Thumb rule

Update sequential circuits and registers. Therefore, the correlation is low (1)

CO3: **Evaluate** the Arithmetic operations for understanding execution process

Action Verb: Evaluate(L5)

PO1: Apply(L3)

CO3 Action verb is higher level than PO1 verb level by two level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)

PO8: Thumb rule

Team work is required. Hence the correlation is low (1)

PO11: Thumb rule

Updating the Numbers and execution process. Therefore the correlation is low (1)

CO4: **Analyze** the hardware requirements of primary and secondary memories to store the data.

Action Verb: Analyze(L4)

PO1: Apply(L3)

CO4 Action verb is less than PO1 by one level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is same as PO2 verb. Therefore, the correlation is High (3)

PO3: Develop (L3)

CO4 Action verb is less than PO3 verb by two levels. Therefore, the correlation is High (3)

PO4: Develop (L3)

CO4 Action verb is less than PO4 verb by two levels. Therefore, the correlation is High (3)

CO5: **Apply** Input/Output devices and Interfaces to connect multiple devices

Action Verb: Apply (L3)

PO1: Apply(L3)

CO5 Action verb is same as PO1. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)

PO5: Apply(L3)

CO5 Action verb is less than PO5 verb . Therefore, the correlation is high (3)

PO8: Thumb rule

Team work is required to provide the solutions on different numbers. Hence the correlation is moderate (2)

PO11: Thumb rule

Updating the Numbers and execution process. Therefore, the correlation is moderate (2)

Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis (Common to CSE,CIC,CSE(DS),AIDS & AIML)	L	T/ CLC	P	C
23APC0504	II-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the asymptotic notations and operations on AVL, B-Trees.

CO2: **Apply** the Trees, Graphs, Divide and conquer method to solve various problems.

CO3: **Apply** the greedy and dynamic programming methods to solve real time problems.

CO4: **Evaluate** the backtracking , branch and bound methods to solve minimization problems.

CO5: **Analyze** the P, NP, NP hard and NP complete problems for solving reduction problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The asymptotic notations	operations on AVL,B-Trees		L2
CO2	Apply	The Trees, Graphs, Divide and conquer method		to solve various problems	L3
CO3	Apply	The greedy and dynamic programming methods		to solve real time problems.	L3
CO4	Evaluate	The backtracking , branch and bound methods		to solve minimization problems	L5
CO5	Analyze	The P, NP, NP hard , NP complete problems		for solving reduction problems	L4

UNIT – I		9Hrs

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

Review of Binary Search Trees: Binary Search Tree – Insertion, Deletion & Traversal

AVL Trees – Creation, Insertion, Deletion operations and Applications

B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II		9 Hrs

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Finding Minimum and Maximum, Strassen's matrix multiplication.

UNIT – III		9 Hrs

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, Multi Stage graphs, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, Travelling Salesperson problem

UNIT – IV		8 Hrs

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

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

UNIT – V		10Hrs

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

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

2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2nd 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, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia.

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,1. Introduction to Algorithms (youtube.com)

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20	2	CO1: Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO11: Thumb rule	2 1 2
2	9	20	2	CO2: Apply	L3	PO1 PO2 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 2 2 2 2
3	9	20	2	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 2 3 2 2 2
4	9	20	2	CO4: Evaluate	L5	PO1 PO2 PO3 PO4 PO6 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 2 2
5	9	20	2	CO5: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	2 3 3 3 3 2
	45	100						

Justification Statements:
CO1: Understand the asymptotic notations and operations on AVL, B-Trees.
Action Verb: Understand (L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Analyze (L4)
CO1 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)
PO11: Thumb rule
The asymptotic performance of algorithms, To Analyze the behavior of algorithms as their input increases. Therefore the correlation is moderate (2)

CO2: Apply the Trees, Graphs, Divide and conquer method to solve various problems.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO4: Analyze (L4)
CO2 Action verb is lesser than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO6: Thumb rule
Greedy and dynamic programming concepts were applied to solve traffic problems and finding best route
to
the destination. Therefore, the correlation is moderate (2)
PO11: Thumb rule
Finding optimal solution to a real-world problem is a continuous activity. Therefore, the correlation is moderate (2)
CO3: Apply the greedy and dynamic programming methods to solve real time problems.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO3 Action verb is same level of PO1 verb. Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO3 Action verb is less than of PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2))
PO6 : Thumb rule
backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)
PO11: Thumb rule
backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is moderate (2)
CO4: Evaluate the backtracking, branch and bound methods to solve minimization problems.
Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO3 Action verb is greater than of PO1 verb . Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO3 Action verb is greater than of PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than of PO3 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO3 Action verb is greater than of PO4 verb. Therefore the correlation is high(3)
PO6 : Thumb rule
Backtracking and searching techniques were applied for GPS. Therefore, the correlation is moderate (2)
PO11: Thumb rule
Backtracking and searching techniques will give optimal solutions to various problems. Therefore, the correlation is moderate (2)
CO5: Analyze the P, NP, NP hard and NP complete problems for solving reduction problems.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is less than of PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Analyze (L4)
CO5 Action verb is same level of PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
In research-oriented purpose P, NP concepts can be applied. Therefore, the correlation is moderate (2)

Course Code	Year & Sem	Object-Oriented Programming Through JAVA (common to CSE, CIC, CSE(DS), AIDS & AIML)	L	T/ CLC	P	C
23APC0506	II-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Java language components and how to apply in applications

CO2: Apply the concepts of OOP's fundamentals like classes, Methods and class libraries to develop applications

CO3: Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications.

CO4: Evaluate the concepts of packages, file I/O, by using access control, and exception handling mechanisms to solve real world scenarios

CO5: Create the GUI applications by using concepts like multi-threading, Java FX, JDBC

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the Java language components		How to apply in applications	L2
CO2	Apply	the concepts of OOP's fundamentals	like classes, methods and class libraries	to develop applications	L3
CO3	Analyze	the concepts of arrays, inheritance and interfaces		to develop efficient java applications	L4
CO4	Evaluate	the concepts of packages , file I/O	by using access control, and exception handling mechanisms	to solve real world scenarios	L5
CO5	Create	The GUI applications, JDBC applications	by using concepts like multi-threading, Java FX, JDBC		L6

UNIT – I		7 Hrs

Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT – II		12 Hrs

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, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT – III		19 Hrs

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.	
UNIT – IV	**19 Hrs**

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT – V	**19 Hrs**

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, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Textbooks:
1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:
1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:
1. https://nptel.ac.in/courses/106/105/106105191/
2.https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	12	13.63%	2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2	13	14.77%	2	CO2: Apply	L3	PO2 PO3 PO4 PO5 PO10 PO11	PO2: Review (L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3) PO10: Thumb Rule PO11: Thumb Rule	3 3 2 3 2 2
3	23	26.13%	3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design(L6) PO4: Interpret(L5) PO5: SSelect(L5)	3 3 1 2 2
4	20	22.72%	3	CO4: Evaluate	L5	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze(L4) PO5: Select(L3)	3 3 3 3
5	20	22.72%	3	CO5: Create	L6	PO2 PO3 PO5 PO10 PO11	PO2: Formulate (L6) PO3: Design (L6) PO5: Create(L6) PO10: Thumb Rule PO11: Thumb rule	3 3 3 3 3
	88	100 %						

Justification Statements:
CO1: Understand the Java language components and how to apply in applications.
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
CO2: Apply the concepts of OOP's fundamentals like classes, Methods and class libraries to

develop applications
Action Verb: Apply (L3)
PO2: Review (L2)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is High (3)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is High (3)
PO4: Analyze(L4)
CO2 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)
CO2 Action verb is less than PO5 verb by three level. Therefore, the correlation is High (3)
PO10: Thumb Rule
Create some Java programs to solve real world problems. Therefore, the correlation is moderate
(2)
PO11: Thumb Rule
Learn java programs to solve. Therefore, the correlation is moderate (2)
CO3: Analyze the concepts of arrays, inheritance and interfaces to develop efficient java applications.
Action Verb: Analyze(L4)
PO1: Apply (L3)
CO3 Action verb is Greater than PO1. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is same level as PO2. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)
PO4: Interpret (L5)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Select (L5)
CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

CO4: Evaluate the concepts of packages, access control, file I/O, and exception handling mechanisms to solve real world scenarios

Action Verb: Evaluate(L5)

PO1: Apply(L3)
CO4 Action verb is Greater than PO1. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is Greater than PO2. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is Greater than PO4. Therefore, the correlation is high (3)
PO5: Select (L3)
CO4 Action verb is Greater than PO5. Therefore, the correlation is high (3)

CO5: Create GUI applications by using concepts like multi-threading, Java FX, JDBC

Action Verb: Create (L6)

PO2: Formulate (L6)
CO5 Action verb is same level as PO2. Therefore, the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is same level as PO3. Therefore, the correlation is high (3)
PO5: Create (L6)
CO5 Action verb is same level as PO5. Therefore, the correlation is high (3)
PO10: Thumb Rule
Java is used to design simple and enterprise applications so need for project management. Therefore, the correlation is high (3)
PO11: Thumb Rule
It is a programming language so new version available so we need to learn. Therefore, the correlation is high (3)

Course Code	Year & Sem	Advanced Data Structures and Algorithms Analysis Lab (Common to CSE,CIC,AIDS & AIML)	L	T	P	C
23APC0505	II-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the operations on AVL Trees, B-Trees and graph traversals.

CO2: Create the Min, Max Heap using arrays and find BFT, DFT for the graphs.

CO3: Create the sorting techniques for finding the time complexities and use greedy method to find

single source shortest path.

CO4: Apply backtracking strategy for finding the N-Queens ,0/1 knapsack problem.

CO5: Apply greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack problem.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the operations	on AVL Trees, B-Trees and graph traversals		L2
CO2	Create	the Min, Max Heap using arrays and find BFT, DFT		for the graphs	L6
CO3	Create	the sorting techniques		for finding the time complexities	L6
CO4	Apply	backtracking strategy		for finding the N-Queens ,0/1 knapsack problem	L3
CO5	Apply	greedy strategy		for job sequencing	L3

List of Experiments:
1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.**(CO1)**
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array.Implement searching, insertion and deletion operations.**(CO1)**
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.**(CO2)**
4. Implement BFT and DFT for given graph, when graph is represented by a) Adjacency Matrix b) Adjacency Lists. **(CO2)**
5. Write a program for finding the bi-connected components in a given graph.**(CO2)**
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).**(CO2)**
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.**(CO3)**
8. Implement Job sequencing with deadlines using Greedy strategy.**(CO5)**
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.**(CO4)**
10. Implement N-Queens Problem Using Backtracking.**(CO4)**
11. Use Backtracking strategy to solve 0/1 Knapsack problem.**(CO4)**
12. Implement Travelling Sales Person problem using Branch and Bound approach.**(CO5)**
Reference Books:
1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
Online Learning Resources:
1. http://cse01-iiith.vlabs.ac.in/
2. http://peterindia.net/Algorithms.html

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 : Understand	L2	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO8: Thumb rule PO11: Thumb rule	2 1 1 2
2	CO2 : Create	L6	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO5: Develop (L6) PO11: Thumb rule	3 3 3 2
3	CO3 : Create	L6	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 1 1
4	CO4 : Apply	L3	PO1 PO2 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO8: Thumb rule PO11: Thumb rule	3 2 2 2
5	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Develop (L3) PO8: Thumb rule PO11: Thumb rule	3 2 3 3 1 2

Justification Statements :

CO1: Understand the operations on AVL Trees, B-Trees and graph traversals.

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Analyze(L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

PO8: Thumb rule

Perform operations on AVL trees and B-trees are individual. There fore the correlation is low(1)

PO11 : Thumb rule

Apply different values of operations on AVL Trees, B-Trees and graph traversals is life long. Therefore the correlation is moderate (2)

CO2: Create the Min, Max Heap using arrays and find BFT, DFT for the graphs

Action Verb : Create (L6)

PO1 Verb : Apply(L3)

CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Analyze(L4)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO5: Develop(L6)

CO2 Action verb is less than PO5 verb by one level. Therefore the correlation is high (3)

PO11: Thumb rule

To Apply the min and max heap on arrays and finding traversals on graphs is lifelong learning. Therefore the

correlation is moderate (2)

CO3: Create the sorting techniques for finding the time complexities and use greedy method to find

single
source shortest path.
Action Verb : Create (L6)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)
PO4: Develop (L6)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO8: Thumb rule
Team work or individual work is required to analyze sorting techniques time complexities. Hence the
correlation is low (1)
PO11: Thumb rule
To Develop sorting techniques and single source shortest path as life long learning. Therefore the correlation
is low (1)

CO4: Apply backtracking strategy for finding the N-Queens ,0/1 knapsack problem
Action Verb : Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO8: Thumb rule
Team work/ individual work is required find the N-Queens and 0/1 Knapsack trough backtracking. Hence
the correlation is medium (2)
PO11: Thumb rule
To Develop back tracking in N-Queens problem is life long learning. Therefore the correlation is medium
(2)

CO5 : Apply greedy strategy for job sequencing and using dynamic programming to find 0/1 knapsack
problem.
Action Verb : Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L3)
CO5 Action verb is less than PO3 verb. Therefore the correlation is high (3)
PO4: Design (L3)
CO5 Action verb is less than PO4 verb. Therefore the correlation is high (3)
PO8: Thumb rule
Team work / individual work is required applying greedy strategy on job sequencing. Hence the correlation
is low (1)
PO11: Thumb rule
To apply dynamic programming for 0/1 knapsack is life long learning. Therefore the correlation is
medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Object-Oriented Programming Through Java Lab	L	T	P	C
23APC0507	II-I	(common to CSE,CIC, CSE(DS), AIDS & AIML)	0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Java syntax, data types, control structures and OOPs principles.

CO2: Apply the problem-solving skills and algorithmic thinking by using OOP concepts

CO3: Apply the fundamental OOP principles to solve programming problems effectively.

CO4: Analyze the Java libraries to implement thread Applications.

CO5: Create graphical user interface (GUI) applications using JavaFX

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The Java syntax, data types, control structures and OOPs principles			L2
CO2	Apply	The problem-solving skills and algorithmic thinking	by using OOP concepts		L3
CO3	Apply	The fundamental OOP principles		to solve programming problems effectively	L3
CO4	Analyze	The Java libraries		to implement thread Applications.	L4
CO5	Create	graphical user interface (GUI) applications	using JavaFX		L6

List of Experiments:

Exercise – 1

a) Write a JAVA program to display default value of all primitive data type of JAVA **(CO1)**

b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root. **(CO2)**

Exercise - 2

a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism. b) Write a JAVA program to sort for an element in a given list of elements using bubble sort. **(CO2)**

c) Write a JAVA program using StringBuffer to delete, remove character. **(CO2)**

Exercise - 3

a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method. **(CO2)**

b) Write a JAVA program implement method overloading. **(CO3)**

c) Write a JAVA program to implement constructor**. (CO3)**

d) Write a JAVA program to implement constructor overloading. **(CO3)**

Exercise - 4

a) Write a JAVA program to implement Single Inheritance **(CO3)**

b) Write a JAVA program to implement multi level Inheritance **(CO3)**

c) Write a JAVA program for abstract class to find areas of different shapes **(CO3)**

Exercise - 5

a) Write a JAVA program give example for "super" keyword. **(CO3)**

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? **(CO3)**

c) Write a JAVA program that implements Runtime polymorphism **(CO3)**

Exercise - 6

a) Write a JAVA program that describes exception handling mechanism **(CO4)**

b) Write a JAVA program Illustrating Multiple catch clauses **(CO4)**

c) Write a JAVA program for creation of Java Built-in Exceptions **(CO4)**

d) Write a JAVA program for creation of User Defined Exception **(CO4)**

Exercise - 7

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) **(CO4)**

b) Write a program illustrating is Alive and join () **(CO4)**
c) Write a Program illustrating Daemon Threads. **(CO4)**
d) Write a JAVA program Producer Consumer Problem **(CO4)**

Exercise – 8
a) Write a JAVA program that import and use the user defined packages **(CO4)**
b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX) **(CO5)**
c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI **(CO5)**

Exercise – 9
a) Write a java program that connects to a database using JDBC **(CO5)**
b) Write a java program to connect to a database using JDBC and insert values into it. **(CO5)**
c) Write a java program to connect to a database using JDBC and delete values from it. **(CO5)**

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11th edition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547 618816347_shared/overview

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 :Understand	L2	PO2 PO5	PO2: Review(L2) PO5: Apply(L3)	3 2
2	CO2 :Apply	L3	PO2 PO3 PO4 PO5	PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply(L3)	3 3 2 3
3	CO3: Apply	L3	PO3 PO4 PO5	PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3)	3 2 3
4	CO4: Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO10 PO11	PO2: Analyze (L4) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
5	CO5 :Create	L6	PO3 PO5 PO8 PO10 PO11	PO3: Design (L6) PO5: Create(L6) PO8: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3

Justification Statements :

CO1: Understand Java syntax thoroughly, encompassing data types and control structures.
Action Verb : Understand(L2)
PO2: Review(L2)
CO1 Action verb is same PO2 verb. Therefore the correlation is High(3)
PO5: Apply(L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)
CO2: Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.
Action Verb : Apply (L3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is High(3)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is less than PO4 verb by one levels. Therefore the correlation is moderate (2)
PO5: Apply (L3)
CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
CO3: Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.
Action Verb : Apply(L3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate(2)
PO5: Apply (L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high(3)
CO4: Analyze the concepts of multithreading and collection frameworks for solving complex programs.
Action Verb :Analyze (L4)
PO2: Analyze (L4)
CO4 Action verb is same PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO8: Thumb Rule
It is a programming language we need to collaborate with team. Therefore the correlation is high (3)
PO10: Thumb Rule
By using java to manage enterprise projects in multi-disciplinary environments . Therefore the correlation is
high (3)
PO11: Thumb Rule
It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation
is high (3)
CO5: Create GUI based applications using Java FX.
Action Verb : Create (L6)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO5: Create(L6)
CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)
PO8: Thumb Rule
It is a programming language we need to collaborate with team. Therefore the correlation is high (3)
PO10: Thumb Rule
By using java to manage enterprise and web based projects in multi-disciplinary environments. Therefore
the correlation is high (3)
PO11: Thumb Rule
It is a programming language we need to learn lifelong because new concepts arise. Therefore the correlation
is high (3)

Course Code	Year & Sem	PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE) (Common to CSE,CIC,CSE(DS),AIDS & AIML)	L	T	P	C
23ASC0501	II-I		0	1	2	2

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Basic concepts of python programming to build scripts in IDLE.

CO2: Apply the modularity techniques to invoke user defined functions.

CO3: Apply the concept of Dictionaries, Tuples and sets to perform operations on data.

CO4: Analyze the file concepts and oops paradigms to manage data.

CO5: Apply the concepts of JSON and XML for data processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	Basic concepts of python programming		to build scripts in IDLE	L2
CO2	**Apply**	the modularity techniques		to invoke user defined functions	L3
CO3	**Apply**	the concept of Dictionaries, Tuples and sets		to perform operations on data.	L3
CO4	**Analyze**	the file concepts and oops paradigms.		to manage data	L4
CO5	**Apply**	the concepts of JSON and XML		for data processing	L3

UNIT – I	9Hrs

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: 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 display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT – II	9 Hrs

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.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.

11. Write a program to perform the given operations on a list: i.Addition ii. Insertion iii. slicing 12. Write a program to perform any 5 built-in functions by taking any list.	

UNIT – III	9 Hrs

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

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:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT – IV	9 Hrs

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.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. 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.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT – V	9Hrs

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a)   Apply head () function to the pandas data frame
    b)   Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO5: Apply (L3)	2 3 2 2
2	9	20	2	CO2 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
3	9	20	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
4	9	20	2	CO4 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3) PO11:Thumb Rule	3 3 3 3 3 2
5	9	20	2	CO5 : Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 2 3
	53	100 %						

Justification Statements:

CO1: Understand the Basic concepts of python programming to build scripts in IDLE.

Action Verb : Understand(L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Review(L2)

CO1 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3 Verb : Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore the correlation is moderate (2)

PO5 Verb : Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

CO2: Apply the modularity techniques to invoke user defined functions.

Action Verb : Apply (L3)

PO1: Apply(L3)

CO2 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Review(L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)

PO3 Verb : Develop (L3)

CO2 Action verb same as PO3 verb. Therefore the correlation high (3)

PO4 Verb : Analyze(L4)
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5 Verb : Apply(L3)
CO2 Action verb is same as PO5 verb. Therefore the correlation is high (3)
CO3: Apply the concept of Dictionaries, Tuples and sets to perform operations on data.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3 Verb : Develop (L3)
CO3 Action verb same as PO3 verb. Therefore the correlation high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5 Verb : Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)
CO4: Analyze the file concepts and oops paradigms to manage data.
Action Verb: Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3 Verb : Develop (L3)
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5 Verb : Apply(L3)
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
To solve the real time problems oops and file concepts are necessary for data security. Therefore the correlation is medium(2)
CO5: Apply the concepts of JSON and XML for data processing.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3 Verb : Develop (L3)
CO3 Action verb same as PO3 verb. Therefore the correlation high (3)
PO4 Verb : Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5 Verb : Apply(L3)
CO3 Action verb is same as PO5 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	Environmental Science	L	T	P	C
23AMC9901	II-I	(common to CSE, CIC, CSD & EEE)	2	0	0	0

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the multidisciplinary nature of environmental studies, various renewable and

nonrenewable resources.

CO2: **Understand** the ecosystem and biodiversity to solve complex environmental problems

CO3: **Apply** the various types of pollution, solid waste management, and related preventive measures

CO4: **Apply** the rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation.

CO5: **Analyze** the population explosion and impact of environmental health issues on human being.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the multidisciplinary nature of environmental studies, various renewable and nonrenewable resources.			L2
2	**Understand**	the ecosystem and biodiversity	to solve complex environmental problems		L2
3	**Apply**	the various types of pollution, solid waste management, and related preventive measures			L3
4	**Apply**	the rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation			L3
5	**Analyze**	the population explosion and impact of environmental health issues on human being.			L4

UNIT – I	

Multidisciplinary Nature of Environmental Studies: Introduction ☐ Multidisciplinary Nature of Environmental Studies ☐ Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy 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 overutilization of surface and sub-surface – 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-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources.

UNIT – II	

Ecosystems: Concept of an ecosystem. – Structure and functions 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: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition:genetic, species and ecosystem diversity – 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-sports of biodiversity – Threats to biodiversity:

habitat loss, poaching of wildlife, man - wildlife conflicts ☐ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III	

Environmental Pollution: Definition, Causes, effects and its controlmeasures of: Air Pollution, Water

pollution, Soil pollution, Marine pollution, Noise pollution, and Thermal pollution and Nuclear hazards.
Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: earthquakes, cyclones, tsunamis, and landslides.

UNIT – IV		

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, Rainwater harvesting and Watershed Management – Resettlement and rehabilitation of people – 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 – Public awareness.

UNIT – V		

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programs. – 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..

Textbooks:
1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

Reference Books:
1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	12	23	3	Understand	L2	PO6, PO7	Thumb Rule Thumb Rule	2, 2
2	15	15	28	3	Understand	L2	PO7	Thumb Rule	2
3	8	8	15	2	Apply	L3	PO6 PO7	Thumb Rule Thumb Rule	2, 2
4	9	10	19	2	Apply	L3	PO6, PO7	Thumb Rule Thumb Rule	2, 2
5	8	8	15	2	Analyze	L4	PO7	Thumb Rule	2
	50	53	100						

Justification Statements

CO1: Understand the multidisciplinary nature of environmental studies, various renewable and nonrenewable resources.
Action Verb: Understand (L2)
Using Thumb rule,CO1correlatesPO6 and PO7 as a moderate (2)
CO2: Understand the ecosystem and biodiversity to solve complex environmental problems
Action Verb: Understand (L2)
Using Thumb rule, CO2 correlates PO7 as a moderate (2)
CO3: Apply the various types of pollution, solid waste management, and related preventive measures
Action Verb: APPLY (L3)
Using Thumb rule,CO3 correlates PO6 and PO7 as a moderate (2)
CO4: Apply the rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation.
Action Verb: APPLY (L3)
Using Thumb rule,CO4 correlates PO6 and PO7 as a moderate (2)
CO5: Analyze the population explosion and impact of environmental health issues on human being
Action Verb: Analyze (L4)
Using Thumb rule,CO5 correlates PO7 as a moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester IV (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T / CLC	P	C			
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	BS	23ABS9916	Probability and Statistics	2	1	0	3	30	70	100
3	PC	23APC0510	Operating Systems	2	1	0	3	30	70	100
4	PC	23APC0508	Database Management Systems	2	1	0	3	30	70	100
5	PC	23APC0512	Software Engineering	2	1	0	3	30	70	100
6	PC	23APC0511	Operating Systems Lab	0	0	3	1.5	30	70	100
7	PC	23APC0509	Database Management Systems Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0503	Full Stack Development-1	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking and Innovation	0	1	2	2	30	70	100
			Total	10	06	10	21	270	630	900
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation										

Course Code	Year & Sem	Managerial Economics and Financial Analysis	L	T	P	C
23AHMMB01	II-II		2	0	0	2

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the fundamentals of managerial economics and **Apply** the forecasting techniques for
estimation of demand.

CO2: **Understand** the production and cost concepts to optimize the output

CO3: **Analyze** the price output relationship in different markets.

CO4: **Evaluate** the capital budgeting techniques to invest in various projects.

CO5: **Analyze** the accounting statements to evaluate the financial performance of business entity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	BL
CO1	Understand Apply	The fundamentals of Managerial economics and the demand of a product	by using statistical and survey methods.		L3
CO2	Understand	Production and cost concepts		To optimize the output	L2
CO3	Analyze	Price output relationship		In perfect and imperfect competition markets	L4
CO4	Evaluate	Capital budgeting techniques		To invest in various projects	L5
CO5	Analyze	Accounting statements		to evaluate the financial performance of business entity	L4

UNIT - I	Managerial economics	

Introduction – meaning, nature, significance, functions, and advantages, ME and its role in other fields. Demand - Concept, Function, Law of Demand- Demand Elasticity-Types– Measurement. Demand Forecasting- Factors governing forecasting, Methods.

UNIT - II	Production and Cost Analysis	

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Iso quants and Iso costs, MRTS, Cobb-Douglas Production Function- Laws of Returns- Internal and External Economies of scale. Cost & Break-Even Analysis- Cost concepts and Cost behavior- Break- Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

UNIT - III	Business Organizations and Markets	

Introduction-Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition, Monopoly- Monopolistic Competition– Oligopoly- Price-Output Determination- Pricing Methods and strategies.

UNIT - IV	Capital Budgeting	

Introduction- Nature, meaning, significance, types of working capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting – Features, Proposals, Time value of money. Methods and Evaluation of Projects – Pay Back Method, Accounting Rate of Return (ARR), Net Present Value (NPV), and Internal Rate Return (IRR) Method, Profitability Index(PI) Method (simple problems).

UNIT - V	Financial Accounting and Analysis	

Introduction - Concepts and Conventions- Double- Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).
Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:
1.Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.
2.Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand, 3/e, 2013
2. S.A.Siddiqui and A.S.Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G.Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. DomnickSalvatore: Managerial Economics in a Global Economy, Cengage, 2013.

Online Learning Resources

1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/rossanz/production-and-cost-45827016
3. https://www.slideshare.net/darkyla/business-organizations-19917607
4. https://www.slideshare.net/balarajbl/market-and-classification-of-market
5. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
6. https://www.slideshare.net/ashu1983/financial-accounting.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Managerial Economics and Financial Analysis	CO1	3												
	CO2	1									1			
	CO3	3									3			
	CO4										3			
	CO5										3			

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	\multicolumn{4}{c}{CO}		Program Outcome (PO)	PO(s):Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	16.1%	2	CO1: Apply	L3	PO1	Apply	3
2	14	22.5%	3	CO2: Understand	L2	PO1, PO10	Apply Apply	1 1
3	14	22.5%	3	CO3: Analyze	L4	PO1, PO10	Apply Apply	3 3
4	10	16.1%	2	CO4: Evaluate	L5	PO10	Apply	3
5	14	22.5%	3	CO5: Analyze	L4	PO10	Apply	3
Total	**62**	**100**						

Justification Statements:

CO1: Understand the fundamentals of managerial economics and Apply the forecasting techniques for estimation of demand.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1verb. Therefore the correlation is high (3)

CO2: Understand the production and cost concepts to optimize the output.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)
PO10: Apply (L3)
CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)

CO3: Analyze the price output relationship in different markets.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)
PO10: Apply (L3)
CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

CO4: Evaluate the capital budgeting techniques to invest in various projects.
Action Verb: Evaluate (L5)
PO10: Apply (L3)
CO4 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

CO5: Analyze the accounting statements to evaluate the financial performance of   business entity.
Action Verb: Analyze (L4)
PO10: Apply (L3)
CO5 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

Course Code	Year & Sem	Probability and Statistics	L	T/CLC	P	C
23ABS9916	II-II		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1:**Understand** the discrete and continuous data through various statistical methods.

CO2:**Apply** the concepts of probability, Baye's theorem and its applications.

CO3:**Apply** the discrete and continuous probability distributions for random data.

CO4:**Analyze** the techniques for testing of hypothesis for large samples.

CO5:**Analyze** the techniques for testing of hypothesis for small samples.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the discrete and continuous data	through statistical methods.		L2
2	Apply	The concepts of probability and its applications			L3
3	Apply	The discrete and continuous probability distributions	for random data.		L3
4	Analyze	The techniques for testing of hypothesis	for large samples		L4
5	Analyze	The techniques for testing of hypothesis	for small samples		L4

UNIT - I	Descriptive statistics	10 Hrs

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (dispersion), Skewness, Kurtosis.
Correlation and Regression: Correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines

UNIT - II	Probability	8Hrs

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT - III	Probability distributions	8Hrs

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshev`s inequality).Approximation of the binomial distribution to normal distribution.

UNIT - IV	Estimation and Testing of hypothesis, large sample tests	8 Hrs

Estimation-parameters, statistics, sampling distribution, point estimation, maximum likelihood estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test.
Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.

UNIT - V	Small sample tests	8Hrs

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), x2 - test for goodness of fit, x2 - test for independent of attributes.

Textbooks:

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012

Reference Books:

1. S. Ross, a First Course in Probability, Pearson Education India, 2002
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968
3. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
4. S.Chand ,Probability and Statistics, Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2										
CO2	3										
CO3	3										
CO4		3									
CO5		3									

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Understand	L2	PO1	Apply (L3)	2
2				Apply	L3	PO1	Apply (L3)	3
3				Apply	L3	PO1	Apply (L3)	3
4				Analyze	L4	PO2	Analyze (L4)	3
5				Analyze	L4	PO2	Analyze (L4)	3

Justification Statements

CO1: Understand the discrete and continuous data through various statistical methods.
Action Verb: Understand (L2)
PO1 Verbs: Apply(L3)
CO1 Action Verb is low level to PO1 verb by one level; Therefore correlation is moderate (2).

CO2: Apply the concepts of probability, Baye's theorem and its applications.
Action Verb: Apply (L3)
PO1 Verbs: Apply(L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO3: Apply the discrete and continuous probability distributions for random data.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO4: Analyze the techniques for testing of hypothesis for large samples.
Action Verb: Analyze(L4)
PO2 Verb: Analyze(L4)
CO4 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO5: Analyze the techniques for testing of hypothesis for small samples.
Action Verb: Analyze(L4)
PO2 Verb: Analyze (L4)
CO5 Action verb is equal to PO2 verb; therefore the correlation is high (3).

Course Code	Year & Sem	Operating Systems	L	T/CLC	P	C
23APC0510	II-II	**(common to CSE & CIC)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic concepts of Operating Systems and its services.

CO2: **Apply** the concepts of process synchronization and CPU scheduling by drawing Gantt chart

CO3: **Analyze** the methods to handle deadlock and memory management

CO4: **Evaluate** the various disk scheduling algorithms

CO5: **Understand** the issues and goals of File System protection

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of Operating Systems and its services			L2
CO2	Apply	the concepts of process synchronization & CPU scheduling	by drawing Gantt chart		L3
CO3	Analyze	the methods to handle deadlock and memory management			L4
CO4	Evaluate	the various disk scheduling algorithms			L5
CO5	Understand	the issues and goals of File System protection			L2

UNIT - I		9 Hrs

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems **System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II		10Hrs

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. **Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. **CPU Scheduling**: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling

UNIT - III		8Hrs

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. **Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV		9Hrs

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. **Virtual Memory Management:** Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. **Storage Management:** Overview of Mass Storage Structure, HDD Scheduling

UNIT - V		8Hrs

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File System Mounting, Partitions and Mounting, File Sharing. **Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Textbooks:

1.Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:
1.Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:
1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	9	20	2	CO2 :Apply	L3	PO1 PO2 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO11: Thumb rule	3 3 2 3
3	9	20	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	9	20	2	CO4 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO7: Thumb rule PO11: Thumb rule	3 3 3 3 3 2 3 2
5	9	20	2	CO5 : Understand	L2	PO1 PO2 PO7 PO11	PO1: Apply(L3) PO2: Review(L2) PO7: Thumb rule PO11: Thumb rule	2 3 3 2
	45	**100**						

Justification Statements :
CO1: Understand the basic concepts of Operating Systems and its services. Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate(2)
PO2 Verb : Review(L2)
CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)
PO11: Thumb rule
In today's world operating system services are updating, those services needs to understand.Therefore the correlation is moderate (2)

CO2: Apply the concepts of process synchronization & CPU scheduling by drawing gantt chart Action Verb : Apply (L3)
PO1: Apply(L3)

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO1 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)
PO6: Thumb rule
Most of the scheduling algorithm were used to solve some of the societal problems like forming Queue line. Therefore the correlation is Moderate (2)
PO11: Thumb rule
Scheduling is the one of the daily activity done in many sectors. Therefore the correlation is High(3)

CO3: Analyze the methods to handle deadlock and memory management Action Verb : Analyze (L4)

PO1: Apply(L3)
CO3 Action verb is greater level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than PO3 verb by one level. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high(3)

CO4: Evaluate the various disk scheduling algorithms
Action Verb : Evaluate (L5)

PO1: Apply(L3)
CO4 Action verb is greater level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore the correlation is high(3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high(3)
PO6: Thumb rule
Disk scheduling and file system interfaces are applied to provide solutions for E-Commerce database access . Therefore the correlation is moderate (2)
PO7: Thumb rule
Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)
PO11: Thumb rule
File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is moderate (2)

CO5: Understand the issues and goals of File System protection
Action Verb : Understand (L2)

PO1: Apply(L3)
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Review (L2)
CO5 Action verb is same asPO2 verb. Therefore, the correlation is high(3)
PO7: Thumb rule
Ethical principles should be followed for various security issues. Therefore the correlation is high(3)
PO11: Thumb rule
Security services and principles are keep on updating in the today's world. Therefore, the correlation is moderate (2)

Course Code	Year & Sem	Database Management Systems	L	T/CLC	P	C
23APC0508	II-II	Common to CSE,AIML,CSE(DS) & CIC	2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the fundamentals of databases to design relational models.

CO2: Apply the E-R model for database design of real world applications.

CO3: Apply the SQL and PL/SQL concepts to formulate queries.

CO4: Analyze normalization methods to enhance database structures

CO5: Analyze the concurrent transactions and recover systems to prevent data loss in

system crash.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of databases		To design relational models.	L2
CO2	Apply	the E-R model		for database design of real world applications	L3
CO3	Apply	the SQL and PL/SQL concepts		To formulate queries.	L3
CO4	Analyze	normalization methods		to enhance database structures	L4
CO5	Analyze	the concurrent transactions and recover systems		to prevent data loss in system crash.	L4

UNIT - I		9 Hrs

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

UNIT - II		9Hrs

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL:Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT - III		9 Hrs

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

NoSQL: Introduction and Properties of NoSQL, Different NoSQL Systems, Columnar families, Schema-Less Databases, Materialized Views, Distribution Models, Sharding

UNIT - IV		9 Hrs

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT - V		9 Hrs

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and

Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Textbooks:
1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:
1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Online Learning Resources:
1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666728202 2456_shared/overview

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co"s Action verb	BTL				
1	9	20	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20	2	CO2 :Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	9	20	2	CO3 :Apply	L3	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4)PO5: Apply(L3) PO7: Thumb rulePO8: Thumb rule PO11: Thumb rule	3 3 3 2 3 2 2 2
4	9	20	2	CO4 :Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO7: Thumb rule	3 3 3 3 3 3

5	9	20	2	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4)PO5: Apply(L3) PO7: Thumb rulePO8: Thumb rule PO11: Thumb rule	3 3 3 2 2 2
	45	100%						

Justification Statements:

CO1: Understand the fundamentals of databases to design relational models.
Action Verb: Understand(L2) PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the E-R model for database design of real world applications.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO11: Thumb rule
For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is moderate (2)

CO3: Apply the SQL and PL/SQL concepts to formulate queries.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
Since ethical principles should be followed to create a database. Therefore the correlation is moderate(2)
PO8 : Thumb rule
Team work is required between DBA and Database designer to create a database. Hence the correlation is moderate (2)
PO11: Thumb rule
For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is moderate(2)

CO4: Analyze normalization methods to enhance database structures
Action Verb: Analyze(L4) PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb . Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO7: Thumb rule
Since ethical principles shall be followed in data manipulation. Therefore the correlation is high(3)

CO5: Analyze the concurrent transactions and recover systems to prevent data loss in

system crash.
Action Verb: Analyze (L4) PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO7 : Thumb rule
Since ethical principles should be followed for transaction management. Therefore the correlation is moderate(2)
PO8: Thumb rule
Team work is required for transaction management and recovery of failure transactions. Hence the correlation is moderate (2)
PO11: Thumb rule
In real time transaction management is continuously updating. Therefore the correlation is moderate (2)

Course Code	Year & Sem	Software Engineering (CSE)	L	T/CLC	P	C
23APC0512	II-II		2	1	0	3

Course Outcomes:
After studying the course, student will be able to
CO1: Understand the different Software Engineering Models
CO2: Analyze the Parameters and prerequisites of software project management.
CO3: Analyze the Design Methodologies of Software Project
CO4: Apply the Coding and Testing Methods for Quality Assurance of the Software project
CO5: Analyze the Software Quality Management Systems (standards) for reliability

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The different Software Engineering Models			L2
CO2	Analyze	The Parameters and prerequisites of SPM			L4
CO3	Analyze	The Design Methodologies of Software Project			L4
CO4	Apply	The Coding and Testing Methods		for Quality Assurance of the Software project	L3
CO5	Analyze	The Software Quality Management Systems (standards)		for reliability	L4

UNIT - I		9 Hrs

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.
Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT - II		9Hrs

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.
Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT - III		9 Hrs

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.
Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)
Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.
User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT - IV		9 Hrs

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Regression Testing ,Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.
Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT - V		9 Hrs

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Textbooks:
1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, McGraw Hill International Edition.

Reference Books:
1. Software Engineering, Ian Sommerville,10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Online Learning Resources:
1) https://nptel.ac.in/courses/106/105/106105182/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012605895063871 48827_shared/overview
3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003 904735_shared/overview

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co"s Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20%	2	CO1 :Understand	L2	PO1	PO1:Apply(L3)	2
2	9	20%	2	CO2 : Analyze	L4	PO1 PO4 PO5	PO1:Apply(L3) PO4: Analyze (L4) PO5:Apply(L3)	3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO3	PO1:Apply(L3) PO3: Develo(L3)	3 3
4	9	20%	2	CO4 :Apply	L3	PO1 PO3 PO4	PO1:Apply(L3) PO3: Develop (L3) PO4:Analyze (L4)	3 3 2
5	9	20%	2	CO5 : Analyze	L4	PO1 PO3 PO4 PO5 PO6 PO09 PO10	PO1:Apply(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule PO09: Thumb	3 3 3 3 2 2 2

							rule PO10: Thumb rule	
	45	100%						

Justification Statements:

CO1: Understand the different Software Engineering
Models Action Verb: Understand(L2)
PO1: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

CO2: Analyze the Parameters and prerequisites of Software project
management Action Verb: Analyze(L4)
PO1: Apply(L3)
CO2 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO2 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

CO3: Analyze the Design Methodologies of Software
Project Action Verb: Analyze(L4)
PO1: Apply(L3)
CO3. Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

CO4: Apply the Coding and Testing Methods for Quality Assurance of the
Software project
Action Verb: Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is moderate(2)

CO5: Analyze the Software Quality Management Systems (standards) for
reliability Action Verb: Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO6: Thumb rule
For some software projects ,Various projects are evaluated for
understanding ,therefore the correlation is moderate(2)
PO9: Thumb rule
Team work is required for software project, therefore the correlation is moderate(2)
PO10: Thumb rule
Demonstrate knowledge and understanding of the engineering and management principles
And apply these to one's own work, therefore the correlation is moderate(2)

Course Code	Year & Sem	Operating Systems Lab (CSE)	L	T	P	C
23APC0511	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the basic commands in UNIX operating systems.

CO 2: Apply the concepts of CPU scheduling algorithms to solve real time problems.

CO 3: Apply the concepts of process synchronization methods.

CO 4: Analyze the various solutions for Memory management and deadlocks.

CO 5: Analyze various file system interfaces.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basic commands in UNIX operating system			L2
CO2	**Apply**	the concepts of CPU scheduling algorithms		to solve real time problems	L3
CO3	**Apply**	the concepts of process synchronization methods			L3
CO4	**Analyze**	the various solutions		for Memory management and Deadlocks	L4
CO5	**Analyze**	various file system interfaces			L4

List of Experiments to be implemented in C/Java
1.Practicing of Basic UNIX Commands. **(CO1)**
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir **(CO1)**
3. Simulate UNIX commands like cp, ls, grep, etc., **(CO1)**
4. Simulate the following CPU scheduling algorithms **(CO2)**   a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with **(CO3)**   a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library. **(CO3)**
7. Write a program to solve producer-consumer problem using Semaphores. **(CO3)**
8. Implement the following memory allocation methods for fixed partition **(CO4)**   a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms **(CO4)**   a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management. **(CO4)**
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention **(CO4)**
12. Simulate the following file allocation strategies **(CO5)**   a) Sequential b) Indexed c) Linked

References:

1.Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.

2.Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016

3. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018

4. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources/Virtual Labs:

1. https://www.cse.iitb.ac.in/~mythili/os/
2. http://peterindia.net/OperatingSystems.html

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO5	PO1: Apply(L3) PO5: Create (L6)	3 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6) PO11:Thumb Rule	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Formulate (L6) PO3: Develop(L6) PO5: Create (L6)	3 3 3 3
4	CO4: Analyze	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Create (L6)	2 2 3 3
5	CO5: Analyze	L4	PO1 PO5	PO1: Apply(L3) PO5: Create (L6)	2 3

Justification Statements :

CO1: Understand the basic commands in UNIX operating systems.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L3)
CO1 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
CO2: Apply the concepts of CPU scheduling algorithms to solve real time problems.
Action Verb: Apply
(L3)PO1 Verb: Apply
(L3)
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Formulate(L6)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop (L6)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11 Verb: Thumb rule
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)
CO3: Apply the concepts of process synchronization methods.
Action Verb:
Apply(L3)PO1
Verb: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: Formulate(L6)

CO3 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: Develop (L6)

CO3 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO4: Analyze the various solutions for Memory management and Deadlocks.

Action Verb: Analyze

(L4)PO1 Verb: Apply

(L3)

CO4 Action verb is less than as PO1 verb by one level. Therefore, the correlation is moderate (2)

PO2 Verb: Idetify(L3)

CO4 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)

PO4 Verb: Analyze (L4)

CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)

PO5 Verb: Create (L6)

CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO5: Analyze various file system interfaces.

Action Verb: Analyze

(L4)PO1 Verb: Apply

(L3)

CO5 Action verb is less than as PO1 verb by one level. Therefore, the correlation is moderate (2)

PO5 Verb: Create (L6)

CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

Course Code	Year & Sem	Database Management Systems Lab (Common to CSE,CIC,CSE(DS),AIML)	L	T	P	C
23APC0509	II-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO1: Apply the DDL, DML&DCL Commands for manipulating the data**.**

CO2: Create queries to manipulate and retrieve data from databases.

CO3: Analyze application programs using PL/SQL

CO4: **Analyze** Procedures, Functions, Cursors, and Triggers to automate tasks and optimize database functionality

CO5: Analyze JDBC concepts for Database connectivity.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	the DDL, DML&DCL Commands		for manipulating the data.	L3
CO2	**Create**	queries		to manipulate and retrieve data from databases.	L6
CO3	**Analyze**	application programs	using PL/SQL		L4
CO4	**Analyze**	Procedures, Functions, Cursors, and Triggers		to automate tasks and optimize database functionality	L4
CO5	**Analyze**	JDBC concepts		for Database connectivity	L4

List of Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command. **(CO1)**
2. Queries (along with subQueries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example: Select the roll number and name of the student who secured fourth rank in the class. **(CO1)**
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views. **(CO1)**
4. Queries using Conversion functions (to_char, to_number and to_date), string functions Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date) **(CO2)**
5.
    i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found) **(CO2)**
    ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block **(CO2)**
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions. **(CO2)**
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE APPLICATION ERROR. **(CO3)**
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES. **(CO3)**
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions. **(CO3)**
10. Develop programs using features parameters in a CURSOR, FOR UPDATECURSOR, WHERE CURRENT of clause and CURSOR variables. **(CO4)**

11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers **(CO4)**
12. Create a table and perform the search operation on table using indexing and non indexing techniques. **(CO4)**
13. Write a Java program that connects to a database using JDBC **(CO5)**
14. Write a Java program to connect to a database using JDBC and insert values into it **(CO5)**
15. Write a Java program to connect to a database using JDBC and delete values from it **(CO5)**

References:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	**Apply**	L3	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3)	3 2 3 3
2	**Create**	L6	PO2 PO5	PO3:Formulate(L6) PO5:Create(L6)	3 3
3	**Analyze**	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	2 1 3 3
4	**Analyze**	L4	PO1 PO2 PO4 PO5	PO1:Apply(L3) PO2:Review(L2) PO4:Design(L6) PO5:Create(L6)	2 1 3 3
5	**Analyze**	L4	PO3 PO5 PO11	PO3:Design(L6) PO5:Create(L6) PO11:Thumb rule	3 3 2

Justification Statements:
CO1: Apply the DDL, DML&DCL Commands for manipulating the data.
Action Verb: Apply(L3)
PO1 Verb: Apply(L3)
CO1 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review(L2)
CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3 Verb: Develop(L3)
CO1 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Apply(L3)
CO1 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

CO2: Create queries to manipulate and retrieve data from databases.
Action Verb: Create (L6)
PO2 Verb : Formulate(L6)
CO2 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO5 Verb: Create(L6)
CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

CO3: Analyze application programs using PL/SQL
Action Verb: Analyze(L4)
PO1 Verb: Apply (L3)
CO3 Action verb is less than PO1 verb. Therefore, the correlation is moderate(2)
PO2 Verb: Review(L2)
CO3 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low(1)
PO4 Verb: Design (L6)
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO3 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO4: Analyze Procedures,Functions, Cursors, and Triggers to automate tasks and optimize database functionality
Action Verb: Analyze(L3) PO1 Verb: Apply (L3)
CO4 Action verb is less than PO1 verb. Therefore, the correlation is moderate(2)
PO2 Verb: Review(L2)
CO4 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low(1)
PO4 Verb: Design (L6)
CO4 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO5: Analyze JDBC concepts for Database connectivity.
Action Verb: Analyze (L3) PO3 Verb: Design (L6)
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO5 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11: Verb:Thumb rule
Database connection is a continuous learning activity for the user, the correlation is moderate(2)

Course Code	Year & Sem	FULL STACK DEVELOPMENT – 1	L	T	P	C
23ASC0503	II-II	**(Skill Enhancement Course)** **(Common to CSE,CIC,AIDS & AIML)**	0	1	2	2

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the web page and identify basic tags and properties in HTML.

CO 2: Apply the concept of CSS properties to design web pages.

CO 3: Analyze the web pages in real time applications of JavaScript for dynamic web pages.

CO 4: Apply the concepts of objects and methods in JavaScript for solving complex problem

CO 5: Evaluate the web pages for developing applications by using events and forms

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the web page and identify basic tags and properties in HTML.			L2
CO2	**Apply**	the concept of CSS properties		to design web pages.	L3
CO3	**Analyze**	the web pages in real time applications of JavaScript		for dynamic web pages.	L4
CO4	**Apply**	the concepts of objects and methods in JavaScript		for solving complex problems	L3
CO5	**Evaluate**	the web pages for developing applications by		using events and forms	L5

List of Experiments:

1. Lists, Links and Images**[CO-1]**

a. Write a HTML program, to explain the working of lists.
Note: It should have an ordered list, unordered list, nested lists and ordered list in anunordered list and definition lists.

b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.

c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.

d. Write a HTML program, in such a way that, rather than placing large images on a page,the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames[CO-1]

• Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan) **[CO-1]**

• Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.). **[CO-1]**

• Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view). **[CO-1]**

• Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using "no frame" attribute such that frames tobe fixed). **[CO-1]**

3. HTML 5 and Cascading Style Sheets, Types of CSS[CO-2]

a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.

b. Write a HTML program, to embed audio and video into HTML web page.

c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property andvalue).

4. Selector forms[CO-2]

a. Write a program to apply different types of selector forms
   - Simple selector (element, id, class, group, universal)
   - Combinator selector (descendant, child, adjacent sibling, general sibling)
   - Pseudo-class selector
   - Pseudo-element selector
   - Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model[CO-2]

a. Write a program to demonstrate the various ways you can reference a color in CSS.

b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.

c. Write a program using the following terms related to CSS font and text:
   i. font-size   ii. font-weight   iii. font-style
   iv. text-decoration   v. text-transformation   vi. text-alignment

d. Write a program, to explain the importance of CSS Box model using
   i. Content   ii. Border   iii. Margin   iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion[CO-2]

a. Write a program to embed internal and external JavaScript in a web page.

b. Write a program to explain the different ways for displaying output.

c. Write a program to explain the different ways for taking input.

d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects[CO-3]

a. Write a program using document object properties and methods.

b. Write a program using window object properties and methods.

c. Write a program using array object properties and methods.

d. Write a program using math object properties and methods.

e. Write a program using string object properties and methods.

f. Write a program using regex object properties and methods.

g. Write a program using date object properties and methods.

h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops[CO-4]

a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words "LARGER NUMBER" in an information message dialog. If the numbers are equal, output HTML text as "EQUAL NUMBERS".

b. Write a program to display week days using switch case.

c. Write a program to print 1 to 10 numbers using for, while and do-while loops.

d. Write a program to print data in object using for-in, for-each and for-of loops

e. Develop a program to determine whether a given number is an 'ARMSTRONG NUMBER' or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,13 + 53+ 33 = 153]

f. Write a program to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's, 2's & 1's. (Eg: If deposited amount is Rs.163, the output should be 1-100's, 1-50's, 1- 10's, 1-2's & 1-1's)

9. Javascript Functions and Events[CO-5]

a. Design a appropriate function should be called to display
   - Factorial of that number
   - Fibonacci series up to that number
   - Prime numbers up to that number
   - Is it palindrome or not

b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
   11. Factorial of that number
   12. Fibonacci series up to that number
   13. Prime numbers up to that number

14. Is it palindrome or not
c. Write a program to validate the following fields in a registration page
    i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
    ii. Mobile (only numbers and length 10 digits)
    iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Textbooks:
1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.

Web Links:
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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2
2	CO2: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 2
3	CO3: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO09	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: Thumb rule	3 3 3 3 3 2
4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
5	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3

Justification Statements:
CO1: Understand the web page and identify basic tags and properties in HTML.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)

PO2 Verb : Review(L2)
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO5 Verb : Apply(L2)
CO1 Action verb is less than PO2 verb by one, Therefore the correlation is moderate (2)
PO11: Thumb rule
To make use of HTML elements and tags in application, need to upgrade for long period.
Therefore, the correlation is moderate (2)
CO2: Apply the concept of CSS properties to design web pages.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review(L2)
CO2 Action verb is greater than PO2 verb by one, Therefore the correlation is high (3)
PO11: Thumb rule
The application can be designed specifically all kind of users and web browsers.
 Therefore the correlation is moderate (2)
CO 3: Analyze the web pages in real time applications of JavaScript for dynamic web pages.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Review (L2)
CO3 Action verb is greater than level as PO2 verb by one. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO9: Thumb rule
To make web site and web pages should be interactive understand by user, so need to provide
proper forms. Therefore, the correlation is moderate (2)
CO4: Apply the concepts of objects and methods in JavaScript for solving complex problem
Action Verb: Apply (L3)
PO1: Apply(L3)
CO4   Action verb is same level of PO1 verb. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop(L2)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L2)
CO4   Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)
PO5: Apply(L3)
CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
The design application needs to upgrade for future specific requirement. Therefore the
correlation is moderate (2)
CO 5: Evaluate the web pages for developing applications by using events and forms
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is greater than two as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	Design Thinking and Innovation	L	T	P	C
23AES0304	II-II		0	1	2	2

Course Outcomes:

After studying the course, student will be able to

CO: 1 **Understand** the concepts and principles of design thinking process.

CO: 2 **Apply** the design thinking techniques for solving problems in various sectors.

CO: 3 **Analyze** the art of innovation & creativity in product development.

CO: 4 **Apply** the design guidelines for produced development.

CO: 5 **Analyze** the design thinking strategies for solving real time business issues.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts and principles of design thinking process.			L1
CO2	Apply	the design thinking techniques for solving problems in various sectors.			L3
CO3	Analyze	the art of innovation & creativity in product development.			L4
CO4	Apply	the design guidelines for produced development.			L3
CO5	Analyze	the design thinking strategies for solving real time business issues.			L4

Unit I:
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit II
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development
Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit III
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit IV
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies
Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit V
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups-Defining and testing Business Models and Business Cases- Developing & testing prototypes
Activity: How to market our own product, About maintenance, Reliability and plan for startup.
Text Books:
1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:
1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritina holden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

Online Learning Resources:
1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	`PSO1	PSO2
Design Thinking & Innovation	CO1	2		2									2	2
	CO2	2	2	2									2	2
	CO3	2	2	2			1						2	2
	CO4	2	2	2			1						2	2
	CO5	2	2	2			2						2	2

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1	11	20.3	L3	Understand	L2	PO1 PO3	Apply (L3) Develop (L3)	2 2
2	10	18.5	L2	Apply	L3	PO1 PO2 PO3	Apply (L3) Identify (L3) Develop (L3)	3 3 3
3	11	20.3	L3	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
4	12	22.2	L3	Apply	L3	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 1
5	10	18.5	L2	Analyze	L4	PO1 PO2 PO3 PO6	Apply (L3) Identify (L3) Develop (L3) Thumb Rule	3 3 3 2
Total	54	100						

Justification Statements:
CO1: Understand the concepts and principles of design thinking process.
Action Verb: Understand (L2)
PO1Verb: **Apply (L3)**
CO1 Action verb is lower than PO1 verb. Therefore, the correlation is medium (2)
PO3 Verb: **Develop (L3)**
CO1 Action verb is lower than PO3 verb. Therefore, the correlation is medium (2)
CO2: Apply the design thinking techniques for solving problems in various sectors.
PO1 Verb: **Apply (L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
CO3: Analyze the art of innovation & creativity in product development.
Action Verb: **Analyze** (L4)

PO1 Verb: **Apply (L3)**
CO3 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO3 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO3 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: Thumb Rule
As per thumb rule CO3 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)
CO4: Apply the design guidelines for produced development.
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: Thumb Rule
As per thumb rule CO4 co-relates slightly with PO6 verb. Therefore, the correlation is high (3)
CO5: Analyze the design thinking strategies for solving real time business issues.
Action Verb: Analyze (L4)
PO1 Verb: **Apply (L3)**
CO5 Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO5 Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Develop (L3)**
CO5 Action verb is same level (greater) as PO3 verb. Therefore, the correlation is low (1)
PO6 Verb: Thumb Rule
As per thumb rule CO5 co-relates moderately with PO6 verb. Therefore, the correlation is high (3)

COMMUNITY SERVICE PROJECT

......Experiential learning through community engagement

Introduction
- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective
Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project
- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTED OUTCOMES
BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes
- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes
- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes
- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development
- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution
- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES
- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY
- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables

25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children
1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment
1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days Programs for

Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs
1. Awareness on RTI
2. Health intervention programmes
3. Yoga

4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
   i. Agriculture
   ii. Health
   iii. Marketing and Cooperation
   iv. Animal Husbandry
   v. Horticulture
   vi. Fisheries
   vii. Sericulture
   viii. Revenue and Survey
   ix. Natural Disaster Management
   x. Irrigation
   xi. Law & Order
   xii. Excise and Prohibition
   xiii. Mines and Geology
   xiv. Energy

Role of Students:
- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like
- Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity
Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmesto be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**
   Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)
Semester V (Third year)

Sl. No.	Category	Course Code	Course Title	L	T / CLC	P	C	CIE	SEE	Total
1	PC	23APC0513	Introduction to Artificial Intelligence	2	1	0	3	30	70	100
2	PC	23APC0515	Introduction to Computer Networks	2	1	0	3	30	70	100
3	PC	23APC0517	Automata Theory and Compiler Design	2	1	0	3	30	70	100
4	PE-I	23APE0501	**Professional Elective-I** Object Oriented Analysis and Design	2	1	0	3	30	70	100
		23APE0502	Soft Computing							
		23APE0503	Microprocessors and Microcontrollers							
		23APE0504	Data Warehousing and Data Mining							
5	**OE-I**		***Open Elective-I**	2	1	0	3	25	75	100
6	PC	23APC0514	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
7	PC	23APC0516	Computer Networks Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	**Skill Enhancement course** Soft skills	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	ES	23AES0504	Introduction To Quantum Technologies and Applications	2	1	0	3	30	70	100
11	PR	23APR0501	Community Service Project	-	-	-	2	100		100
			Total	**12**	**07**	**10**	**26**	**395**	**705**	**1100**

*Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23AOE0101	Green Buildings	CIVIL
2.	23AOE0102	Construction Technology and Management	
3.	23AOE0201	Electrical Safety Practices and Standards	EEE
4.	23AOE0301	Sustainable Energy Technologies	ME
5.	23AOE0401	Electronic Circuits	ECE
6.	23AOE9901	Mathematical Foundations for Machine Learning and AI	Mathematics
7.	23AOE9906	Materials Characterization Techniques	Physics
8.	23AOE9911	Chemistry of Energy Systems	Chemistry
9.	23AOE9915	English for Competitive Examinations	Humanities
10.	23AOEMB01	Entrepreneurship and New Venture Creation	
11.	23AES0504	Quantum Technologies And Applications	CSE & Allied

Course Code	Year & Sem	Introduction to Artificial Intelligence	L	T / CLC	P	C
23APC0513	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

- CO1: **Understand** the basic concepts of artificial intelligence and intelligent agents
- CO2: **Apply** the searching techniques for solving searching problems.
- CO3: **Analyze** the concepts of Reinforcement Learning and NLP Models.
- CO4: **Evaluate** Natural Language Interfaces and perception mechanisms for Machines understanding.
- CO5: **Analyze** the robotic designing modules and philosophy constraints for artificial intelligence.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The basics concepts of artificial intelligence and intelligent agents			L2
CO2	**Apply**	the searching techniques		For Solving searching problems	L3
CO3	**Analyze**	The concepts of Reinforcement Learning and NLP Models			L4
CO4	**Evaluate**	Natural Language Interfaces and perception mechanisms		For Machines understanding	L5
CO5	**Analyze**	the robotic designing modules and philosophy constraints		for artificial intelligence.	L4

UNIT - I		9 Hrs

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.
Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT - II		9Hrs

Solving Problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT - III		9 Hrs

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL
Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT - IV		9 Hrs

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition
Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT - V		9 Hrs

Robotics: Introduction, Robot Hardware, Robotic Perception, Planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains
Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.

Reference Books:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

Online Learning Resources:

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	10	19%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	13	25%	3	CO2 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3)	3 2 3 2 3
3	10	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO7	PO1: Apply (L3) PO2: Analyze (L4) PO3: Develop (L3) PO4: Analyze (L4) PO5:Apply(L3) PO6: Thumb Rule PO7: Thumb Rule	3 3 3 3 3 3 3
4	9	17%	2	CO4 :Evaluate	L5	PO2 PO3 PO5 PO6 PO7	PO2: Review(L2) PO3: Develop (L3) PO5: Apply(L3) PO6: Thumb Rule PO7: Thumb Rule	3 3 3 3 3
5	11	20%	3	CO5 :Analyze	L4	PO1 PO2 PO3 PO6 PO7 PO8 PO11	PO1:Apply(L3) PO2:Analyze(L4) PO3: Develop(L3) PO6:Thumb Rule PO7: Thumb Rule PO8:Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
	53	100 %						

Justification Statements :
CO1: Understand the basic concepts of artificial intelligence and intelligent agents
Action Verb : Understand(L2)
PO1 : **Apply(L3)**
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 : **Review(L2)**
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
CO2: Apply the searching techniques for solving searching problems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium(2)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5:Apply(L3)
CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

CO3:Analyze the concepts of Reinforcement Learning and NLP Models.
Action Verb : Analyze (L4)

PO1: Apply (L3)

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5:Apply(L3)

CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO6 : Thumb rule

Apply contextual knowledge is used for society to address the security issues so correlation is high(3)

PO7: Thumb rule

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

CO4: Evaluate Natural Language Interfaces and perception mechanisms for Machines understanding.

Action Verb : Evaluvate(L5)

PO2: Review(L2)

CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO6 : Thumb rule

To address the security issues we apply contextual knowledge. so correlation is high(3)

PO7: Thumb rule

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

CO5: Analyze the robotic designing modules and philosophy constraints for artificial intelligence.

Action Verb : Analyze(L4)

PO1:Apply(L3)

CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2:Analyze(L4)

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO6:Thumb Rule

Apply contextual knowledge is used for society to address the security issues so correlation is medium (2)

PO7: Thumb Rule

Since ethical principles should be followed to create a robot. Therefore the correlation is medium (2)

PO8: Thumb rule

Team work is required to create robots. Hence the correlation is medium (2)

PO11: Thumb rule

For some of AI applications, AI concepts are used to create robots designs. Therefore the correlation is medium (2)

Course Code	Year & Sem	Introduction to Computer Networks	L	T / CLC	P	C
23APC0515	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the fundamental concepts of computer networks and the Internet, including network edge/core, packet-switched networks, reference models, and transmission media.

CO2: **Analyze** the design issues and protocols of the data link layer, including error detection, correction, and multiple access techniques used in local area networks (LANs) and access networks.

CO3: **Evaluate** routing algorithms and the principles of internetworking within the network layer, with a focus on their implementation in the Internet.

CO4: **Apply** the principles of connectionless and connection-oriented transport protocols, including UDP, TCP, and congestion control mechanisms in network communication.

CO5: **Understand** the principles behind common network applications, including web services (HTTP), email, DNS, peer-to-peer applications, and content distribution networks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The fundamental concepts of computer networks and the Internet, including network edge/core, packet-switched networks, reference models, and transmission media.			L2
CO2	**Analyse**	The design issues and protocols of the data link layer, including error detection, correction, and multiple access techniques.	By examining protocols and link layer models		L4
CO3	**Evaluate**	Routing algorithms and the principles of internetworking within the network layer, with focus on Internet implementation.		To explore the functioning of the network layer	L5
CO4	**Apply**	Principles of connectionless and connection-oriented transport protocols, including UDP, TCP, and congestion control mechanisms.			L3
CO5	**Understand**	Principles behind common network applications, including web services (HTTP), email, DNS, peer-to-peer applications, and content distribution networks.			L2

UNIT - I	**Computer Networks and the Internet**	8 Hrs
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**	10 Hrs
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, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request (Textbook 2)		
UNIT - III	**The Network Layer**	8 Hrs
Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)		
UNIT - IV	**The Transport Layer**	9 Hrs
Connectionless Transport: UDP (Textbook 2) The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)		
UNIT - V	**Principles of Network Applications**	8 Hrs

Principles of Network Applications Lecture 8Hrs 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)

Textbooks:
Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 6th Edition, PEARSON.
James F. Kurose, Keith W. Ross, —Computer Networking: A Top-Down Approach‖, 6th edition, Pearson, 2019.

Reference Books:
Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
Youlu Zheng, Shakil Akthar, —Networks for Computer Scientists and Engineers‖, Oxford Publishers, 2016.

Online Learning Resources:
https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183/3

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	8	18%	2	Understand	L2	PO1 PO2 PO5 PO10	PO1: Apply (L3) PO2: Review (L2) PO5: Apply (L3) PO10: Thumb rule	3 2 2 2
2	10	24%	3	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 3 3
3	8	18%	2	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb rule PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3 3 3 3
4	9	22%	3	Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2
	8	18%	2	Analyse	L4	PO1 PO2	PO1: Apply (L3) PO2: Analyse (L4)	3 3

5						PO3	PO3: Design (L3)	3
						PO4	PO4: Analyse (L4)	2
						PO5	PO5: Apply (L3)	3
						PO6	PO6: Thumb rule	3
						PO7	PO7: Thumb rule	3
						PO8	PO8: Thumb rule	3
						PO9	PO9: Thumb rule	3
						PO10	PO10: Thumb rule	3
						PO11	PO11: Thumb rule	3
	43	100 %						

Justification Statements :

CO1: Understand the fundamental concepts of computer networks and the Internet

Action Verb: Understand (L2)

PO1: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)

PO2: Review (L2)

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO5: Apply (L3)

CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)

PO10: **Thumb rule**

CO1 supports effective communication in documentation and presentation. Therefore, the correlation is medium (2)

CO2: Analyze the design issues and protocols of the data link layer

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO2 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L3)

CO2 Action verb is greater than PO3 verb by one level. Therefore, the correlation is medium (2)

PO4: Analyze (L4)

CO2 Action verb is same level as PO4 verb. Therefore, the correlation is medium (2)

PO5: Apply (L3)

CO2 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

PO8: Team Work (L3)

CO2 includes teamwork in LAN/protocol analysis. Therefore, the correlation is high (3)

PO11: **Thumb rule**

CO2 Action verb is greater than PO11 verb by one level. Therefore, the correlation is high (3)

CO3: Evaluate routing algorithms and internetworking principles

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)

PO3: Design (L3)

CO3 Action verb is greater than PO3 verb by two levels. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)

PO5: Apply (L3)

CO3 Action verb is greater than PO5 verb by two levels. Therefore, the correlation is high (3)

PO6: **Thumb rule**

CO3 Action verb is greater than PO6 verb by one level. Therefore, the correlation is high (3)

PO7: **Thumb rule**

CO3 involves routing decisions with ethical implications. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO3 requires collaboration in simulations. Therefore, the correlation is high (3)

PO9: **Thumb rule**

CO3 supports communication through evaluation reports. Therefore, the correlation is high (3)

PO11: **Thumb rule**

CO3 supports life-long learning in evolving protocols. Therefore, the correlation is high (3)

CO4: Apply transport protocols including TCP and UDP

Action Verb: Apply (L3)

PO1: Apply (L3)

CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)

PO3: Design (L3)

CO4 Action verb is same level as PO3 verb. Therefore, the correlation is medium (2)

PO4: Analyze (L4)

CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)

PO5: Apply (L3)

CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO4 involves simulation teamwork. Therefore, the correlation is medium (2)

PO11: **Thumb rule**

CO4 helps in adapting tools. Therefore, the correlation is medium (2)

CO5: Analyze the principles behind network applications

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO5 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L3)

CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is same level as PO4 verb. Therefore, the correlation is medium (2)

PO5: Apply (L3)

CO5 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

PO6: **Thumb rule**

CO5 considers societal/ethical impact. Therefore, the correlation is high (3)

PO7: **Thumb rule**

CO5 involves ethical aspects in application use. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO5 requires teamwork for application development. Therefore, the correlation is high (3)

PO9: **Thumb rule**

CO5 involves communication in web/email protocols. Therefore, the correlation is high (3)

PO10: **Thumb rule**

CO5 requires planning and management. Therefore, the correlation is high (3)

PO11: **Thumb rule**

CO5 supports emerging applications and life-long learning. Therefore, the correlation is high (3)

Course Code	Year & Sem	Automata Theory and Compiler Design	L	T / CLC	P	C
23APC0517	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the different Formal Language and Regular Expressions. for Conversion of regular expression to NFA, NFA to DFA.

CO 2: Apply the Bottom-up parsing for checking string acceptance.

CO 3: Analyze the different types of grammars by using Chomsky hierarchy.

CO 4: Apply the dynamic memory allocation for memory management.

CO 5: Evaluate the target code generation for three address statement.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the different Formal Language and Regular Expressions		for Conversion of regular expression to NFA, NFA to DFA	L2
CO2	Apply	the Bottom-up parsing		for checking string acceptance	L4
CO3	Analyse	the different types of grammars	by using Chomsky hierarchy		L3
CO4	Apply	the dynamic memory allocation		for memory management	L4
CO5	Evaluate	the target code generation		For three address statement	L5

UNIT - I		9 Hrs

Formal Language and Regular Expressions : Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools.

UNIT - II		9Hrs

Context Free grammars and parsing : Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification.

UNIT - III		9 Hrs

Semantics : Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

UNIT - IV		9 Hrs

Run time storage: Storage organization, storage allocation strategies scope access to now local names, parameters, language facilities for dynamics storage allocation.

Code optimization: Principal sources of optimization, optimization of basic blocks, peephole optimization, flow graphs, Data flow analysis of flow graphs.

UNIT - V		9 Hrs

Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.

Textbooks:

1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

Reference Books:

1. Louden: ―Compiler Construction, Principles & Practice‖, 1st Edition, Thomson Press, 2006.
2. Tremblay J P, Sorenson G P: ―The Theory & Practice of Compiler writing‖, 1st Edition, BSP publication, 2010.

3.	Theory of Computation, V. Kulkarni, Oxford University Press, 2013											

Online Learning Resources:
1. https://nptel.ac.in/courses/106/104/106104028/
2. https://nptel.ac.in/courses/106/104/106104123/

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO				Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation						
1	9	20%	2		CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyse(L4)	2 1
2	9	20%	2		CO2 : Apply	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO11: Thumb rule	3 3 2
3	9	20%	2		CO3 : Analyze	L3	PO1 PO2 PO3 PO4 PO8 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 2 1 1 1 1
4	9	20%	2		CO4 :Apply	L4	PO1 PO2	PO1: Apply(L3) PO2: Analyse (L4)	3 3
5	9	20%	2		CO5 : Evaluate	L5	PO2 PO3 PO4 PO8 PO11	PO2: Analyse (L4) PO3: Design (L6) PO4: Design (L6) PO8: Thumb rule PO11: Thumb rule	3 2 2 1 2
	45	100 %							

Justification Statements :

CO 1: Understand the different Formal Language and Regular Expressions. for Conversion of regular expression to NFA, NFA to DFA.
Action Verb : Understand (L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
CO 2: Apply the Bottom-up parsing for checking string acceptance.
Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Analyze(L4)
CO2 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO11: Thumb rule
In Automata Parsing Techniques are lifelong learning. Therefore the correlation is medium(2)
CO 3: Analyze the different types of grammars by using Chomsky hierarchy.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

PO4: Design (L6)

CO3 Action verb is less than PO4 verb by two levels. Therefore the correlation is low (1)

PO8 : Thumb rule

Team work is required to implement different types of grammars Hence the correlation is low (1)

PO11: Thumb rule

Context Sensitive features can be lifelong learning. Therefore the correlation is low (1)

CO 4: Apply the dynamic memory allocation for memory management.

Action Verb : Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO 5: Evaluate the target code generation for three address statement.

Action Verb : Evaluate (L5)

PO2: Analyze (L4)

CO5 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)

PO3: Design (L6)

CO5 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)

PO4: Design (L6)

CO5 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

PO8: Thumb rule

Team work is required for code generation. Hence the correlation is low (1)

PO11: Thumb rule

In real time DAG representation can be lifelong learning. Therefore the correlation is medium (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	OBJECT ORIENTED ANALYSIS AND DESIGN (Professional Elective-I)	L	T / CLC	P	C
23APE0501	III-I		2	1	0	3

Course Outcomes:
After studying the course, student will be able to
CO 1: Understand the fundamentals of UML, object-oriented modeling, and software development life cycle
CO 2: Apply the basic and advanced structural modeling techniques to design class and object diagrams
CO 3: Analyze the behavioral aspects of systems using interaction, activity, and use case diagrams
CO 4: Analyze the complex behavioral modeling through state machines and architectural modeling using component and deployment diagrams
CO 5: Evaluate the design solutions using design patterns and frameworks through a unified case study

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamentals of UML, object-oriented modelling, and software development life cycle			L2
CO2	Apply	basic and advanced structural modelling techniques to design class and object diagrams			L3
CO3	Analyse	behavioural aspects of systems using interaction, activity, and use case diagrams			L4
CO4	Analyse	complex behavioural modelling through state machines and architectural modelling using component and deployment diagrams			L4
CO5	Evaluate	design solutions using design patterns and frameworks through a unified case study			L5

UNIT - I		9 Hrs

Introduction to UML: Importance of modelling, principles of modelling, object-oriented modelling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT - II		9Hrs

Basic Structural Modelling: Classes, Relationships, common Mechanisms, and diagrams.
Advanced Structural Modelling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams.

UNIT - III		9 Hrs

Basic Behavioural Modelling-I: Interactions, Interaction diagrams.
Basic Behavioural Modelling-II: Use cases, Use case Diagrams, Activity Diagrams.

UNIT - IV		9 Hrs

Advanced Behavioral Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modelling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT - V		9 Hrs

Patterns and Frameworks, Artifact Diagrams. Case Study: The Unified Library application.

Textbooks:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modelling Language User Guide, Pearson Education 2nd Edition.
2. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.

Reference Books:
1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modelling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.

4. Mark Priestley: Practical Object-Oriented Design with UML, TMH.
5. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	Understand	L2	PO1 PO2 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO11: Thumb Rule	3 2 2
2	9	20%	2	Apply	L3	PO1 PO2 PO3 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO5: Apply (L3) PO8: Thumb Rule PO11: Thumb Rule	3 3 3 3 2 2
3	9	20%	2	Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb Rule PO11: Thumb Rule	3 3 2 2 3 3 3
4	9	20%	2	Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3
5	9	20%	2	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb Rule PO7: Thumb Rule PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3 3 3 3 3
	45	100%						

Justification Statements :

CO1: Understand the fundamentals of UML, object-oriented modeling, and software development life cycle
Action Verb: Understand (L2)
PO1: CO1 Action verb is one level lower than PO1 verb (Apply - L3). Therefore, the correlation is medium (2)
PO2: Analyze (L4)

CO1 Action verb is two levels lower than PO2 verb (Analyze - L4). Therefore, the correlation is low (2)
PO11: Thumb Rule
CO1 supports life-long learning of modeling practices. Therefore, the correlation is medium (2)
CO2: Apply basic and advanced structural modeling techniques to design class and object diagrams
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is one level lower than PO2 verb. Therefore, the correlation is medium (3)
PO3: Design (L6)
CO2 Action verb is same as PO3 verb (Design - L3). Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO8: Thumb Rule
Team collaboration helps implement class diagrams. Correlation is medium (2)
PO11: Thumb Rule
CO2 supports modeling as a learning process. Correlation is medium (2)
CO3: Analyze behavioral aspects of systems using interaction, activity, and use case diagrams
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is one level higher than PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is one level higher than PO3 verb. Therefore, the correlation is medium (2)
PO4: Design (L6)
CO3 Action verb is same as PO4 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO3 Action verb is one level higher than PO5 verb. Therefore, the correlation is high (3)
PO8: Thumb Rule
Behavioral modeling requires collaboration. Correlation is high (3)
PO11: Thumb Rule
Diagram-based analysis supports learning. Correlation is high (3)
CO4: Analyze complex behavioral modeling through state machines and architectural modeling using component and deployment diagrams
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is one level higher than PO1 verb. Therefore, the correlation is high (3)
PO2: CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO4 Action verb is one level higher than PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is one level higher than PO5 verb. Therefore, the correlation is high (3)
PO8: Thumb Rule
Teamwork during architectural modeling. Correlation is high (3)
PO11: Thumb Rule
CO4 contributes to design learning. Correlation is high (3)
CO5: Evaluate design solutions using design patterns and frameworks through a unified case study
Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO5 Action verb is two levels higher than PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is one level higher than PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is two levels higher than PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is one level higher than PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is two levels higher than PO5 verb. Therefore, the correlation is high (3)
PO6: Thumb Rule
Design patterns affect societal solutions. Correlation is high (3)

PO7: Thumb Rule
Ethical use of frameworks. Correlation is high (3)
PO8: Thumb Rule
Case study promotes collaboration. Correlation is high (3)
PO9: Thumb Rule
Patterns need effective communication. Correlation is high (3)
PO10: Thumb Rule
Projects need management frameworks. Correlation is high (3)
PO11: Thumb Rule
Patterns enhance learning. Correlation is high (3)

Course Code	Year & Sem	SOFT COMPUTING (Professional Elective-I)	L	T/CLC	P	C
23APE0502	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand The difference between "Soft" computing and "Hard" Computing how to apply in applications.

CO2: Apply fuzzy logic and reasoning to handle and solve engineering problems.

CO3: Analyze The Basic Concepts, Basic Operators for Genetic Algorithms.

CO4: Evaluate The various operations of genetic algorithms and Rough Sets to Develop efficient algorithms of genetic.

CO5: Create Integration of Soft Computing Techniques and rough set rule induction.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The difference between "Soft" computing and "Hard" computing		How to apply in applications	L2
CO2	Apply	fuzzy logic and reasoning to handle and solve engineering problems.	Like fuzzy sets, membership rules.	Apply the Classification techniques on various applications	L3
CO3	Analyze	The Basic Concepts, Basic Operators	selection, crossover, and mutation operators.	For Genetic Algorithms.	L4
CO4	Evaluate	The various operations of genetic algorithms and Rough Sets	Like initialization, fitness evaluation, selection, crossover, and mutation operations.	To develop efficient algorithms of genetic	L5
CO5	Create	Integration of Soft Computing Techniques and rough set		Rule induction.	L6

UNIT – I		
Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques		
UNIT – II		
Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems		
UNIT – III		
Decision Fuzzy Making, Particle Swarm Optimization.		
UNIT – IV		
Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm		
UNIT – V		
Rough Sets, Rough Sets Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques		

Textbooks:

1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning

Reference Books:

1. S. N. Sivanandam & S. N. Deepa, ―Principles of Soft Computing‖, 2nd edition, Wiley India, 2008.

2. David E. Goldberg, ―Genetic Algorithms-In Search, optimization and Machine learning‖, Pearson Education.
3. J. S. R. Jang, C.T. Sun and E.Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Pearson Education, 2004.
4. An Introduction to Genetic Algorithm‖, PHI, 1998.
5. Timothy J. Ross G.J. Klir & B. Yuan, ―Fuzzy Sets & Fuzzy Logic‖, PHI, 1995.
6. Melanie Mitchell, ―Fuzzy Logic with Engineering Applications‖, McGraw- Hill International editions, 1995.

Online Resources:
1

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1			2	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	2 1
2			2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO10 PO11	PO1:Apply(L3) PO2:Apply(L3) PO3:Apply(L3) PO5: Apply(L3) PO10: Thumb PO11: Thumb Rule	3 3 2 3 2 2
3			3	CO3: Analyze	L4	PO2 PO3 PO4 PO5 PO11	PO2: Evaluate(L5) PO3: Evaluate(L5) PO4: Evaluate(L5) PO5: Evaluate(L5) PO11: Evaluate(L5)	3 3 1 2 2
4			3	CO4: Evaluate	L5	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze(L4) PO5: Select(L3)	3 3 3 3
5			3	CO5: Create	L6	PO2 PO3 PO5 PO10 PO11	PO2: Formulate (L6) PO3: Design (L6) PO5: Create(L6) PO10: Thumb Rule PO11: Thumb rule	3 3 3 3 3

Justification Statements:

CO1: The difference between "Soft" computing and "Hard" Computing how to apply in applications

Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore, the correlation is low (1)
CO2: fuzzy logic and reasoning to handle and solve engineering problems.
Action Verb: Apply (L3)

PO1: Apply((L3)

CO2 Action verb is same level as PO1 verb. Therefore, the correlation is High (3)

PO2: Apply (L3)

CO2 Action verb is same level as PO2 verb. Therefore, the correlation is High (3)

PO3: Apply(L3)

CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO5: Apply(L3)

CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

CO3: The Basic Concepts, Basic Operators for Genetic Algorithms.

Action Verb: Analyze (L4)

PO2: Evaluate (L5)

CO3 Action verb is less than PO2. Therefore, the correlation is moderate (2)

PO3: Evaluate (L5)

CO3 Action verb is less than PO3. Therefore, the correlation is moderate (2)

PO4: Evaluate (L5)

CO3 Action verb is less than PO4. Therefore, the correlation is moderate (2)

PO5: Evaluate (L5)

CO3 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)

PO11: Select (L5)

CO3 Action verb is less than PO11 verb by one level. Therefore, the correlation is medium (2)

CO4: The various operations of genetic algorithms and Rough Sets to develop efficient algorithms of genetic.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4 Action verb is Greater than PO1. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO4 Action verb is Greater than PO2. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO4 Action verb is Greater than PO4. Therefore, the correlation is high (3)

PO5: Select (L3)

CO4 Action verb is Greater than PO5. Therefore, the correlation is high (3)

CO5: Integration of Soft Computing Techniques and rough set rule induction.

PO2: Formulate (L6)

CO5 Action verb is same level as PO2. Therefore, the correlation is high (3)

PO3: Design (L6)

CO5 Action verb is same level as PO3. Therefore, the correlation is high (3)

PO5: Create (L6)

CO5 Action verb is same level as PO5. Therefore, the correlation is high (3)

PO10: Thumb Rule

Java is used to design simple and enterprise applications so need for project management.

Therefore, the correlation is high (3)

PO11: Thumb Rule

It is a programming language so new version available so we need to learn. Therefore, the

Correlation is high (3)

Course Code	Year & Sem	MICROPROCESSORS AND MICROCONTROLLERS	L	T/CLC	P	C
23APE0503	III-I	**(Professional Elective-I)**	**2**	**1**	**0**	**3**

Course Outcomes: Student will be able to

CO1: Understand the architecture, pin configuration and operating modes of the 8086.

CO2: Develop assembly language programs using instruction set and assembler directives.

CO3: Analyze the Memory and peripheral devices interfacing with 8086 microprocessor.

CO4: Understand the architecture, instruction set and assembly language programming of 8051 microcontroller.

CO5: Analyze the Interfacing Peripheral devices such as timers, ADCs, DACs etc.,with 8051 microcontroller

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the architecture, pin configuration and operating modes of the 8086.			L2
CO2	Develop	assembly language programs		using instruction set and assembler directives.	L3
CO3	Analyze	the Memory and peripheral devices interfacing	with 8086 Microprocessor		L4
CO4	Understand	the architecture details of the 8051 Microcontroller for embedded applications.			L2
CO5	Analyze	Interfacing of Peripheral devices such as timers, ADCs, DACs etc.,		with 8051 microcontroller	L4

UNIT - I		21Hrs
8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.		
UNIT - II		12Hrs
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.		
UNIT - III		19Hrs
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.		
UNIT - IV		12Hrs
Microcontroller : Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.		
UNIT - V		11Hrs
Interfacing Microcontroller :- Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface-Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.		

Textbooks:

1. Microprocessors and Interfacing–Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.

2. KM Bhurchandi, AK Ray, Advanced Microprocessors and Peripherals,3rd edition, McGraw Hill Education,

2017.

3.RajKamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

Reference Books:

1.Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.

2. Kenneth J.Ayala, The 8051Microcontroller, 3rd edition, Cengage Learning,2004.

Online Learning Resources:

NPTEL Videos

Mapping of Course Outcomes with Program Outcomes

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

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL				
1	21	28%	2	Understand	L2	PO1, PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
2	12	16%	2	Develop	L3	PO1, PO2, PO3, PO4	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze(L4)	3 3 3 2
3	19	25%	2	Analyze	L4	PO1, PO2, PO3	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3)	3 3 3
4	12	16%	3	Understand	L2	PO1, PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
5	11	15%	2	Analyze	L4	PO1, PO3, PO4	PO1: Apply(L3) PO3: Develop (L3) PO4: Analyze(L4)	3 3 3
	75	100%						

Justification Statements:

CO1: Understand the architecture, pin configuration and operating modes of the 8086.
Action Verb: Understand (L2)

PO1 Verb: Apply (L3) CO1 Action Verb is less than PO1 verb by one level. Therefore, the correlation is medium (2).

PO2 Verb: Identify (L3) CO1 Action Verb is less than PO2 verb by one level. Therefore, the correlation is medium (2).

CO2 Develop assembly language programs using instruction set and assembler directives.
Action Verb: Develop (L3)

PO1 Verbs: Apply (L3) CO2 Action Verb is equal to the PO1 verb. Therefore, the correlation is high (3).

PO2 Verbs: Identify(L3) CO2 Action Verb is in the same level of PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3) CO2 Action Verb is same level of PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4) CO2 Action Verb is less than PO4 verb by one level. Therefore, the correlation is Medium (2).

CO3: Analyze the Memory and peripheral devices interfacing with 8086 microprocessor.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO3 Action Verb is greater than PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Identify(L3) CO3 Action Verb is greater than PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3) CO3 Action Verb is is greater than PO3 verb. Therefore, the correlation is high (3).
CO4: Understand the architecture, instruction set and assembly language programming of 8051 microcontroller.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3) CO4 Action Verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2).
PO2 Verbs: Identify(L3) CO4 Action Verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2).
CO5: Analyze the Interfacing Peripheral devices such as timers, ADCs, DACs etc.,with 8051 microcontroller Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO5 Action Verb is greater than PO1 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3) CO5 Action Verb is greater than PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4) CO5 Action Verb is same level as PO4 verb. Therefore, the correlation is High (3).

Course Code	Year & Sem	Data Warehousing and Data Mining (Professional Elective-I)	L	T/CLC	P	C
23APE0504	**III-I**		**2**	**1**	**0**	**3**

Course Outcomes:

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

CO1: **Design** a Data warehouse system and perform business analysis with OLAP tools .

CO2: **Apply** suitable pre-processing and visualization techniques for data analysis.

CO3: **Apply** frequent pattern and association rule mining techniques for data analysis.

CO4: **Design** appropriate classification and clustering techniques for data analysis.

CO5: **Apply** various machine learning algorithms using WEKA for classification and clustering tasks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Design	Data warehouse system and perform business analysis with OLAP tools.			L6
CO2	Apply	suitable pre-processing and visualization techniques for data analysis.			L3
CO3	Apply	frequent pattern and association rule mining techniques for data analysis.			L3
CO4	Design	appropriate classification and clustering techniques for data analysis.		to form clusters	L6
CO5	Apply	various machine learning algorithms using WEKA for classification and clustering tasks.			L3

UNIT - I		9 Hrs

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT - II		9 Hrs

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT - III		9 Hrs

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT - IV		9 Hrs

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection- Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT - V		9 Hrs

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

Textbooks:

1.   Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

Reference Books:

1.   Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.

2.   K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

3.   Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1				CO1: Design	L6	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Design(L3) PO5: Apply(L3)	3 2 3 3
2				CO2: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 2 3 2
3				CO3:Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 2 3 2
4				CO4:Design	L6	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Design(L3) PO5: Apply(L3)	3 2 3 3
5				CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO11: Thumb Rule	3 3 3 2 3 2

Justification Statements :
CO1:Design a Data warehouse system and perform business analysis with OLAP tools .
Action Verb: Design(L6)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb . Therefore the correlation is high(3)
PO3 Verb: Design(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO5: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
CO2:Apply suitable pre-processing and visualization techniques for data analysis.
Action Verb : Apply (L3)
PO1: Apply(L3)

CO4 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2: Identify(L3)

CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is same as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than as PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply(L3)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

PO11: Thumb rule

We will apply these mining techniques to create solution. Therefore the correlation
is medium(2)

CO3:Apply frequent pattern and association rule mining techniques for data analysis.
Action Verb : Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2: Identify(L3)

CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is same as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than as PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply(L3)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

PO11: Thumb rule

We will apply these mining techniques to create solution. Therefore the correlation
is medium(2)

CO4:Design appropriate classification and clustering techniques for data analysis.
Action Verb: Design(L6)

PO1 Verb: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Review(L2)

CO1 Action verb is same level as PO2 verb . Therefore the correlation is high(3)

PO3 Verb: Design(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO5: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

**CO5: Apply various machine learning algorithms using WEKA for classification and clustering
        tasks.**
Action Verb : Apply (L3)

PO1: Apply(L3)

CO4 Action verb is same as PO1 verb. Therefore the correlation is high (3)

PO2: Identify(L3)

CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO5 Action verb is same as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than as PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply(L3)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

PO11: Thumb rule

We will apply these mining techniques to create solution. Therefore the correlation is medium(2)

Course Code	Year & Sem	GREEN BUILDING (Open Elective I)	L	T	P	C
23AOE0101	III-I		2	1	0	3

Course Outcomes (CO)

Student will be able to	
CO1	Understand the fundamental concepts and significance of green buildings, including their necessity, benefits and sustainable features.
CO2	Apply knowledge of typical energy-saving approaches and sustainable practices to enhance the design and performance of green buildings.
CO3	Analyze strategies for maximizing system efficiency in energy usage by integrating renewable energy sources in buildings and industrial process
CO4	Apply principles of energy modeling to assess building performance in terms of energy consumption and savings.
CO5	Analyze indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke for healthy building environments.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the fundamental concepts and significance, including their necessity, benefits and sustainable features.	of green buildings		L2
2	Apply	Knowledge of typical energy saving approaches and sustainable practices	Of green buildings	To enhance and design performance	L3
3	Analyze	Strategies for maximizing system efficiency in energy usage by integrating renewable energy sources	In building and industrial process		L4
4	Apply	principles of energy modeling to assess building performance		in terms of energy consumption and savings.	L3
5	Analyze	indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke		for healthy building environments.	L4

UNIT - I	INTRODUCTION TO GREEN BUILDING	9 Hrs

Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.

UNIT - II	GREEN BUILDING CONCEPTS AND PRACTICES	9 Hrs

Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT - III	GREEN BUILDING DESIGN	9 Hrs

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT - IV	AIR CONDITIONING	9 Hrs

Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT - V	MATERIAL CONSERVATION	9 Hrs

Handling of Non-Process Waste, Waste Reduction During Construction, Materials with Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

Textbooks:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009

Reference Books:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102195/

Mapping of course outcomes with program outcomes

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

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)
Correlation matrix

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	12	20	2	Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	12	20	2	Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
3	12	20	2	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
4	12	20	2	Apply	L3	PO1	Apply (L3)	3

							PO2	Analyze (L4)	2
							PO6	Thumb Rule	2
5	12	20	2	Analyze	L4		PO1	Apply (L3)	2
							PO2	Analyze (L4)	3
							PO4	Analyze (L4)	3
							PO6	Thumb Rule	3

CO-PO MAPPING JUSTIFICATION:
JUSTIFICATION STATEMENTS:

CO 1: Understand the fundamental concepts and significance of green buildings, including their necessity, benefits and sustainable features.
Action Verb: Understand (L2)
PO1: Apply(L3)
CO Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO 1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO 1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO 2: Apply knowledge of typical energy-saving approaches and sustainable practices to enhance the design and performance of green buildings.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO 2: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)
CO 2 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO 3: Analyze strategies for maximizing system efficiency in energy usage by integrating renewable energy sources in buildings and industrial process
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO 3 Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2)
PO2: Analyze (L4)
CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)
PO 4: Analysis (L4)
CO 3 Action Verb is equal to PO4; Therefore, correlation is high (3)
CO 3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as high (3).

CO4: Apply principles of energy modeling to assess building performance in terms of energy consumption and savings.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO Action verb is equal to PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO 4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)
CO 4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO 5: Analyze indoor environmental quality parameters such as air conditioning systems, indoor air quality, and control of tobacco smoke for healthy building environments.
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO Action verb is greater than PO1 verb. Therefore, the correlation is moderate (2).
PO2: Analyze (L4)
CO Action verb is equal to PO2 verb. Therefore, the correlation is high (3)
PO 4: Analysis (L4)
CO 5 Action Verb is equal to PO4; Therefore, correlation is high (3)
CO 5 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 as high (3).

Course Code	Year & Sem	CONSTRUCTION TECHNOLOGY AND MANAGEMENT (Open Elective-1)	L	T / CLC	P	C
23AOE0102	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

	Student will be able to
CO1	Understand the project management fundamentals, organizational structures, and leadership principles in construction.
CO2	Understand the manpower planning, equipment management, and cost estimation in civil engineering projects.
CO3	Apply the planning, scheduling, and project management techniques such as CPM and PERT.
CO4	Understand the various contract types, contract formation, and legal aspects in construction management
CO5	Understand the safety management practices, accident prevention strategies, and quality management systems in construction.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the project management fundamentals, organizational structures, and leadership principle		in construction	L2
CO2	Understand	the manpower planning, equipment management, and cost estimation		in civil engineering projects.	L2
CO3	Apply	the planning, scheduling, and project management techniques such as CPM and PERT.		in construction projects	L3
CO4	Understand	the various contract types, contract formation, and legal aspects		in construction management	L2
CO5	Understand	the safety management practices, accident prevention strategies, and quality management systems		in construction	L2

UNIT - I		9 Hrs

IINTRODUCTION: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.

UNIT - II		9Hrs

MAN AND MACHINE: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

UNIT - III		9 Hrs

PLANNING, SCHEDULING AND PROJECT MANAGEMENT: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network- formulation and Time Computation.

UNIT - IV		9 Hrs

CONTRACTS: Types of Contracts, formation of Contract – Contract Conditions – Contract forLabour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.

UNIT - V		9 Hrs

	SAFETY MANAGEMENT: Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.

Textbooks:
1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019

Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

Reference Books:
1. Brien, J.O. and Plotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010.
2. Punmia, B.C., and Khandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management and Organisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:
>   **https://archive.nptel.ac.in/courses/105/104/105104161/**
>   **https://archive.nptel.ac.in/courses/105/103/105103093/**

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)
Correlation matrix

Unit No	Course Outcomes						Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL				
1	10	18.18	3	Understand	L1		PO1	Apply (L3)	2
							PO6	Thumb Rule	2
							PO7	Thumb Rule	2
							PO10	Thumb Rule	2
2	10	18.18	3	Understand	L1		PO1	Apply (L3)	2
							PO6	Thumb Rule	2
							PO10	Thumb Rule	2
3	15	27.27	3	Apply	L3		PO1	Apply (L3)	3
							PO2	Analyze (L4)	2
							PO6	Thumb Rule	2
							PO10	Thumb Rule	2
4	10	18.18	3	Understand	L1		PO1	Apply (L3)	2
							PO6	Thumb Rule	2
							PO10	Thumb Rule	2
5	10	18.18	3	Understand	L1		PO1	Apply (L3)	2
							PO6	Thumb Rule	2
							PO10	Thumb Rule	2

JUSTIFICATION STATEMENTS:

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	ELECTRICAL SAFETY PRACTICES AND STANDARDS (Open Elective-1)	L	T / CLC	P	C
23AOE0201	III-I		2	1	0	3

After completion of the course, students will be able to:
CO1	Understanding the Fundamentals of Electrical Safety -L2
CO2	Identifying and Applying Safety Components -L3
CO3	Analyzing Grounding Practices and Electrical Bonding-L4
CO4	Applying Safety Practices in Electrical Installations and Environments- L4
CO5	Evaluating Electrical Safety Standards and Regulatory Compliance -L5

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Fundamentals of Electrical Safety			L2
CO2	Identify	Applying Safety Components			L3
CO3	Analyze	Grounding Practices and Electrical Bonding			L4
CO4	Apply	Safety Practices in Electrical Installations and Environments			L4
CO5	Evaluate	Electrical Safety Standards and Regulatory Compliance			L5

UNIT - I	**Introduction To Electrical Safety**	**9 Hrs**

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**	**9Hrs**

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 Hrs**

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 Hrs**

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 Hrs**

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

Textbooks:

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.

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	–	–	–	1	–	–	–	–	1	1	2
CO2	3	3	–	–	–	2	–	–	–	–	2	2	3
CO3	3	–	1	–	3	3	–	–	–	–	3	3	3
CO4	3	2	–	–	3	2	–	–	–	–	2	2	3
CO5	3	3	2	–	3	3	1	–	–	–	2	3	3

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	Lesson Plan (Hrs.)	%	correlation	Verb	BTL	Program Outcomes(PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
1				Understand	L2	PO1 PO2 PO6	Apply-L3 Analyse-L4 Analyse-L4	Medium-2 Low-1 Low-1
2				Identify	L3	PO1 PO2 PO6	Apply-L3 Analyse-L4 Analyse-L4	High-3 Medium-2 Medium-2
3				Analyze	L4	PO1 PO3 PO5 PO6	Apply-L3 Design-L6 Apply-L3 Analyse-L4	High-3 Low-1 High-3 High-3
4				Apply	L4	PO1 PO2 PO5 PO6	Apply-L3 Analyse-L4 Apply-L3 Analyse-L4	High-3 High-3 High-3 High-3
5				Evaluate	L5	PO1 PO2 PO3 PO5 PO6 PO7	Apply-L3 Analyse-L4 Design-L6 Apply-L3 Analyse-L4 Apply-L3	High-3 High-3 Medium-1 High-3 High-3 High-3

Justification:
CO1: Understanding the Fundamentals of Electrical Safety
Action Verb: L2
CO1 Action Verb is Less than PO1 Action By1 Therefore The Correlation Is Medium-2
CO1 Action Verb is Less than PO2 Action By2 Therefore The Correlation Is Low-1
CO1 Action Verb is Less Than PO6 Action By2 Therefore The Correlation Is Low-1

CO2: Identifying and Applying Safety Components
Action Verb: L3
CO2 Action Verb Is Equal To PO1 Therefore The Correlation Is High-3
CO2 Action Verb Is Less than PO2 Action by one Therefore The Correlation Is Medium-2
CO2 Action Verb Is Less than PO6 action by one Therefore The Correlation Is Medium-2
CO3: Analyzing Grounding Practices and Electrical Bonding
Action Verb: L4
CO3 Action Verb Is greater than PO1 action by one Therefore The Correlation Is High-3
CO3 Action Verb Is Less than PO3 Action by 2 Therefore The Correlation Is Low-1

CO3 Action Verb Is greater than PO5 Action by 1 Therefore The Correlation Is High-3
CO3 Action Verb Is Equal To PO6 Therefore The Correlation Is High-3

CO4: Applying Safety Practices in Electrical Installations and Environments
Action Verb: L4
CO4 Action Verb Is Greater Than PO1 Action By 1 Therefore The Correlation Is High-3
CO4 Action Verb Is Equal To PO2 Therefore The Correlation Is High-3
CO4 Action Verb Is Greater Than PO5 Action By 1 Therefore The Correlation Is High-3
CO4 Action Verb Is Equal To PO6 Therefore The Correlation Is High-3

CO5: Evaluating Electrical Safety Standards and Regulatory Compliance
Action Verb: L5
CO5 Action Verb Is Greater Than PO1 Action By 2 Therefore The Correlation Is High-3
CO5 Action Verb Is Greater Than PO2 Action By 1 Therefore The Correlation Is High-3
CO5 Action Verb Is less Than PO3 Action By One Therefore The Correlation Is Medium-1
CO5 Action Verb Is Greater Than   PO5 Action By 2therefore The Correlation Is High-3
CO5 Action Verb Is Greater Than PO6 Action By 1therefore The Correlation Is High-3
CO5 Action Verb Is Greater Than PO7 Action By 2 Therefore The Correlation Is High-3

Course Code	Year & Sem	Sustainable Energy Technologies	L	T / CLC	P	C
23AOE0301	**III-I**	**(Open Elective-1)**	**2**	1	0	3

	After completion of the course, students will be able to:
CO1	Analyze solar radiation data, PV module characteristics, and the environmental impact of solar power systems.
CO2	Evaluate the performance of various solar thermal collectors and select appropriate battery storage systems for PV applications.
CO3	Apply the principles of wind and biomass energy conversion to analyze the performance of renewable energy systems.
CO4	Analyze the operational principles and applications of geothermal, ocean energy, and fuel cell systems.
CO5	Design an off-grid solar PV power plant considering component selection, system integration, and economic aspects

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Solar radiation data, PV module characteristics, and the environmental impact of solar power systems.			L4
CO2	Evaluate	The performance of various solar thermal collectors and select appropriate battery storage systems.	for PV applications.		L5
CO3	Apply	The principles of wind and biomass energy conversion.	to analyze the performance of renewable energy systems.		L3
CO4	Analyze	The operational principles and applications of geothermal, ocean energy, and fuel cell systems.			L4
CO5	Design	An off-grid solar PV power plant.	considering component selection, system integration, and economic aspects.		L6

UNIT - I		9 Hrs

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems

UNIT - II		9Hrs

SOLAR PV MODULES AND PV SYSTEMS:PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance

UNIT - III		9 Hrs

STORAGE IN PV SYSTEMS: Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar

cookers, central power tower concept and solar chimney.

UNIT - IV		9 Hrs

G**WIND ENERGY**: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT - V	Standards For Electrical Safety	9 Hrs

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Textbooks:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

Reference Books:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers.

Online Learning Resources:

- https://nptel.ac.in/courses/112106318
- https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13
- https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3
- https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)

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

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	Lesson Plan (Hrs.)	CO %	CO correlation	Verb	BTL	Program Outcomes(PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
1				Analyze	L4	PO1, PO2, PO4	Apply(L3) Analyze(L4) Analyze(L4)	3
2				Evaluate	L5	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design(L6)	3
3				Apply	L3	PO1, PO2	Apply(L3) Analyze(L4)	3

4				Analyze	L4	PO1, PO2, PO4	Apply(L3) Analyze(L4) Analyze(L4)	3
5				Design	L6	PO2, PO3, PO5, PO6	Analyze(L4) Design(L6) Usage(L3) Design(L6)	3

Justification Statements:

CO1: Analyze solar radiation data, PV module characteristics, and the environmental impact of solar power systems.

Action Verb: Analyze (L4)

PO1, PO2 & PO4 Verbs: Apply (L3), Analyze (L4), Sustainability (L3)

The CO1 Action Verb 'Analyze' (L4) is at a higher cognitive level than PO1 and PO7 verbs and is equal to PO2's 'Analyze' (L4). This outcome requires analyzing complex data in the context of sustainable engineering. Therefore, the correlation is high (3).

CO2: Evaluate the performance of various solar thermal collectors and select appropriate battery storage systems for PV applications.

Action Verb: Evaluate (L5)

PO2 & PO3 Verbs: Analyze (L4), Design (L6)

The CO2 Action Verb 'Evaluate' (L5) is a higher-order skill that requires analysis (PO2) and is a critical component of designing solutions (PO3). The ability to make judgments based on criteria is fundamental to these POs. Therefore, the correlation is high (3).

CO3: Apply the principles of wind and biomass energy conversion to analyze the performance of renewable energy systems.

Action Verb: Apply (L3)

PO1 & PO2 Verbs: Apply (L3), Analyze (L4)

The CO3 Action Verb 'Apply' (L3) is at the same cognitive level as PO1's verb and is a prerequisite for PO2's 'Analyze' (L4). It involves applying fundamental engineering knowledge to solve problems. Therefore, the correlation is high (3).

CO4: Analyze the operational principles and applications of geothermal, ocean energy, and fuel cell systems.

Action Verb: Analyze (L4)

PO1, PO2 & PO4 Verbs: Apply (L3), Analyze (L4)

The CO4 Action Verb 'Analyze' (L4) is at a higher level than PO1's 'Apply' (L3) and is equal to the verbs for PO2 and PO4. It requires a detailed investigation of complex energy systems. Therefore, the correlation is high (3).

CO5: Design an off-grid solar PV power plant considering component selection, system integration, and economic aspects.

Action Verb: Design (L6)

PO2, PO3 & PO5 Verbs: Analyze (L4), Design (L6), Usage (L3)

The CO5 Action Verb 'Design' (L6) is at the same cognitive level as PO3's verb. This complex design task requires in-depth analysis of the problem (PO2) and the use of modern engineering tools (PO5). Therefore, the correlation is high (3).

Course Code	Year & Sem	ELECTRONIC CIRCUITS	L	T / CLC	P	C
23AOE0401	**III-I**	**(Open Elective-1)**	**2**	1	0	3

After completion of the course, students will be able to:	
CO1	**Understand** the operation of various semiconductor diodes and their applications.
CO2	**Analyze** the BJT characteristics, biasing methods and stabilization techniques.
CO3	**Understand** the single and multi-stage amplifiers using simplified hybrid model.
CO4	**Evaluate** the parameters of feedback amplifiers and frequency of various oscillators.
CO5	**Analyze** the characteristics, operation of Operational amplifier and it's applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Operation of various semiconductor diodes and their applications.		Rectifiers, Clampers, Clippers, voltage regulators.	L2
CO2	Analyze	BJT characteristics, biasing methods and stabilization techniques.			L4
CO3	Understand	Single and multi-stage amplifiers using simplified hybrid model.		BJT, Coupled amplifiers	L2
CO4	Evaluate	Parameters of feedback amplifiers and frequency of various oscillators.			L5
CO5	Analyze	characteristics, operation of Operational amplifier and it's applications			L4

UNIT – I		16Hrs

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half- wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only). Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage
regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT – II		17Hrs

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector
Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT – III		19 Hrs

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.
Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled
amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT – IV		20 Hrs

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).		
Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.		
UNIT – V		18 Hrs
Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.		
Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.		
Textbooks:		
1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.		
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.		
Reference Books:		
1. Electronics Devices and Circuits Theory, R.L.Boylestad, LousisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.		
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012		
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.		
Online Learning Resources:		
nptel videos		

Mapping of course outcomes with program outcomes

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

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	16	18%	2	Understand	L2	PO1, PO2	PO1: Apply (L3) PO2: Review(L2)	2 3
2	17	19%	2	Analyze	L4	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
3	19	21%	3	Understand	L2	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2:Review (L2) PO3:Analyze(L4) PO5: Select(L1)	2 3 1 3
4	20	22%	3	Evaluate	L5	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2:Identify(L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 3
5	18	20%	2	Analyze	L4	PO1, PO2, PO4	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze(L4)	3 3 3
	90	**100%**						

Correlation atrix Justification Statements:
CO1: Understand the operation of various semiconductor diodes and their applications.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore, the correlation is moderate (2).
PO2 Verbs: Review (L2)

CO1 Action Verb is equal to PO2 verb; Therefore, the correlation is high (3).
CO2: Analyze the BJT characteristics, biasing methods and stabilization techniques.
Action Verb: Analyze(L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb; Therefore, the correlation is high (3).
PO2 Verbs: Identify (L3)
CO2 Action Verb is greater than PO2 verb; Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3)
CO2 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; Therefore, the correlation is high (3).
CO3: Understand the single and multi-stage amplifiers using simplified hybrid model.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3),
CO3 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2 Verbs: Review (L2),
CO3 Action Verb is equal to PO2 verb by same levels; therefore, correlation is High (3).
PO4 Verbs: Analyze-L4,
CO3 Action Verb is less than PO4 verb by two levels; therefore, correlation is low (1).
PO5 Verbs: Select-L1,
CO3 Action Verb is more than PO5 verb by one level; therefore, correlation is high (3).
CO4: Evaluate the parameters of feedback amplifiers and frequency of various oscillators.
Action Verb: Evaluate(L5)
PO1 Verbs: Apply (L3)
CO4 Action Verb is high than PO1 verb by two levels ; Therefore, correlation is high (3).
PO2 Verb: Identify (L3)
CO4 Action Verb is high than PO2 verb by two levels ; Therefore, correlation is high (3).
PO4 Verbs: Analyze(L4)
CO4 Action Verb is higher than PO4 verb by one levels; therefore, correlation is high (3).
PO5 Verbs: Apply (L3),
CO4 Action Verb is higher than PO5 verb by two levels; Therefore, correlation is high (3).
CO5: Analyze the characteristics, operation of Operational amplifiers and it's applications
Action Verb: Analyze(L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is PO1 verb by two levels ; Therefore, correlation is high (3).
PO2 Verb: Identify (L3)
CO5 Action Verb is high than PO2 verb by two levels ; Therefore, correlation is high (3).
PO4 Verbs: Analyze(L4)
CO5 Action Verb is higher than PO4 verb by one levels; therefore, correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Mathematical Foundations for Machine Learning and AI **(Open Elective-1)**	L	T / CLC	P	C
23AOE9901	**III-I**		**2**	1	0	3

Course Outcomes (CO): Student will be able to
1. Apply linear algebra concepts to ML techniques like PCA and regression.
2. Analyze probabilistic models and statistical methods for AI applications.
3. Apply optimization techniques for machine learning algorithms.
4. Apply vector calculus and transformations in AI-based models.
5. Evaluate graph-based AI models using mathematical representations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Apply**	linear algebra concepts	to ML techniques like PCA and regression.		**L3**
2	**Analyze**	probabilistic models and statistical methods	for AI applications.		**L4**
3	**Apply**	optimization techniques	for machine learning algorithms.		**L3**
4	**Apply**	vector calculus and transformations	in AI-based models.		**L3**
5	**Evaluate**	graph-based AI models	using mathematical representations.		**L5**

UNIT I: Linear Algebra for Machine Learning **8 hours**
Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigen values, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: Probability and Statistics for AI **8 hours**
Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: Optimization Techniques for ML **8 hours**
Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.

UNIT IV: Vector Calculus & Transformations **8 hours**
Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI **8 hours**
Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Textbooks:
1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Web References:
- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/
- Deep AI – Mathematical Foundations for AI https://deepai.org

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Apply	L3	PO1	Apply	3
2				Analyze	L4	PO2	Analyze	3
3				Apply	L3	PO1	Apply	3
4				Apply	L3	PO1	Apply	3
5				Evaluate	L5	PO3	Evaluate	3

CO1: Apply linear algebra concepts to ML techniques like PCA and regression.
 Action Verb: Apply(L3)
PO1 Verbs: Apply (L3)
        CO1 Action Verb is equal toPO1 verb ; Therefore correlation is high (3).
CO2: Analyze probabilistic models and statistical methods for AI applications.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
        CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO3: Apply optimization techniques for machine learning algorithms.
Action Verb: Apply **(L3)**
PO1 Verb: Apply (L3)
        CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO4: Apply vector calculus and transformations in AI-based models.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
         CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO5: Evaluate graph-based AI models using mathematical representations.
Action Verb: Evaluate(L5)
PO3 Verb: Evaluate (L6)
        CO5 Action verb is equal to PO3 verb; therefore the correlation is high (3).

Course Code	Year & Sem	MATERIALS CHARACTERIZATION TECHNIQUES (Open Elective-1)	L	T / CLC	P	C
23AOE9906	III-I		2	1	0	3

	After completion of the course, students will be able to:
CO1	Understand the crystal structure and crystal size by using X-ray Diffraction (XRD) technique.
CO2	Analyze the basic principles of Scanning Electron Microscopy (SEM).
CO3	Analyze the fundamentals of Transmission Electron Microscope (TEM).
CO4	Apply the various spectroscopic techniques for engineering applications.
CO5	Analyze the electric and magnetic properties of a specimen using various characterization techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The crystal structure and crystal size by using X-ray Diffraction (XRD) technique.			L2
CO2	Analyze	The various spectroscopic techniques for engineering applications.			L4
CO3	Analyze	The fundamentals of Transmission Electron Microscope (TEM).			L4
CO4	Apply	The various spectroscopic techniques for engineering applications.			L3
CO5	Analyze	The electric and magnetic properties of a specimen using various characterization techniques.			L4

UNIT - I	Structure analysis by Powder X-Ray Diffraction	9 Hrs

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT - II	Microscopy technique -1 –Scanning Electron Microscopy (SEM)	9Hrs

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT - III	Microscopy Technique -2 - Transmission Electron Microscopy (TEM)	9 Hrs

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

UNIT - IV	Spectroscopy techniques	9 Hrs

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT - V	Electrical & Magnetic Characterization techniques	9 Hrs

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.

2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley &

Sons Ltd., 2008.		

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall , 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. Materials Characterization Techniques -Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

Online Learning Resources:

1. **https://nptel.ac.in/courses/115/103/115103030/**
2. **https://nptel.ac.in/content/syllabus_pdf/113106034.pdf**
3. **https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/**

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)

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

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	CO Lesson Plan (Hrs.)	%	correlation	Verb	BTL	Program Outcomes(PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
1				Understand	L2	PO1	PO1: Apply (L3)	2
2				Analyze	L4	PO1	PO1: Apply (L3)	3
3				Analyze	L4	PO1, PO5	PO1, PO5: Apply (L3)	3
4				Apply	L3	PO1	PO1: Apply (L3)	3
5				Analyze	L4	PO1, PO2	PO1, PO2: Apply (L3)	3

Justification:
CO1: Understand the crystal structure and crystal size by using X-ray Diffraction (XRD) technique.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb level is less than PO1 verb by one level; Therefore, correlation is moderate (2).
CO2: Analyze the basic principles of Scanning Electron Microscopy (SEM).
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb level is greater than PO1 verb by one level; Therefore, correlation is high (3).

CO3: Analyze the fundamentals of Transmission Electron Microscope (TEM).
Action Verb: Analyze (L4)
PO1 and PO5 Verbs: Apply (L3)
CO3 Action Verb level is greater than PO1 and PO5 verbs by one level; Therefore correlation is high (3).
CO4: Apply the various spectroscopic techniques for engineering applications.
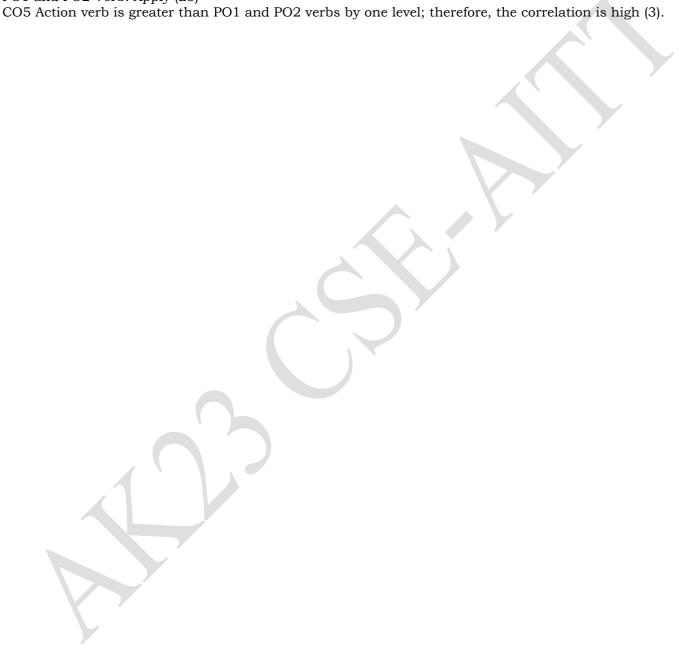**Action Verb: Apply (L3)**
PO1 Verb: Apply (L3)
 CO4 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).
CO5: Analyze the electric and magnetic properties of a specimen using various characterization techniques.
Action Verb: Analyze (L4)
PO1 and PO2 Verb: Apply (L3)
CO5 Action verb is greater than PO1 and PO2 verbs by one level; therefore, the correlation is high (3).

Course Code	Year & Sem	Chemistry of Energy Systems	L	T / CLC	P	C
23AOE9911	III-I	(Open Elective-1)	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the problems based on electrode potential and concept of batteries.
CO2	Apply fuel technology in various energy and engineering contexts.
CO3	Analyze the advantages of photoelectric catalytic process such as high effieiency, low environmental impact and renewable energy applications.
CO4	Apply the electrochemical principles to photo voltaic cell, solar power and solar cells.
CO5	Analyze various methods for storage of hydrogen fuel.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	the problems based on electrode potential and concept of batteries.			L2
CO2	Apply	fuel technology in various energy and engineering contexts.			L3
CO3	Analyze	the advantages of photoelectric catalytic process such as high efficiency, low environmental impack and renewable energy applications.			L4
CO4	Apply	the electrochemical principles to photo voltaic cell, solar power and solar cells.			L3
CO5	Analyze	various methods for storage of hydrogen fuel.			L4

UNIT - I	Electrochemical Systems	9 Hrs

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	9Hrs

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 Hrs

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 Hrs

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications

UNIT - V	Hydrogen Storage	9 Hrs

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.

Textbooks:

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

Online Learning Resources:

2. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3												
CO3	3												
CO4	3												
CO5	3												

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	CO					Program Outcomes(PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1				Understand	L2	PO1	PO1: Apply (L3)	2
2				Apply	L3	PO1	PO1: Apply (L3)	3
3				Analyze	L3	PO1	PO1: Apply (L3)	3
4				Apply	L4	PO1	PO1: Apply (L3)	3
5				Analyze	L4	PO1	PO1: Apply (L3)	3

Justification:
CO1: Understand the problems based on electrode potential and concept of batteries
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2: Apply fuel technology in various energy and engineering contexts
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO3: Analyze the advantages of photoelectric catalytic process such as high efficiency, low environmental impact and renewable energy applications
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO3 Action Verb is less than PO1 verb; Therefore correlation is high (2).
CO4: Apply the electrochemical principles to photo voltaic cell, solar power and solar cells
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO5 Analyze various methods for storage of hydrogen fuel
Action Verb: Analyze (L4)
PO1 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

Course Code	Year & Sem	English For Competitive Examinations (Open Elective-I)	L	T	P	C
23AOE9915	III-I		2	1	0	3

Course Outcomes (CO)

Student will be able to	
CO1	Understand the basics of English grammar to develop proficiency in language skills.
CO2	Apply the grammatical structures in sentences for an effective communication
CO3	Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams
CO4	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills
CO5	Create effective writing forms like essays and precise writing by using grammar and structure rules

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the basics of English grammar to develop proficiency in language skills.			L2
2	**Apply**	the grammatical structures in sentences for an effective communication			L3
3	**Analyze**	the use of various concepts in grammar and vocabulary in everyday use and competitive exams		in everyday use and competitive exams	L3
4	**Understand**	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills			L4
5	**Evaluate**	effective writing forms like essays and precise writing by using grammar and structure rules.	by using grammar and structure rules.		L6

UNIT - I	GRAMMAR-1	9 Hrs
Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-repositions-usage-Tag Questions, types-identifying errors- Practice	

UNIT - II	GRAMMAR-2	9 Hrs

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT - III	VERBAL ABILITY	9 Hrs

Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT - IV	READING COMPREHENSION AND VOCUBULARY	9 Hrs

Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones- Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT - V	WRITING FOR COMPETITIVE EXAMINATIONS	9 Hrs

Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs- Essay

writing-types

Textbooks:

1.Wren & Martin, English for Competitive Examinations, S.Chand & Co, 2021
2.Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.

Reference Books:

1.Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.
2.Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3.Shalini Verma , Word Power Made Handy, S Chand Publications
4.Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.
5.Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6.Michel Swan, Practical English Usage,Oxford,2006.

Online Learning Resources:

1.https://www.grammar.cl/english/parts-of-speech.html
2.https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3.https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active- passive-voice
4.https://languagetool.org/insights/post/verb-tenses/
5.https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

Mapping of course outcomes with program outcomes

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

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Understand			Thumb Rule	
2	CO2: Apply			Thumb Rule	
3	CO3: Analyze			Thumb Rule	
4	CO4: Apply			Thumb Rule	
5	CO5: Evaluate			Thumb Rule	

Justification Statements:

CO1: Understand the basics of English grammar to develop proficiency in language skills.
Action Verb: Understand (L2)
CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).
CO2: Apply the grammatical structures in sentences for an effective communication.
CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)
CO3: Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).
CO4: Analyze unfamiliar passages to **draw** logical conclusions, thereby **enhancing** reading comprehension and vocabulary skills
Action Verb: Analyze (L4)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).
CO5: Create effective writing forms like essays and precise writing by using grammar and structure rules.
Action Verb: Create(L6)
CO5 Action Verb Create is of BTL 6. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

Year: III   **Semester:** I   **Branch of Study: All Branches**

Subject Code: 23AOEMB01	Subject Name: Entrepreneurship and New Venture Creation (Open Elective-I)	**L** 2	**T** 1	**P** -	**Credits** 03

Course Outcomes

CO1: Understand the entrepreneurial mind – set for venture creation and Intrapreneurial Leadership.

CO2: Analyze the process of problem-opportunity identification through design thinking, and validating with the potential customer.

CO3: Understand Prototype Development and validate MVP of their venture idea.

CO4: Evaluate the financial and market viability of a venture by conducting financial and marketing feasibility.

CO5: Understand an investible pitch deck of their practice venture to attract stakeholders.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	an entrepreneurial mind – set		for venture creation and Entrepreneurial Leadership	L2
CO2	Analyze	the process of problem-opportunity identification	Through design thinking, and validating with the potential customer.		L4
CO3	Understand	Proto type Development and validate MVP of their venture idea			L2
CO4	Evaluate	the financial and market viability of a venture	by conducting financial and marketing feasibility.		L5
CO5	Understand	an investible pitch deck of their practice venture		to attract stakeholders	L2

UNIT-I: Entrepreneurship Fundamentals and context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Unit II: Problem & Customer Identification

Understanding and analyzing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analyzing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity Map the Start-up Life-cycle to Funding Options.

UNIT-V: Scale Outlook and Venture Pitch readiness *Understand and identify potential and aspiration for scale vis-à-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.*

Textbooks:
- Robert D.Hisrich, Michael P.Peters, Dean A. Shepherd, Sabyasachi Sinha. Entrepreneurship,McGrawHill,11thEdition(2020)
- Ries E, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.CrownBusiness,(2011).
- Oster walder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.(2010).

References:
- Simon Sinek, *Start with Why,* Penguin Books limited.(2011)
- BrownTim,*Change by Design Revised &Updated: HowDesign Thinking*
- *Transforms Organizations and Inspires Innovation,*HarperBusiness.(2019)
- NamitaThapar(2022)The Dolphin and the Shark:Stories on Entrepreneurship , Penguin Books Limited
- Saras D.Sarasvathy, (2008) Effectuation:Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Entrepreneurship and new venture creation	CO1	**2**												
	CO2			**3**										
	CO3				3									
	CO4	**3**												
	CO5									2				

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s):Action Verb and BTL	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	10	14.93	2	Understand	L2	PO1	Apply (L3)	2
2	12	17.91	2	Analyze	L4	PO3	Apply (L3)	3
3	12	17.91	2	Create	L6	PO4	Apply (L3)	3
4	18	26.86	3	Evaluate	L5	PO1	Apply (L3)	3
5	15	22.38	3	Understand	L2	PO9	Thumb Rule	2
Total	**67**	**100**						

Justification Statements:

CO1: Understand an entrepreneurial mind – set for venture creation and Intrapreneurial Leadership.
Action Verb: Understand (L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

CO2: Analyze the process of problem-opportunity identification through design thinking, and validating with the potential customer.
Action Verb: Analyze (L4)
PO3: Apply (L3)
CO2 Action verb is more than PO3 verb. Therefore the correlation is High (3)

CO3: Understand Prototype Development and validate MVP of their venture idea.
Action Verb: Understand (L2)
PO4: Apply (L3)

CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)

CO4: Evaluate the financial and market viability of a venture by conducting financial and marketing feasibility.
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO4 Action verb is more than PO1 verb by two levels. Therefore the correlation is High (3)

CO5: Understand an investible pitch deck of their practice venture to attract stakeholders.
Action Verb: Understand (L2)
PO9: Thumb Rule
As using thumb rule, correlates with PO9. Therefore the correlation is medium (2)

Course Code	Year & Sem	ARTIFICIAL INTELLIGENCE LAB	L	T	P	C
23APC0514	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Apply the Searching Algorithm for finding shortest path.

CO 2: Analyze the informed and un-informed search for puzzle solving.

CO 3: Apply the Back tracking Algorithm to the N Queen problem.

CO 4: Analyze the AI algorithms to implement simple Chatbot.

CO 5: Apply the NLTK to implement Lemmatization and POS.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Apply**	the Searching Algorithm		for finding shortest path	L3
CO2	**Analyze**	the informed and un-informed search		for puzzle solving.	L4
CO3	**Apply**	the Back tracking Algorithm		to the N Queen problem	L3
CO4	**Analyze**	the AI algorithms		to implement simple Chatbot	L4
CO5	**Apply**	the NLTK		to implement Lemmatization and POS	L3

List of Experiments
1. Write a Program to Implement BFS and DFS.**(CO1)**
2. Write a Program to find the solution for travelling sales person problem. **(CO1)**
3. Write a program to implement simulated annealing Algorithm. **(CO1)**
4. Write a Program to Implement Tic-Tac-Toe game. **(CO2)**
5. Write a Program to Implement 8-Puzzle problem. **(CO2)**
6. Write a program to implement Towers of Hanoi problem. **(CO2)**
7. Write a program to implement A* Algorithm. **(CO2)**
8. Write a Program to Implement Water-Jug problem. **(CO2)**
9. Write a program to implement Hangman game. **(CO2)**
10. Write a program to solve N Queen problem using backtracking. **(CO3)**
11. Generate Calendar for the given month and year using a python program. **(CO4)**
12. Write a program to implement simple Chatbot. **(CO4)**
13. Write a program to remove stop words for a given passage from a text file using NLTK. **(CO5)**
14. Write a program to implement stemming for a given sentence using NLTK. **(CO5)**
15. Write a program to POS (Parts of Speech) tagging for the give sentence using NLTK. **(CO5)**
16. Write a program to implement Lemmatization using NLTK. **(CO5)**

Reference Books:

1. Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/,
3. https://github.com/pytorch
4. Theano: http://deeplearning.net/software/theano/ https://github.com/Theano/Theano
5. https://www.nltk.org/

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)

1	CO1: Apply	L3	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review(L2) PO11: Thumb rule	3 3 3
2	CO2: Analyze	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3
3	CO3: Apply	L3	PO1 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 2 3 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 2 3

Justification Statements:

CO 1: Apply the Searching Algorithm for finding shortest path.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is Same PO1 verb. Therefore, the correlation is high(3)
PO2 Verb: Review(L2)
CO1 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Simulated annealing Algorithm development is a continues learning process for the users to communicate
AI the correlation is high (3)

CO 2: Analyze the informed and un-informed search for puzzle solving.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Chatgpt development is a continues learning process for the users to communicate AI the correlation is high
(3)

CO 3: Apply the Back tracking Algorithm to the N Queen problem.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is Less than as PO4 verb by one level. Therefore, the correlation is high (2)
PO5: Apply (L3)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
N Queen problem using backtracking is a continues learning process for the users to communicate AI the
correlation is high (3)

CO 4: Analyze the AI algorithms to implement simple Chatbot.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
NLTK is continuous learning process for programmers to implement so the correlation is high (3)

CO 5: Apply the NLTK to implement Lemmatization and POS.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

Course Code	Year & Sem	COMPUTER NETWORKS LAB	L	T	P	C
23APC0516	III-I		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand the Networking hardware setup, cabling and NIC configurations

CO 2: Analyse the methods to simulate Data Link Layer protocols

CO 3: Apply the Network monitoring commands and routing protocols

CO 4: Apply the Network applications using Java (RMI, TCP/UDP, Hello/Echo)

CO 5: Analyse the Network performance using Wireshark and NS2/NS3

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	Networking hardware setup, cabling and NIC configurations			L2
CO2	**Analyse**	the methods		to simulate data link layer protocols	L4
CO3	**Apply**	Network monitoring commands and routing protocols	Using Packet Tracer, CLI, and shell tools		L3
CO4	**Apply**	Network applications using Java (RMI, TCP/UDP, Hello/Echo)		Simulate communication between devices	L3
CO5	**Analyse**	Network performance using Wire shark and NS2/NS3			L4

List of Experiments

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.
    a. Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
    b. Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.**(CO1)**
2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslook up**(CO2)**
3. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network. **(CO3)**
4. Use Packet tracer software to build network topology and configure using Distance vector routing protocol. **(CO3)**
5. Use Packet tracer software to build network topology and configure using Link State routing protocol. **(CO3)**
6. Using JAVA RMI Write a program to implement Basic Calculator**(CO4)**
7. Implement a Chatting application using JAVA TCP and UDP sockets. **(CO4)**
8. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbour. Implement Hello and Echo commands using JAVA. **(CO4)**
9. Using Wire shark perform the following operations: -Inspect HTTP Traffic
    a. Inspect HTTP Traffic from a Given IP Address,
    b. Inspect HTTP Traffic to a Given IP Address,
    c. Reject Packets to Given IP Address,
    d. Monitor Apache and My SQL Network Traffic. **(CO5)**
10. Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss. **(CO5)**
11. Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss. **(CO5)**
12. Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the

traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss. **(CO5)**

Reference Books:

1. Shivendra S.Panwar, Shiwen Mao, Jeong- dong Ryoo, and Yihan Li, ―TCP/IP Essentials A Lab-Based Approach‖, Cambridge University Press, 2004.
2. Cisco Networking Academy, ―CCNA1 and CCNA2 Companion Guide‖, Cisco Networking Academy Program, 3rd edition, 2003.
3. Elloitte Rusty Harold, ―Java Network Programming‖, 3rd edition, O'REILLY, 2011.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	**Understand**	L2	PO1 PO2 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule) PO11: Thumb rule	3 2 2 2 2
2	**Analyse**	L4	PO1 PO2 PO3 PO4	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4)	3 3 3 3
3	**Apply**	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyze (L4) PO3: Design (L3) PO4: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2 2
4	**Apply**	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyze (L4) PO3: Design (L3) PO4: Analyze (L4) PO5: Apply (L3) PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2 2
5	**Analyse**	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyze (L4) PO5: Apply (L3) PO6: Thumb rule PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 2 2 3 3 3 3 3 3

Justification Statements:

CO1: Understand networking hardware setup, cabling and NIC configurations

Action Verb: Understand (L2)

PO1: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2: Analyze (L4)

CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is medium (2)
PO5: Apply (L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)
PO8: Thumb rule
CO1 Action verb is less than PO8 verb by one level. Therefore the correlation is medium (2)
PO11: Thumb rule
CO1 Action verb is less than PO11 verb by one level. Therefore the correlation is medium (2)
CO2: Analyse the methods to simulate data link layer protocols .
Action Verb: Analyse (L4)
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Identify(L3)
CO2 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyse (L4)
CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
CO3: Apply network monitoring commands and routing protocols
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply (L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8: Thumb rule
CO3 Action verb is same level as PO8 verb. Therefore the correlation is medium (2)
PO9: Thumb rule
CO3 Action verb is same level as PO9 verb. Therefore the correlation is medium (2)
PO11: Thumb rule
CO3 Action verb is same level as PO11 verb. Therefore the correlation is medium (2)
CO4: Apply network applications using Java (RMI, TCP/UDP, Hello/Echo)
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO3: Design (L3)
CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8: Thumb rule
CO4 Action verb is same level as PO8 verb. Therefore the correlation is medium (2)
PO9: Thumb rule
CO4 Action verb is same level as PO9 verb. Therefore the correlation is medium (2)
PO11: Thumb rule
CO4 Action verb is same level as PO11 verb. Therefore the correlation is medium (2)
CO5: Analyze network performance using Wireshark and NS2/NS3
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action verb is greater than PO1 verb by one level. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L3)
CO5 Action verb is greater than PO3 verb by one level. Therefore the correlation is medium (2)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is medium (2)

PO5: Apply (L3)
CO5 Action verb is greater than PO5 verb by one level. Therefore the correlation is high (3)
PO6: Thumb rule
CO5 Action verb is same level as PO6 verb. Therefore the correlation is medium (3)
PO7: Thumb rule
CO5 Action verb is greater than PO7 verb by one level. Therefore the correlation is low (3)
PO8: **Thumb rule**
CO5 Action verb is greater than PO8 verb by one level. Therefore the correlation is high (3)
PO9: Thumb rule
CO5 Action verb is greater than PO9 verb by one level. Therefore the correlation is high (3)
PO11: Thumb rule
CO5 Action verb is greater than PO11 verb by one level. Therefore the correlation is high (3)

Course Code	**SOFT SKILLS LAB**		L	T	P	C
23ASC9901			**0**	**1**	**2**	**2**
Pre-Requisites	SOFT SKILLS	Semester	**II**			

Course Outcomes (CO): Student will be able to

CO1: Understand the various techniques of soft skills and communication skills.
CO2: Analyze the listening and thinking skills to enhance professional development.
CO3: Apply the critical thinking skills in problem solving and decision making through Discussions.
CO4: Evaluate the emotional intelligence and stress management for individuals and groups.
 CO5: Apply the corporate etiquette atmosphere to enhance professional behavior in workplace environment.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	the various techniques of soft skills and communication skills.			**L2**
2	Analyze	the listening and thinking skills to enhance professional development.			**L4**
3	Apply	the critical thinking skills in problem solving and decision making through Discussions .			**L3**
4	Evaluate	the emotional intelligence and stress management to control in themselves and others.			**L5**
5	Apply	the corporate etiquette atmosphere to enhance processional behavior in workplace environment.			**L3**

 UNIT I   Soft Skills & Communication Skills

 Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

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

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection

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

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - 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

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   Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

Prescribed Books:
1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow,   I K International Publishing House, 2018

Reference Books:
1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

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
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview

9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

Correlation of COs with the POs & PSOs for B.Tech
AK-23 Regulations
*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated

Course Title	Course Outcomes COs	Programme Outcomes(POs)											
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12
Soft Skills Lab	CO1										2		
	CO2									3	3		
	CO3									2			
	CO4									3			
	CO5									2	2		

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO6to PO12)	Level of Correlation (0-3)
	(Approx. Hrs)	%	corr	Verb	BTL			
1			CO1	**UNDERSTAND**	L2	PO10	Thumb rule	2
2			CO2	**ANALYZE**	L4	PO9, PO10	Thumb rule	3,3
3			**CO3**	**APPLY**	L3	PO9	Thumb rule	2
4			**CO4**	**EVALUATE**	L5	PO9	Thumb rule	3
5			**CO5**	**Apply**	L3	PO9, PO10	Thumb rule	2,2

CO1: Understand the various techniques of soft skills and communication skills.

Action Verb: Understand (L2)
CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
CO2: Analyze the listening and thinking skills to enhance professional development.
Action Verb: Analyze **(L4)**
CO2 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3)
CO3: Apply the critical thinking skills in problem solving and decision making through Discussions .

Action Verb: Apply (L3)
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).
CO4: Evaluate the emotional intelligence and stress management to control themselves and others.

Action Verb: Evaluate **(L5)**
CO4 Action Verb Evaluate is of BTL 5. Using Thumb rule, L2 correlates PO6 to PO12 as high(3).
CO5: : : Apply the corporate etiquette atmosphere to enhance processional behavior in workplace environment.
Action Verb: Create e (L3)
CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

Course Code	Year & Sem	TINKERING LAB	L	T	P	C
23AES0404	**III-I**		**0**	**0**	**2**	**1**

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.

Course Outcomes: After studying the course, student will be able to
    CO1: Develop arduino/ESP32 programming for basic circuits using breadboard/Tinkercad
    CO2: **Analyze** the LDR interfacing circuits with arduino / ESP32 controllers.
    CO3: **Analyze** the control of traffic light circuit, sensor-based servomotor and mobile app-based LED.
    CO4: Design a walking robot and rocket using 3-Dimensional (3D) printing Technology.
    CO5: **Create** a prototype for soil moisture monitor and redesign a motor bike using Design Thinking steps.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Develop**	Arduino/ESP32 programming for basic circuits	breadboard/Tinkercad		L3
CO2	**Analyze**	The LDR interfacing circuits	Arduino / ESP32		L4
CO3	**Analyze**	The control of traffic light circuit, sensor-based servomotor and mobile app-based LED			L4
CO4	**Design**	A walking robot and rocket	3D Printing Technology		L6
CO5	**Create**	A prototype for soil moisture monitor and redesign a motor bike	Design Thinking steps		L6

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.

List of experiments:
1) Make your own parallel and series circuits using breadboard for any application of your choice. **(CO1)**
2) Demonstrate a traffic light circuit using breadboard**.(CO3)**
3) Build and demonstrate automatic Street Light using LDR. **(CO2)**
4) Simulate the Arduino LED blinking activity in Tinkercad. **(CO1)**
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.(CO1)
6) Interfacing IR Sensor and Servo Motor with Arduino.(CO3)
7) Blink LED using ESP32. **(CO1)**
8) LDR Interfacing with ESP32.**(CO2)**
9) Control an LED using Mobile App. (CO3)
10) Design and 3D print a Walking Robot **(CO4)**
11) Design and 3D Print a Rocket. **(CO4)**
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard. (CO5)
13) Demonstrate all the steps in design thinking to redesign a motor bike. **(CO5)**

Students need to refer to the following links:

Course Outcomes: The students will be able to experiment, innovate, and solve real-world challenges.
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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation BTL (0-3)
1	**CO1: Develop**	L3	**PO1** **PO5**	**PO1: Apply(L3**) **PO5: Select(L1)**	3 3
2	**CO2: Analyze**	L4	**PO2** **PO3** **PO5**	**PO2: Review (L3)** **PO3: Develop(L3)** **PO5: Create (L6)**	3 3 1
3	**CO3: Analyze**	L4	**PO3** **PO5** **PO9** **PO10**	**PO3: Design (L6)** **PO5: Create(L6)** **PO9: Thumb rule** **PO10: Thumb rule**	1 1 3 3
4	**CO4: Design**	L6	**PO3** **PO4** **PO5**	**PO3: Analyze(L4)** **PO4: Design(L6)** **PO5: Create(L6)**	3 3 3
5	**CO5: Create**	L6	**PO2** **PO3** **PO5** **PO6** **PO9** **PO10** **PO11**	**PO2: Review(L2)** **PO3: Analyze(L4)** **PO5:Create(L6)** **PO6:Thumb rule** **PO9:Thumb rule** **PO10:Thumb rule** **PO11: Thumb rule**	3 3 3 3 3 3 3

Justification Statements:

CO1: Develop Arduino/ESP32 programming for basic circuits using breadboard/Tinkercad
Action Verb: **Develop (L3)**
PO1 Verb: Apply (L3)
CO1 Action verb is equal as PO1 verb. Therefore, the correlation is high (3)
PO5 Verb: Select (L1)
CO1 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

CO2: Analyze the LDR interfacing circuits with Arduino / ESP32 controllers.

Action Verb: Analyze (L4)
PO2 Verb: Review (L3)
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO2 Action verb is lesser than as PO5 verb by two levels Therefore, the correlation is low (1)

CO3: Analyze the control of traffic light circuit, sensor-based servomotor and mobile app-based LED.
Action Verb: Analyze (L4)
PO3 Verb: Design (L6)

CO3 Action verb is lesser than PO3 verb by two levels. Therefore, the correlation is low (1)
PO5 Verb: Create (L6)
CO3 Action verb is lesser than PO5 verb by two levels Therefore, the correlation is low (1)
PO9: Thumb rule
CO3 using Thumb rule, correlates with PO9 as high (3)
PO10: Thumb rule
CO3 using Thumb rule, correlates with PO10 as high (3)

CO4: Design a walking robot and rocket using 3-Dimensional (3D) printing Technology.

Action Verb: Design (L6)
PO3 Verb: Analyze (L4)
CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO4 Verb: Design (L6)
CO4 Action verb is equal to PO4 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO4 Action verb is equal to as PO5 verb. Therefore, the correlation is high (3)

CO5: Create a prototype for soil moisture monitor and redesign a motor bike using Design Thinking steps
Action Verb: Create (L6)

PO2 Verb: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Analyze (L4)
CO5 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: Create (L6)
CO5 Action verb is equal to PO5 verb. Therefore, the correlation is high (3)
PO6 Verb: Thumb rule
CO5 using Thumb rule, correlates with PO6 as high (3)
PO9: Thumb rule
CO5 using Thumb rule, correlates with PO9 as high (3)
PO10: Thumb rule
CO5 using Thumb rule, correlates with PO10 as high (3)
PO11: Thumb rule
CO5 using Thumb rule, correlates with PO11 as high (3)

Course Code	Year & Sem	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (Qualitative Treatment)	L	T / CLC	P	C
23AES0504	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the transition from classical to quantum physics and quantum states**.**

CO2: Understand qubits, quantum systems, and their philosophical significance.

CO3: Analyze quantum computer requirements, system fragility, hardware platforms, and software roles.

CO4: Analyze quantum information, communication, computing, and their future potential.

CO5: Apply quantum applications, industry cases, challenges, and opportunities.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the transition from classical		to quantum physics and quantum states**.**	L2
CO2	**Understand**	qubits, quantum systems, and their philosophical significance			L2
CO3	**Analyze**	quantum computer requirements, system fragility, hardware platforms, and software roles.			L4
CO4	**Analyze**	quantum information, communication, computing, and their future potential.			L4
CO5	**Apply**	quantum applications, industry cases, challenges, and opportunities.			L3

UNIT – I	Introduction to Quantum Theory and Technologies	9 Hrs

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 Hrs

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 Hrs

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 Hrs

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 Hrs

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

Textbooks:

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**:**

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	9	20	2	CO1: Understand	L2		PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	2 1 3
2	9	20	2	CO2: Understand	L2		PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	2 1 3
3	9	20	2	CO3: Analyze	L4		PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	3 3 3

4	9	20	2	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO11: Thumb Rule	3 3 3
5	9	20	2	CO5: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Apply(L3) PO11: Thumb Rule	3 3 3
	45	100						

Justification Statements:

CO1: Understand the transition from classical to quantum physics and quantum states**.**
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than one level PO1 verb. Therefore, the correlation is moderate (2)
PO2 Verb: Analyze (L4)
CO1 Action verb is less than two level PO2 verb. Therefore, the correlation is low (1)
PO11: Thumb Rule
Quantum physics demands that we accept probability and discreteness at nature's core. Therefore, the correlation is high (3)
CO2: Understand qubits, quantum systems, and their philosophical significance.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action verb is less than one level PO1 verb. Therefore, the correlation is moderate (2)
PO2: Analyze **(L4)**
CO2 Action verb is less than two level PO2 verb. Therefore, the correlation is low (1)
PO11: Thumb Rule
A qubit is a superposed quantum state that enables powerful new ways to store and process information. Therefore, the correlation is high (3)

CO3: Analyze quantum computer requirements, system fragility, hardware platforms, and software roles.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO11: Thumb Rule
Building a quantum computer requires stable qubits, precise control, error correction, and scalability. Therefore, the correlation is high (3)

CO4: Analyze quantum information, communication, computing, and their future potential.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO11: Thumb Rule
Quantum communication and computing leverage superposition, entanglement, and no-cloning to enable secure communication and powerful computation. Therefore, the correlation is high (3)

CO5: Analyze quantum applications, industry cases, challenges, and opportunities.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action verb is same as PO . Therefore, the correlation is high(3)
PO2: Apply(L3)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO11: Thumb Rule
Quantum technologies enable breakthroughs in healthcare, materials, optimization, and security. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
COMPUTER SCIENCE AND ENGINEERING (CSE)
(Effective for the batches admitted in 2023-24)

Semester VI (Third year)

Sl. No.	Category	Course Code	Course Title	L	T / CLC	P	C	CIE	SEE	Total
				Hours per week			**Credits**			
1	PC	23APC0518	Machine Learning	2	1	0	3	30	70	100
2	PC	23APC0520	Cloud Computing	2	1	0	3	30	70	100
3	PC	23APC0521	Cryptography and Network Security	2	1	0	3	30	70	100
4	PE-II	23APE0505	**Professional Elective-II** Software Testing Methodologies	2	1	0	3	30	70	100
		23APE0506	Cyber Security							
		23APE0507	DevOps							
		23APE0508	Embedded Systems Design							
5	**PE-III**	23APE0509	**Professional Elective-III** Software Project Management	2	1	0	3	30	70	100
		23APE0510	Mobile Adhoc Networks							
		23APE0511	Natural Language Processing							
		23APE0512	Distributed Operating System							
6	**OE-II**		***Open Elective-II**	2	1	0	3	25	75	100
7	PC	23APC0519	Machine Learning Lab	0	0	3	1.5	30	70	100
8	PC	23APC0522	Cryptography and Network Security Lab	0	0	3	1.5	30	70	100
9	SC	23ASC0504	**Skill Enhancement Course** Full Stack Development - II	0	1	2	2	30	70	100
10	AC	23AMC9902	**Audit Course** Technical Paper Writing & IPR	2	0	0	-	30		30
11	SC	23ASC0505	TECHNICAL WORKSHOP	-	-	-	-	0	0	0
			Total	14	07	08	23	295	635	930

NOTE: The workshop can be conducted in either III-I Semester or III-II semester. Participants with 90% or above attendance must submit their participation certificate to the Examination Section before the notification for the III-II regular examinations is issued.

*Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23AOE0103	Disaster Management	CIVIL
2.	23AOE0104	Sustainability In Engineering Practices	
3.	23AOE0202	Renewable Energy Sources	EEE
4.	23APE0322	Automation and Robotics	ME
5.	23AOE0402	Digital Electronics	ECE
6.	23AOE9902	Advanced Operations Research	Mathematics
7.	23AOE9903	Mathematical Foundation of Quantum Technologies	
8.	23AOE9907	Physics Of Electronic Materials and Devices	Physics
9.	23AOE9912	Chemistry Of Polymers and Applications	Chemistry
10.	23AOE9916	Academic Writing and Public Speaking	Humanities

Course Code	Year & Sem	MACHINE LEARNING	L	T / CLC	P	C
23APC0518	III-II		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the types of Machine Learning and preparing to model.

CO2: Evaluate the hypotheses by comparing its learning algorithms

CO3: Evaluate the decision making problems by using SVM and graphical models

CO4: Apply the supervised learning techniques for few machine learning problems.

CO5: Analyze the Unsupervised learning methods using clustering methods.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the types of Machine Learning and preparing to model.			L2
CO2	Evaluate	the hypotheses	by comparing its learning algorithms		L5
CO3	Evaluate	The decision making problems	by using SVM and graphical models		L5
CO4	Apply	The supervised learning techniques		for few machine learning problems	L3
CO5	Analyze	The Unsupervised learning methods	using clustering methods.		L4

UNIT – I	**Introduction to Machine Learning &Preparing to Model**	**8 Hrs**

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	**Modelling and Evaluation &Basics of Feature Engineering**	**8 Hrs**

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

UNIT – III	**Bayesian Concept Learning & Supervised Learning: Classification**	**9 Hrs**

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 – IV	**Supervised Learning: Regression**	**9 Hrs**

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 – V	**Unsupervised Learning**	**9 Hrs**

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

Textbooks:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, ―Introduction to Machine Learning‖, MIT Press, 2004.
2. Stephen Marsland, ―Machine Learning -An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
3. Andreas C. Müller and Sarah Guido ―Introduction to Machine Learning with Python: A Guide for Data Scientists‖, Oreilly.

Online Resources:

1. Andrew Ng, ―Machine Learning B.Techning‖
   https://www.deeplearning.ai/machine-learning- B.Techning/
2. 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

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
							CO	
1	8	19%	2	Understand	L2	PO1	PO1: Apply(L3)	2
						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop(L3)	2
						PO5	PO5: Apply(L3)	2
2	8	19%	2	Evaluate	L5	PO1	PO1: Apply(L3)	3
						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	3
						PO5	PO5: Apply(L3)	3
						PO8	PO8: Thumb rule	3
						PO11	PO11: Thumb rule	3
3	9	21%	3	Evaluate	L5	PO1	PO1: Apply(L3)	3
						PO2	PO2: Analyze(L4)	3
						PO3	PO3: Design (L6)	2
						PO4	PO4: Design (L6)	2
						PO5	PO5: Create(L6)	2
						PO7	PO7: Thumb rule	3
						PO11	PO11: Thumb rule	3
4	9	21%	3	Apply	L3	PO1	PO1: Apply(L3)	3
						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop (L3)	3
						PO4	PO4: Analyze (L4)	2
						PO5	PO5: Apply(L3)	3
						PO6	PO6: Thumb rule	2
5	9	21%	3	Analyze	L4	PO1	PO1: Apply(L3)	3
						PO2	PO2: Review(L2)	3
						PO3	PO3: Develop(L3)	3
						PO4	PO4: Analyze(L4)	3
						PO5	PO5: Apply(L3)	3
						PO8	PO8: Thumb rule	3
						PO11	PO11: Thumb rule	3
	43							

Justification Statements:
CO1: Understand the types of Machine Learning and preparing to model.
Action Verb: Understand(L2)
PO1 Verb: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop(L3)
CO2 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO5: Apply(L3)

CO2 Action verb is less than PO5 verb by one level. Therefore, the correlation is moderate (2)

CO2: Evaluate the hypotheses by comparing its learning algorithms
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO2 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2 Verb : Review(L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is High(3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore, the correlation is High (3)
PO4: Analyze (L4)
CO2 Action verb is greater than PO4 verb. Therefore the correlation is High(3)
PO5 Verb : Apply(L3)
CO2 Action verb is greater than PO5 verb. Therefore, the correlation is High (3)
PO8 : Thumb rule
While creating hypothesis one need to follow the ethical principles. Therefore, the correlation is High (3)
PO11: Thumb rule
In current scenario all machine learning models are updating so one needs to follow the change. Therefore, the correlation is high (3)

CO3: Evaluate the decision making problems by using SVM and graphical models
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO3 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2: Analyze (L4)
CO3 Action verb is greater level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is medium(2)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5: Create(L6)
CO3 Action verb is less than PO5 verb by one level. Therefore the correlation is medium(2)
PO7: Thumb rule
While making decisions for solving real world problems one must follow the ethical principles. Therefore, the correlation is High (3)
PO11: Thumb rule
For developing solutions for future problems a continuous study is need. Therefore, the correlation is high (3)

CO4: Apply the supervised learning techniques for few machine learning problems
Action Verb : Apply (L3)
PO1 Verb : Apply(L3)
CO4 Action verb is same level of PO1 verb. Therefore, the correlation is High (3)
PO2 Verb : Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is High(3)
PO3: Develop (L3)
CO4 Action verb is same level of PO3 verb. Therefore, the correlation is High (3)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)
PO5 Verb : Apply(L3)
CO4 Action verb is same level of PO5 verb. Therefore, the correlation is High (3)
PO6: Thumb rule
Some of the machine learning models will provide solutions to current societal problems. Therefore the correlation is medium (2)

CO5: Analyze the Unsupervised learning methods using clustering methods.
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)
PO2 Verb : Review(L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is High(3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore, the correlation is High (3)

PO4: Analyze (L4)

CO5 Action verb is greater than PO4 verb. Therefore the correlation is High(3)
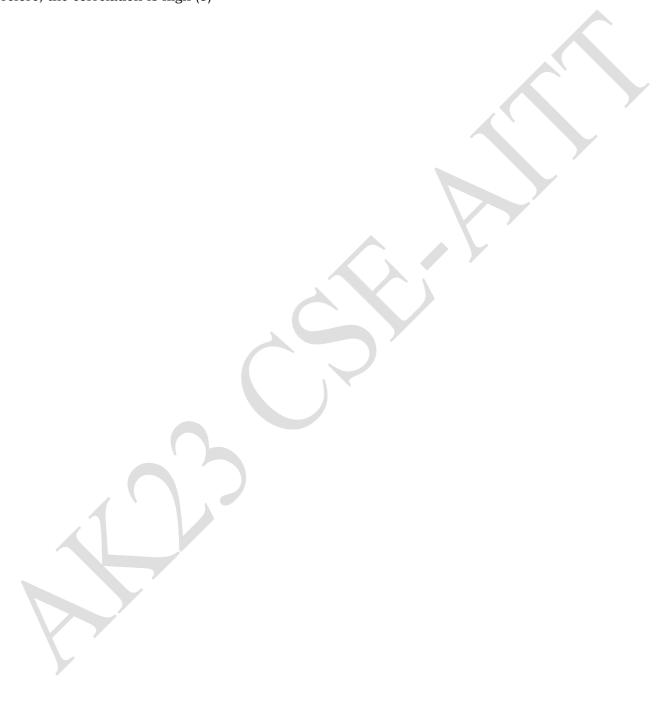
PO5 Verb : Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore, the correlation is High (3)

PO8 : Thumb rule

some ethical principles will apply while training a model using discrimination methods. Therefore, the correlation is High (3)

PO11: Thumb rule

In today's world training a machine is big challenge to the developers, it is a continuous learning process. Therefore, the correlation is high (3)

Course Code	Year & Sem	CLOUD COMPUTING	L	T/CLC	P	C
23APC0520	III-II		2	1	0	3

Pre-Requisites				Semester	

Course Outcomes (CO): Student will be able to

CO1	**Understand** the cloud computing basic concepts, technologies and services
CO2	**Understand** the Hadoop,python basics on application design
CO3	**Apply** python on cloud applications
CO4	**Apply** big data analytics,multimedia cloud on cloud applications.
CO5	**Analyze** cloud security on industry,healthcare and education

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Cloud concepts, technologies and services			L2
CO2	Understand	Hadoop, python basics	On Application design		L2
CO3	Apply	Python	On cloud applications		L3
CO4	Apply	Big data analytics,multimedia cloud	On Cloud applications		L3
CO5	Analyze	Cloud security	On Industry,Healthcare and Education		L4

UNIT – I	Basics of Cloud computing	9 Hrs

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 Hrs

Hadoop Map Reduce: 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 Hrs

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for Map Reduce, Python packages of Interest, Python web Application Frame work, Designing a REST ful web API.

Cloud Application Developmenting Python: Design Approaches, Image Processing APP, Document Storage App, Map Reduce App, Social Media Analytics App.

UNIT - IV	Big data, Multimedia and Tuning	9 Hrs

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

Cloud Application Bench marking 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 Hrs

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity

Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Health care & Education: Cloud Computing for Health care, 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 issue raised by virtualization and data location, commercial and business considerations, Special Topics.

Textbooks:

1. CloudcomputingAhands-onApproach‖ByArshdeepBahga,VijayMadisetti,Universities Press, 2016
2. CloudComputingPrinciplesandParadigms:ByRajKumarBuyya,JamesBroberg,Andrzej, Goscinski,Wiley,2016

Reference Books:

1. MasteringCloudComputingbyRajkumarBuyya,ChristianVecchiola,SThamaraiSelvi,TMH
2. Cloud computing A Hands-On Approach by Arshdeep Bahga 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. CloudApplicationArchitectures:BuildingApplicationsandInfrastructureintheCloud,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)

Correlation of COs with the POs & PSOs for B.Tech

Course Outcomes COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2						2		2
CO2	3	3	2		2			1	1		
CO3	3	2	2	1				1			
CO4	3	2	2		2				2		2
CO5	2	2		1				2			

(*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated)

CO-PO mapping justification:

Unit No.	CO					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20%	2	**CO1:Understand**	**L2**	PO1	PO1:Apply(L3)	2
						PO2	PO2:Review(L2)	3
						PO3	PO3:Develop(L3)	2
						PO9	PO9:Thumb Rule	3
						PO11	PO11:Thumb Rule	3
2	9	20%	2	**CO2:Understand**	**L2**	PO1	PO1:Apply(L3)	2
						PO2	PO2:Review(L2)	3
						PO3	PO3:Develop(L3)	2
						PO5	PO5:Apply(L3)	2
						PO8	PO8:Thumb Rule	3
						PO9	PO9:Thumb Rule	3
3	9	20%	2	**CO3:Apply**	**L3**	PO1	PO1:Apply(L3)	3
						PO2	PO2:Review(L2)	3
						PO3	PO3:Develop(L3)	3
						PO4	PO4:Analyze(L4)	2

						PO8	PO8:Thumb Rule	3
4	9	20%	2	**CO4:Apply**	**L3**	PO1 PO2 PO3 PO5 PO9 PO11	PO1:Apply(L3) PO2:Review(L2) PO3Develop(L3) PO5:Apply(L3) PO9:Thumb Rule PO11:Thumb Rule	3 3 3 3 3 3
5	9	20%	2	**CO5:Analyze**	**L4**	PO1 PO2 PO4 PO8	PO1:Apply(L3) PO2:Review(L2) PO4:Analyze(L4) PO8:Thumb Rule	2 1 3 3
	45	100						

Justification Statements:

CO1: Understanding the cloud computing concepts, technologies and services
Action Verb: Understand (L2)
PO1 verb:Apply(L3)
CO1 Action Verb Less then PO1 verb.Therefore,the correlation is moderate(2).
PO2 Verb: Review(L2)
CO1 Action verb is grater than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop(L3)
CO1 Action verb is greater than PO3 verb. Therefore the correlation is moderate(2)
PO9 Verb:Thumb Rule
Cloud computing concepts are Communicate effectively within the engineering community and society as large.Then the correlation is high(3)
PO11verb:Thumb Rule
Recognize the need of basic concepts ,technologies and services as independent and lifelong learning.Then the correlation is high(3)

CO2: Understand Hadoop,python basics on application design
Action Verb: Understand (L2)
PO1 verb Apply(L3)
CO2 action verb is one level greater then PO1.Then the correlation is moderate(2)
PO2 verb:Review(L2)
CO2 action verb is grater then PO2. Then the correlation is high(3)
PO3 verb:Develop(L3)
CO2 action verb is less then PO2.Then the correlation is moderate(2)
PO5 verb: Apply(L3)
CO2 action verb is less than PO2.Then the correlation is moderate(2)
PO8 verb:Themb Rule
Hadoop, python basics are effectively work as individual and collaboratively .Then the correlation is High(3)
PO9 verb:Thumb Rule
The concepts of Haddop and basic concepts for adesign the application for effectively communicate with the engineering community and society.Then the correlation is high(3)

CO3: Apply python on cloud applications.
Action Verb: Apply (L3)
PO1 verb:Apply(L3)
CO3 Action Verb is same as PO1.Then the correlation is high(3)
PO2 verb:Review(L2)
CO3 action verb greater then PO2.Then the correlation is high(3)
PO3 verb:Develop(3)
CO3 action verb is same as PO3.Then the correlation is high(3)
PO4 verb: Analyze(L4)
CO3 action verb is less then PO4.then the correlation is moderate(2)
PO8 verb:Thumb Rule

Python concepts are applicable for cloud applications as effectively work as individual and collaboratively as a member.Then the correlation is High(3)

CO4: Apply big data analytics,multimedia cloud on cloud applications
Action Verb: Apply (L3)
PO1 verb:Apply(L3)
CO4 Action Verb same as PO1. Then the correlation is high(3).
PO2 verb: Review(L2)
CO4 action verb is less than PO2.Then the correlation is high(3)
PO3 verb:Develop(L3)
CO4 action verb is same as PO3.Then the correlation is high(3)
PO5 verb:Apply(L3)
CO4 action verb is same as PO5.Then the correlation is high(3)
PO9 verb:Thumb Rule
Big data analytics, multimedia cloud is applicable on cloud applications for effectively communicate within engineering community and society .Then the correlation is High(3)
PO11 verb:Thumb Rule
Apply big data analytics, multimedia cloud on cloud applications as lifelong learning.Then the correlation is high(3)

CO5: Analyze cloud security on industry,healthcare and education
Action Verb: Analyze(L4)
PO1 verb:Apply(L3)
CO5 Action Verb is greater than by one level of PO1 .Then the correlation is moderate(2)
PO2 verb:Review(L2)
CO5 action verb is greater than by two levels of PO2.Then the correlation is low(1)
PO4 verb:Analyze(L4)
CO5 action verb is same as PO4.Then the correlation is high(3)
PO8 verb:Thumb Rule
Analyze cloud security on industry, healthcare and education as individual work .Then the correlation is High(3)

Course Code	Year & Sem	Cryptography and Network Security	L	T / CLC	P	C
23APC0521	III-II		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the basic Security and Cryptography concepts and techniques

CO2: **Analyze** the various cryptography algorithms for data encryption

CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message

CO4: **Apply** the various security mechanisms for E-mail and IP security

CO5: **Analyze** the various security breaches in real world applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basic Security and Cryptography concepts and techniques			L2
CO2	Analyze	The various cryptographic algoritms		for data encryption	L4
CO3	Analyze	The different MAC and HASH algorithms		to authenticate a message	L4
CO4	Apply	The security mechanism		E-mail and IP security	L3
CO5	Analyze	The various security breaches		real world applications	L4

UNIT - I		14 Hrs

Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography

Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Structure, AES Transformation Functions

UNIT - II		10 Hrs

Number Theory: The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms,

Finite Fields: Finite Fields of the Form GF(p), Finite Fields of the Form GF(2n)

Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT - III		9 Hrs

Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC &CMAC.

Digital Signatures: NIST Digital Signature Algorithm, Distribution of Public Keys,

X.509 Certificates, Public- Key Infrastructure

UNIT - IV		9 Hrs

User Authentication: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT - V		9 Hrs

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

Fire walls: Fire wall Character is tics and Access Policy, Types of Fire walls, Fire wall Location and Configurations.

Textbooks:

Cryptography and Network Security – William Stallings, Pearson Education, 8th Edition.
Cryptography, Network Security and Cyber Laws–Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books:

1. Cryptography and Network Security-BehrouzA Forouzan, Debdeep Mukhopadhyaya, Mc- Graw Hill, 3rd Edition, 2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20%	2	CO1:Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20%	2	CO2 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3 3
4	9	20%	2	CO4 : Apply	L3	PO1 PO2 PO7	PO1: Apply(L3) PO2: Review(L2) PO7: Thumb rule	3 3 2
5	9	20%	2	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO7 PO8 PO11	PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO7: Thumb rule PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
	45	100 %						

Justification Statements :

CO1: **Understand** the basic Security and Cryptography concepts and techniques

Action Verb : Understand(L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Review(L2)

CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)

CO2: **Analyze** the various cryptography algorithms for data encryption

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO2 Action verb is greater than PO1 verb .Therefore the correlation is high (3)

PO2: Review(L2)

CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

CO2 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is same as PO4 verb. Therefore the correlation is high(3)

PO5: Apply(L3)

CO2 Action verb is greater than PO5 verb .Therefore the correlation is high (3)

PO6: Thumb rule

For some of Security applications, Various Cryptographic algorithms were applied for societal needs. Therefore, the correlation is high(3)

PO11: Thumb rule

For some of Security applications, Various Cryptographic algorithms were analyzed. Therefore the correlation is high(3)

CO3: **Analyze** the different MAC and HASH algorithms to authenticate a message.

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2: Review(L2)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is same as PO2 verb. Therefore the correlation is high(3)

PO5: Apply(L3)

CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO7 : Thumb rule

Since ethical principles should be followed to while authenticating a message. Therefore the correlation is high(3)

PO8 : Thumb rule

Team work is required between client and server to perform authentication. Hence the correlation is high(3)

PO11 : Thumb rule

For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

CO4: Apply the various security mechanisms for Email and IP security**.**

Action Verb : Apply(L3)

PO1: Apply(L3)

CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Review(L2)

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO7: Thumb rule

Since ethical principles shall be followed in maintaining IP Security. Therefore the correlation is medium(2)

CO5: Analyze the various security breaches in real world applications.

Action Verb : Analyze (L4)

PO2: Review(L2)

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L3)

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)

PO5: Apply(L3)

CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO7 : Thumb rule

Since ethical principles should be followed to analyze the security breaches. Therefore the correlation is high(3)

PO8 : Thumb rule

Team work is required between client and server to secure the data. Hence the correlation is high(3)

PO11 : Thumb rule

For some of Security applications, Various Cryptographic algorithms were analysed. Therefore the correlation is high(3)

Course Code	Year & Sem	Software Testing Methodologies	L	T / CLC	P	C
23APE0505	III-II	**(Professional Elective-II)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the purpose of software testing, taxonomy of bugs, and the concepts of flow graphs and path testing.

CO2: Apply the transaction flow and data flow testing strategies to validate logical correctness and data integrity in software modules.

CO3: Analyze the domain and interface testing approaches to assess system behavior and software testability.

CO4: Create regular expressions and logic-based test cases using decision tables, path expressions, and KV charts for effective software validation.

CO5: Apply state transition testing and graph matrix techniques to evaluate system behavior and support test tool development.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the purpose of software testing, taxonomy of bugs, and the concepts of flow graphs and path testing.			L2
CO2	**Apply**	transaction flow and data flow testing strategies to validate logical correctness and data integrity in software modules.			L3
CO3	**Analyse**	domain and interface testing approaches to assess system behaviour and software testability.			L4
CO4	**Create**	regular expressions and logic-based test cases using decision tables, path expressions, and KV charts for effective software validation.			L6
CO5	**Apply**	state transition testing and graph matrix techniques to evaluate system behaviour and support test tool development.			L3

UNIT - I		9 Hrs

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs, Flow graphs and Path testing:- Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II		9Hrs

Transaction Flow Testing: transaction flows, transaction flow testing techniques. Dataflow testing:- Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT - III		9 Hrs

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT - IV		9 Hrs

Paths, Path products and Regular expressions: path products &path expression, reduction procedure, applications, regular expressions & flow anomaly detection. Logic Based Testing:-over view, decision tables, path expressions, kv charts, specifications.

UNIT - V		9 Hrs

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips. Graph Matrices and Application:-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools

Textbooks:

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.

2. Software Testing Tools – Dr. K.V.K.K. Prasad, Dreamtech.

Reference Books:

1.   The craft of software testing – Brian Marick, Pearson Education.

2.   Software Testing Techniques – SPD(Oreille)

3.   Software Testing in the Real World – Edward Kit, Pearson.

4.   Effective methods of Software Testing, Perry, John Wiley.

5.   Art of Software Testing – Meyers, John Wiley.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	9	20%	2	CO2 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyse (L4) PO3: Develop (L3) PO4: Analyse (L4) PO5:Apply(L3)	3 2 3 2 3
3	9	20%	2	CO3 : Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO7	PO1: Apply (L3) PO2: Analyse (L4) PO3: Develop (L3) PO4: Analyse (L4) PO5:Apply(L3) PO6: Thumb Rule PO7: Thumb Rule	3 3 3 3 3 3 3
4	9	20%	2	CO4 : Create	L6	PO3 PO5	PO3: Design (L6) PO5: Create(L6)	3 3
5	9	20%	2	CO5 :Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyse (L4) PO3: Develop (L3) PO4: Analyse (L4) PO5:Apply(L3)	3 2 3 2 3
	45	100 %						

Justification Statements :

CO1: Understand the purpose of software testing, taxonomy of bugs, and the concepts of flow graphs and path testing.

Action Verb : Understand(L2)

PO1 : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 : Review(L2)

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the transaction flow and data flow testing strategies to validate logical correctness and data integrity in software modules.

Action Verb : Apply (L3)

PO1: Apply(L3)

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO2 Action verb is less than PO2 verb by one level. Therefore the correlation is medium(2)

PO3: Develop (L3)

CO2 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

PO5:Apply(L3)

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

CO3:Analyze the domain and interface testing approaches to assess system behavior and software testability.

Action Verb : Analyze (L4)

PO1: Apply (L3)

CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO3: Develop (L3)

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)

PO5:Apply(L3)

CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)

PO6 : Thumb rule

Apply contextual knowledge is used for society to address the security issues so correlation is high(3)

PO7: Thumb rule

The ethical knowledge is used to perform operations . Hence the correlation is high (3)

CO4: Create regular expressions and logic-based test cases using decision tables, path expressions, and KV charts for effective software validation.

Action Verb : Create (L6)

PO3: Design (L6)

CO4 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO4 Action verb is same as PO5 verb. Therefore the correlation is high (3)

CO5: state transition testing and graph matrix techniques to evaluate system behaviour and support test tool development.

PO1: Apply(L3)

CO5 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Analyze (L4)

CO5 Action verb is less than PO2 verb by one level. Therefore the correlation is medium(2)

PO3: Develop (L3)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

PO5:Apply(L3)

CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	Cyber Security (Professional Elective-II)	L	T/CLC	P	C
23APE0506	III-II		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the fundamentals of cybercriminals and information security.

CO2: Analyze the cybercriminals plan attack and execute cyber offenses using techniques.

CO3: Apply the credit card frauds in mobile and Wireless computing Era.

CO4: Apply the methods used in cybercrime and finding the DDos attacks.

CO5: Evaluate the different types of web-based threats and suggest preventive measures.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	the fundamentals of cybercriminals and information security			L2
CO2	Analyze	The cybercriminals plan and execute cyber offenses	using techniques		L4
CO3	Apply	the credit card frauds in mobile and Wireless computing Era			L3
CO4	Apply	the methods used in cybercrime		finding the DDos attacks	L3
CO5	Evaluate	evaluate different types of web-based threats and suggest preventive measures.			L5

UNIT – I Introduction to Cybercrime		8 Hrs

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT – II Cyber Offenses: How Criminals Plan Them		9 Hrs

Introduction , How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing .

UNIT – III Cybercrime: Mobile and Wireless Devices		9 Hrs

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones,

mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT IV Tools and Methods Used in Cybercrime		8 Hrs

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V Cyber Security:Organizational Implications		8 Hrs

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal
    Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1 .Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2.Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	8	19%	2	CO1:Understand	L2	PO1 PO2 PO5 PO10	PO1: Apply (L3) PO2: Review (L2) PO5: Apply (L3) PO10: Thumb rule	3 2 2 2
2	9	21%	3	CO2: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 3 3
3	9	21%	3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2
4	8	19%	2	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2
5	8	19%	2	CO5: Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb rule PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3 3 3 3
	42	100 %						

Justification Statements:

    CO1: **Understand** the fundamentals of cybercriminals and information security.

      Action Verb: Understand (L2)

PO1: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2: Review (L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)
PO10: **Thumb rule**
CO1 supports effective communication in documentation and presentation. Therefore, the correlation is medium (2)

       CO2: **Analyze** the cybercriminals plan attack and execute cyber offenses using techniques.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L3)
CO2 Action verb is greater than PO3 verb by one level. Therefore, the correlation is medium (2)
PO4: Analyze (L4)
CO2 Action verb is same level as PO4 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO2 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)
PO8: Team Work (L3)
CO2 includes teamwork in LAN/protocol analysis. Therefore, the correlation is high (3)
PO11: **Thumb rule**
CO2 Action verb is greater than PO11 verb by one level. Therefore, the correlation is high (3)

       CO3: Apply the credit card frauds in mobile and Wireless computing Era.
       Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Design (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is medium (2)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO8: **Thumb rule**
CO4 involves simulation teamwork. Therefore, the correlation is medium (2)
PO11: **Thumb rule**
CO4 helps in adapting tools. Therefore, the correlation is medium (2)

       CO4: **Apply** the methods used in cybercrime and finding the DDos attacks.
       Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Design (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is medium (2)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
PO8: **Thumb rule**
CO4 involves simulation teamwork. Therefore, the correlation is medium (2)
PO11: **Thumb rule**
CO4 helps in adapting tools. Therefore, the correlation is medium (2)

       CO5: Evaluate the different types of web-based threats and suggest preventive measures.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO3 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)

PO3: Design (L3)

CO3 Action verb is greater than PO3 verb by two levels. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)

PO5: Apply (L3)

CO3 Action verb is greater than PO5 verb by two levels. Therefore, the correlation is high (3)

PO6: **Thumb rule**

CO3 Action verb is greater than PO6 verb by one level. Therefore, the correlation is high (3)

PO7: **Thumb rule**

CO3 involves routing decisions with ethical implications. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO3 requires collaboration in simulations. Therefore, the correlation is high (3)

PO9: **Thumb rule**

CO3 supports communication through evaluation reports. Therefore, the correlation is high (3)

PO11: **Thumb rule**

CO3 supports life-long learning in evolving protocols. Therefore, the correlation is high (3)

Course Code	Year & Sem	Devops	L	T / CLC	P	C
23APE0507	III-II	**(Professional Elective-II)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the principles, cultural foundations, and adoption strategies of DevOps for enabling organizational transformation.

CO 2: Apply business model canvas components and DevOps plays to optimize the software delivery pipeline and align with organizational goals.

CO 3: Analyze DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.

CO 4: Evaluate enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.

CO 5: Create a roadmap for DevOps adoption in large organizations by designing pilot projects, fostering collaboration, and managing change initiatives.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the principles, cultural foundations, and adoption strategies of DevOps		for enabling organizational transformation.	L2
CO2	**Apply**	business model canvas components and DevOps plays		to optimize the software delivery pipeline and align with organizational goals.	L3
CO3	**Analyse**	DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.			L4
CO4	**Evaluate**	enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.			L5
CO5	**Create**	roadmap for DevOps adoption in large organizations	by designing pilot projects, fostering collaboration, and managing change initiatives.		L6

UNIT - I		9 Hrs

DevOps: An Overview, DevOps: Origins, DevOps: Roots, DevOps: Practices DevOps: Culture.
Adopting DevOps: Developing the Playbook. Developing a Business Case for a DevOps: Developing the Business Case

UNIT - II		9Hrs

Completing the Business Model Canvas, Customer Segments, Value Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. **DevOps Plays for Optimizing the delivery Pipeline**: DevOps as an optimization Exercise, Core Themes, The DevOps Plays, Specializing Core Plays

UNIT - III		9 Hrs

DevOps Plays for Driving Innovation: Optimize to Innovate, The Uber Syndrome, Innovation and the Role of Technology, Core Themes, play: Build a DevOps Platform, play: Deliver Micro services Architectures, play: DevOps an API Economy, play: Organizing for Innovation.

UNIT - IV		9 Hrs

Scaling DevOps for the Enterprise: Core Themes, play: DevOps Center of Competency, play: Developing Culture of Innovation at Scale, play: Developing a Culture of continuous Improvement, play: Team Models for DevOps, play: Standardization of Tools and Process, play: Security Considerations for DevOps, Play:

DevOps and Outsourcing.

UNIT - V		9 Hrs

Leading DevOps Adoption in the Enterprise: Play: DevOps as a transformation Exercise, play: Developing a Culture of Collaboration and Trust, play: DevOps Thinking for the Line of Business, play: starting with Pilot Projects, Play: Rearing Unicorns on an Aircrafts Carrier. Appendix Case Study: Example DevOps Adoption Roadmap Organization Background, Roadmap Structure, Adoption Roadmap.

Textbooks:

1. Sanjeev Sharma, The Dev Ops Adoption Playbook, Published by John Wiley & Sons, Inc.2017

Reference Books:

1. Sanjeev Sharma & Bernie Coyne, Dev Ops for Dummies, Published by John Wiley & Sons, Inc.
2. Michael Huttermann, Dev Ops for Developers, Apress publishers,2012.

Online Learning Resources:

Learning DevOps with Terra form Infrastructure Automation Course |Udemy

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	9	20%	2	Understand	L2		PO1 PO2 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO11: Thumb Rule	3 2 2
2	9	20%	2	Apply	L3		PO1 PO2 PO3 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO5: Apply (L3) PO8: Thumb Rule PO11: Thumb Rule	3 3 3 3 2 2
3	9	20%	2	Analyze	L4		PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb Rule PO11: Thumb Rule	3 3 2 2 3 3 3
4	9	20%	2	Evaluate	L5		PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb Rule PO7: Thumb Rule PO8: Thumb Rule PO9: Thumb Rule PO10: Thumb Rule PO11: Thumb Rule	3 3 3 3 3 3 3 3 3 3 3
5	9	20%	2	Create	L6		PO3 PO5	PO3: Design (L6) PO5: Create(L6)	3 3
	45	100%							

Justification Statements :
CO1: Understand the principles, cultural foundations, and adoption strategies of DevOps for enabling organizational transformation.
Action Verb: Understand (L2)
PO1: CO1 Action verb is one level lower than PO1 verb (Apply - L3). Therefore, the correlation is medium (2)
PO2: Analyze (L4)
CO1 Action verb is two levels lower than PO2 verb (Analyze - L4). Therefore, the correlation is low (2)
PO11: Thumb Rule
CO1 supports life-long learning of modeling practices. Therefore, the correlation is medium (2)
CO2: Apply **business model canvas components and DevOps plays to optimize the software delivery pipeline and align with organizational goals.**
Action Verb: Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is one level lower than PO2 verb. Therefore, the correlation is medium (3)
PO3: Design (L6)
CO2 Action verb is same as PO3 verb (Design - L3). Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO8: Thumb Rule
Team collaboration helps implement class diagrams. Correlation is medium (2)
PO11: Thumb Rule
CO2 supports modeling as a learning process. Correlation is medium (2)
CO3: Analyze DevOps strategies for innovation through platform development, microservices, APIs, and organizational restructuring.
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is one level higher than PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is one level higher than PO3 verb. Therefore, the correlation is medium (2)
PO4: Design (L6)
CO3 Action verb is same as PO4 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO3 Action verb is one level higher than PO5 verb. Therefore, the correlation is high (3)
PO8: Thumb Rule
Behavioral modeling requires collaboration. Correlation is high (3)
PO11: Thumb Rule
Diagram-based analysis supports learning. Correlation is high (3)
CO4: Evaluate enterprise-level DevOps practices including scaling innovation, standardization, team models, and security integration.
Action Verb: Evaluate (L5)
PO1: Apply(L3)
CO5 Action verb is two levels higher than PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is one level higher than PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO5 Action verb is two levels higher than PO3 verb. Therefore, the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is one level higher than PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is two levels higher than PO5 verb. Therefore, the correlation is high (3)
PO6: Thumb Rule
Design patterns affect societal solutions. Correlation is high (3)
PO7: Thumb Rule
Ethical use of frameworks. Correlation is high (3)
PO8: Thumb Rule
Case study promotes collaboration. Correlation is high (3)
PO9: Thumb Rule
Patterns need effective communication. Correlation is high (3)
PO10: Thumb Rule

Projects need management frameworks. Correlation is high (3)

PO11: Thumb Rule

Patterns enhance learning. Correlation is high (3)

CO5: Create a roadmap for DevOps adoption in large organizations by designing pilot projects, fostering collaboration, and managing change initiatives.
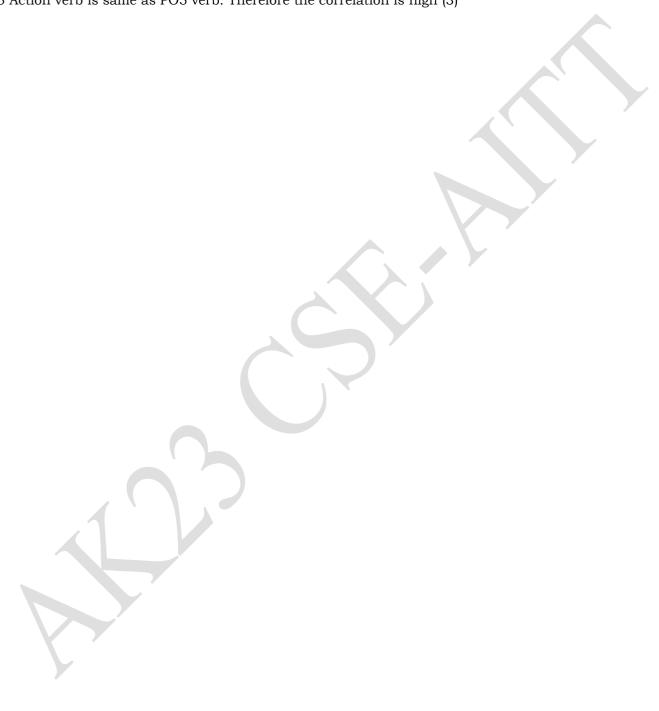
Action Verb : Create (L6)

PO3: Design (L6)

CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)

PO5: Create(L6)

CO5 Action verb is same as PO5 verb. Therefore the correlation is high (3)

Course Code	Year & Sem	EMBEDDED SYSTEMS DESIGN	L	T/CLC	P	C
23APE0508	III-II	(Professional Elective-II)	2	1	0	3

Course Outcomes: Students should be able to

CO1: Understand the classification, architecture design and applications of embedded systems

CO2: Understand various core I/O components of general purpose and domain specific embedded processors.

CO3: Analyze the operation of Onboard and External communication Interfaces such as I2C, SPI, Wi-Fi, GSM etc.,

CO4: Analyze the Embedded Firmware design approaches and development languages.

CO5: Understand the basic concepts of RTOS based embedded system design

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the classification, architecture design and applications of embedded systems			L2
CO2	Understand	various core I/O components		of general purpose and domain specific embedded processors.	L2
CO3	Analyze	the operation of Onboard and External communication Interfaces		such as I2C, SPI, Wi-Fi, GSM etc.,	L4
CO4	Analyze	the Embedded Firmware design approaches and development languages.			L4
CO5	Understand	the basic concepts of		RTOS based embedded system design	L2

UNIT - I	Introduction to Embedded Systems	12Hrs

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT - II	Typical Embedded System	17Hrs

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT - III	Communication Interface	18Hrs

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

UNIT - IV	Embedded Firmware Design and Development	19Hrs

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

UNIT - V	RTOS based Embedded System Design	24 Hrs

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication, shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Textbooks:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.		
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).		

Reference Books:

1. Embedded System Design -Frank Vahid, Tony Grivargis, john Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

Online Learning Resources:

NPTEL Videos

Mapping of Course Outcomes with Program Outcomes

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

Correlation matrix

Unit No.	CO Lesson plan (Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	12	13%	2	**Understand**	L2	PO1 PO2	PO1: Apply (L3) PO2: Identify (L3)	**2** **2**
2	17	19%	2	**Understand**	L2	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	**2** **2** **2** **1**
3	18	20%	**2**	**Analyze**	L4	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	**3** **3** **3** **3**
4	19	21%	**3**	**Analyze**	L4	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	**3** **3** **3** **3**
5	24	27%	**3**	**Understand**	L2	PO1 PO2 PO4	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4)	**2** **2** **1**
	90	100%						

Justification Statements:

CO1: Understand the classification, architecture design and applications of embedded systems
Action Verb: Understand (L2)
PO1 Verb: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3) CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).

CO2: Understand various core I/O components of general purpose and domain specific embedded processors.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3) CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3) CO2 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Identify (L3) CO2 Action Verb is less than PO3 verb by one level; Therefore correlation is moderate (2).
PO4 Verb:Analyze (L4) CO2 Action Verb is less than PO4 verb by two levels; Therefore correlation is low (1).

CO3: Analyze the operation of Onboard and External communication Interfaces such as I2C, SPI, Wi-Fi, GSM etc.,

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3) CO3 Action Verb is greater than PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3) CO3 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

PO3 Verb: Develop (L3) CO3 Action Verb is greater than PO3 verb; Therefore correlation is high (3).

PO4 Verb: Analyze (L4) CO3 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

CO4: Analyze the Embedded Firmware design approaches and development languages.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO4 Action Verb is greater than PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3) CO4 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

PO3 Verb: Develop (L3) CO4 Action Verb is greater than PO3 verb; Therefore correlation is high (3).

PO4 Verb: Analysis (L4) CO4 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

CO5: Understand the basic concepts of RTOS based embedded system design

Action Verb: Understand (L2)

PO1 Verb: Apply (L3) CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO2 verb: Identify (L3) CO5 Action verb is less than PO2 by one level; Therefore correlation is moderate (2).

PO4 verb: Analyze (L4) CO5 Action verb is less than PO4 verb by two levels; Therefore the correlation is low (1).

Course Code	Year & Sem	Software Project Management	L	T / CLC	P	C
23APE0509	III-II	**(Professional Elective-III)**	2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the purpose and importance of project management

CO2: Analyze the phases and process of software project management life cycle

CO3: Analyze process workflows and responsibilities

CO4: Analyze automation tools, process metrics, and team management strategies to determine their impact on controlling and tailoring software project processes.

CO5: Apply process control and instrumentation for CCPDS-R

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the purpose and importance of project management			L2
CO2	**Analyze**	the phases and process of software management life cycle			L4
CO3	**Analyze**	process workflows and responsibilities			L4
CO4	**Analyze**	automation tools, process metrics, and team management strategies		to determine their impact on controlling and tailoring software project processes.	
CO5	**Apply**	process control and instrumentation		for CCPDS-R	L3

UNIT - I		9 Hrs

Conventional Software Management: The water fall 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		9Hrs

The old way and the new: The principles of convention al software Engineering, principles of modern software management, transitioning to aniter ative process.

Lifecycle 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 Hrs

Work Flows of the process: Software process work flows, Inter Trans work flows.Check points of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: work break down structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning

UNIT - IV		9 Hrs

Process Automation: Automation Building Blocks, The Project Environment.

Project Control and Process instrumentation: The sevencore Metrics, Management indicators, quality **indicators Tailoring the Process:** Process discriminants. Managing people and organizing teams.

UNIT - V		9 Hrs

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)

Textbooks:

3.   Software Project Management, Walker Royce,Pearson Education,2012

4.   BobHughes,MikeCotterellandRajibMall—SoftwareProjectManagement‖,6t
   hEdition, Mc Graw Hill Edition, 2017

Reference Books:

1. PankajJalote,―SoftwareProjectManagementinpractice‖,5thEdition,PearsonEducation, 2017.
2. Murali K.Chemuturi,Thomas M.Cagley Jr.‖Mastering Software Project Management: Best Practices, Tools and Techniques‖, J.Ross Publishing, 2010
3. SanjayMohapatra,―SoftwareProjectManagement‖,CengageLearning,2011

Online Learning Resources:

http://nptel.ac.in/courses/106101061/29

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	9	20%	2	CO1 :Understand	L2	PO1 PO10	PO1: Apply(L3) PO10: Thumb rule	2 2
2	9	20%	2	CO2 : Analyze	L4	PO1 PO2 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO8: Thumb rule PO10: Thumb rule	3 3 3 3
3	9	20%	2	CO3 : Analyze	L4	PO1 PO2 PO4 PO8 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO8: Thumb rule PO10: Thumb rule	3 3 3 3 3
4	9	20%	2	CO4 : Analyze	L4	PO1 PO2 PO4	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4)	3 3 3
5	9	20%	2	CO5 : Apply	L3	PO1 PO2 PO4 PO10	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze (L4) PO10: Thumb rule	3 3 2 2
	45	100 %						

Justification Statements :

CO1: Understand the purpose and importance of project management

Action Verb: Understand (L2)

PO1: Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO10: Thumb rule

To understand the purpose and importance of project management, knowledge on projects and management principles are required. Therefore the correlation is medium (2)

CO2: Analyze the phases and process of software project management life cycle

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO2 Action verb is more than PO1 verb. Therefore the correlation is high (3)

PO2: Identify (L3)

CO2 Action verb is more than PO2 verb. Therefore the correlation is high (3)

PO8: Thumb rule

To analyze the phases and process of software project management life cycle, teamwork and individual performance is required. Therefore the correlation is high (3)

PO10: Thumb rule

To analyze the phases and process of software project management life cycle, knowledge on projects and management principles are required. Therefore the correlation is high (3)

CO3: Analyze process workflows and responsibilities
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO3 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO3 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO8: Thumb rule
To analyze process workflows and responsibilities, teamwork and individual performance is required. Therefore the correlation is high(3).
PO10: Thumb rule
To analyze process workflows and responsibilities, knowledge on projects and management principles are required. Therefore the correlation is high(3).

CO4: Analyze automation tools, process metrics, and team management strategies to determine their impact on controlling and tailoring software project processes.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO4 Action verb is more than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

CO5: Apply process control and instrumentation for CCPDS-R
Action Verb : Apply (L3)
PO1: Apply(L3)
CO5 Action verb is same as PO1 verb. Therefore the correlation is high (3)
PO2: Identify (L3)
CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO10: Thumb rule
To apply process control and instrumentation for CCPDS-R, knowledge on projects and management principles are required. Therefore the correlation is medium (2).

Course Code	Year & Sem	MOBILE ADHOC NETWORKS	L	T / CLC	P	C
23APE0510	III-II	(Professional Elective-III)	2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** MANETs and their routing algorithms based on topology, position, and other routing approaches.

CO2: **Analyze** broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.

CO3: **Understand** wireless sensor networks in terms of applications, architecture, and protocol layers.

CO4: **Evaluate** data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.

CO5: **Analyze** sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	MANETs and their routing algorithms	based on topology, position, and other routing approaches.		L2
CO2	**Analyze**	Broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.			L4
CO3	**Understand**	wireless sensor networks in terms of applications, architecture, and protocol layers.			L2
CO4	**Evaluate**	Data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.			L5
CO5	**Analyze**	Sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.			L4

UNIT - I	Introduction to Ad Hoc Networks	9 Hrs

Characteristics of MANETs, Applications of MANETs and challenges of MANETs -Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, Other routing algorithms.

UNIT - II	Data Transmission	9 Hrs

Broadcast storm problem, Broadcasting, Multicasting and Geocasting -TC Pover Ad Hoc: TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - III	Basics of Wireless, Sensors and Applications	8 Hrs

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT - IV	Data Retrieval in Sensor Networks	10 Hrs

Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots-Security: Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

UNIT - V	Sensor Network Platforms and Tools	9 Hrs

Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms -Operating System: Tiny OS -Imperative Language: nesC, Data flow style language: Tiny GALS, Node Level Simulators, ns- 2 and its sensor network extension.

Textbooks:

1. Ad Hoc and Sensor Networks –Theory and Applications, Carlos Corderio Dharma P. Aggarwal,World Scientific Publications, March 2006,ISBN –981-256-681-3

2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao,

Leonidas Guibas, Elsevier Science, ISBN –978-1-55860-914-3 (Morgan Kauffman)
Reference Books:
Online Learning Resources:

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO						Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL				
1	**9**	18%	2	Understand	L2	PO1 PO2 PO3 PO5 PO11	PO1:Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO5: Apply (L3) PO11: Thumb rule	2 1 2 2 2
2	**9**	24%	3	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO11	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO11: Thumb rule	3 3 3 3 3 3
3	8	18%	2	Understand	L2	PO1 PO2 PO5 PO6	PO1: Apply(L3) PO2: Analyse (L4) PO5: Apply (L3) PO11: Thumb rule	2 1 2 2
4	10	22%	3	Evaluate	L5	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3)	3 3 3 3 3
5	**9**	18%	2	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO9 PO10	PO1: Apply(L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO9: Thumb rule PO10: Thumb rule	3 3 3 3 3 3 3
	43	**100 %**						

Justification Statements :

CO1: Understand MANETs and their routing algorithms based on topology, position, and other routing approaches.
Action Verb**: Understand (L2)**

PO1: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2: Analyze (L4)
CO1 Action verb is less than as PO2 verb by two level . Therefore, the correlation is low(1)
PO3: Design (L3)
CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)
PO11: **Thumb rule**
CO1 supports effective communication in documentation and presentation. Therefore, the correlation is medium (2)

CO2: Analyze broadcasting, multicasting, and Geocasting in MANETs, and evaluate TCP issues and solutions in Ad Hoc networks.
Action Verb**: Analyze (L4)**

PO1: Apply (L3)
CO2 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L3)
CO2 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO2 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO2 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)
PO11: **Thumb rule**
CO2 Encourages continuous learning due to evolving wireless communication protocols.. Therefore, the correlation is high (3)

CO3: **Understand wireless sensor networks in terms of applications, architecture, and protocol layers.**
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action verb is less than PO1 verb by one levels. Therefore, the correlation is medium(2).
PO2: Analyze (L4)
CO3 Action verb is less than PO2 verb by two level. Therefore, the correlation is high (1)
PO5: Apply (L3)
CO3 Action verb is greater than PO5 verb by one levels. Therefore, the correlation is medium(2).
PO11: **Thumb rule**
CO3 Encourages continuous learning due to rapid evolution in IoT and sensor technologies. Therefore, the correlation is medium(2)

CO4: **Evaluate data retrieval and protocol support in WSNs and security mechanisms in Ad Hoc and sensor networks.**
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO4 Action verb is greater than PO1 verb by two level. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Design (L3)
CO4 Action verb is greater than PO3 verb by two level. Therefore, the correlation is high(3).
PO4: Analyze (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

CO5: Analyze sensor network hardware, programming platforms, and simulation tools like TinyOS, nesC, TinyGALS, and ns-2.
Action Verb**: Analyze (L4)**

PO1: Apply (L3)
CO5 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L3)

CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is same level as PO4 verb. Therefore, the correlation is the correlation is high (3)

PO5: Apply (L3)

CO5 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

PO9: **Thumb rule**

CO5 involves sensor network hardware, programming platforms. Therefore, the correlation is high (3)

PO10: **Thumb rule**

CO5 involves simulation tools like TinyOS, nesC, TinyGALS, and ns-2. Therefore, the correlation is high (3)

Course Code	Year & Sem	Natural Language Processing	L	T / CLC	P	C
23APE0511	III-II	**(Professional Electives-III)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the basic concepts of NLP to build language models

CO2: Apply parsing techniques to study syntactic structure of sentences in natural language

CO3: Analyze grammars and mechanisms of augmented transition network for NLP

CO4: Apply language models and semantic interpretation to NLP

CO5: Analyze machine translation and multi lingual information retrieval approaches to improve system performance

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the basic concepts of NLP		to build language models	L2
CO2	Apply	parsing techniques		to study syntactic structure of sentences in natural language	L3
CO3	Analyze	grammars and mechanisms of		augmented transition network for NLP	L4
CO4	Apply	language models and semantic interpretation		to generate compelling 2D transitions between images	L3
CO5	Analyze	machine translation and multi lingual information retrieval approaches		To improve system performance	L4

UNIT - I	Introduction to Natural language	8 Hrs

Introduction to Natural language: 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 Hrs

Grammars and Parsing: 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	8 Hrs

Grammars for Natural Language: 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	8 Hrs

Semantic Interpretation: 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 Modeling: Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modeling Problems, Multilingual and cross lingual language modeling.

UNIT - V	Machine Translation Survey	9 Hrs

Machine Translation 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 Preprocessing, 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.

Textbooks:

1.James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications : From Theory To PracticeDaniel M.Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi,Vineet chaitanya,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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	8	19%	2	CO1:Understand	L2	PO1 PO2 PO4	PO1: Apply(L3) PO2: Review(L2) PO4: Interpret(L2)	2 3 3
2	9	21%	3	CO2 : Apply	L3	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 2 3 2
3	8	19%	2	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3 3
4	8	19%	2	CO4 : Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
5	9	21%	3	CO5 :Analyze	L4	PO1 PO2 PO4 PO6 PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO6: Thumb rule PO11: Thumb rule	3 3 3 3 3
	42	100%						

Justification Statements :

CO1: Understand the basic concepts of NLP concepts to build languge models

Action Verb : Understand(L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

PO2 Verb : Review(L2)

CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)

PO4: Interpret(L2)

CO1 Action verb is same as PO4 verb. Therefore the correlation is high(3)

CO2: Apply parsing techniques to study syntactic structure of sentences in natural language

Action Verb : Apply(L3)

PO1: Apply(L3)

CO2 Action verb is same as PO1 verb .Therefore the correlation is high (3)

PO2: Identify(L3)

CO2 Action verb is same as PO2 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is less than PO4 verb by one level. Therefore the correlation is medium(2)

PO5: Apply(L3)

CO2 Action verb is same as PO5 verb .Therefore the correlation is high (3)
PO11: Thumb rule
For developing natural language applications, one needs to learn continuously. Therefore the correlation is medium(2)

CO3: Analyze grammars and mechanisms of augmented transistion network for NLP
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO5: Apply(L3)
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
For developing natural language applications, one needs to learn continuously.Therefore the correlation is high(3)

CO4: Apply language models and semantic interpretation to NLP
Action Verb : Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop(L3)
CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO11: Thumb rule
For developing natural language applications, one needs to learn continuously.Therefore the correlation is medium(2)

CO5: Analyze machine translation and multi lingual information retrieval approaches to improve system performance
Action Verb : Analyze (L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO2: Identify(L3)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same as PO4 verb. Therefore the correlation is high(3)
PO6: Thumb rule
Information retrieval methods are used in many real time applications.Therefore the correlation is high(3)
PO11: Thumb rule
In language translation retrieval approaches to improve performance gets updated regularly. Therefore the correlation is high(3)

Course Code	Year & Sem	DISTRUBUTED OPERATING SYSTEM	L	T / CLC	P	C
23APE0512	III-II	**(Professional Electives-III)**	**2**	**1**	**0**	**3**

Course Outcomes:

After studying the course, student will be able to

CO1: **Understand** the different types of system architectures in distributed systems and assess their suitability for various application scenarios.

CO2: **Apply** and compare distributed mutual exclusion algorithms and assess their efficiency and reliability.

CO3: **Evaluate** *the performance and correctness of centralized, distributed, and hierarchical deadlock detection algorithms.*

CO4: **Analyze** the structure and components of multiprocessor operating systems and discuss key design issues such as threads, synchronization, and processor scheduling

CO5: **Evaluate** the key issues and components involved in load distribution within distributed systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the different types of system architectures in distributed systems and assess their suitability		For various application scenarios	L2
CO2	**Apply**	and compare distributed mutual exclusion algorithms and assess their efficiency and reliability.			L3
CO3	**Evaluate**	the performance and correctness of centralized, distributed, and hierarchical deadlock detection algorithms.			L5
CO4	**Analyze**	the structure and components of multiprocessor operating systems and discuss key design issues	such as threads, synchronization, and processor scheduling		L4
CO5	**Evaluate**	the key issues and components involved in load distribution within distributed systems. .			L5

UNIT - I	**Architectures of Distributed Systems**	8 Hrs

System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lam port's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

UNIT - II	**Distributed Mutual Exclusion**	10 Hrs

The Classification of Mutual Exclusion Algorithms, Non-Token –Based Algorithms: Lamport's Algorithm, The Ricart-Agrawalsa Algorithm, Maekawa's Algorithm,Token- Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heurisric Algorithm,Raymond's Heuristic Algorithm.

UNIT - III	**Distributed Deadlock Detection**	8 Hrs

Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT - IV	**Multiprocessor System Architectures**	9 Hrs

Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling. Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

UNIT - V	**Distributed Scheduling**	8 Hrs

Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration Distributed Shared

Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues.

Textbooks:

Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, Tata Mc Graw- Hill Edition 2001

Reference Books:

Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	8	18%	2	Understand	L2	PO1 PO2 PO5 PO10	PO1: Apply (L3) PO2: Review (L2) PO5: Apply (L3) PO10: Thumb rule	3 2 2 2
2	10	24%	3	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 3 3
3	8	18%	2	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb rule PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3 3 3 3
4	9	22%	3	Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO8: Thumb rule PO11: Thumb rule	3 3 2 2 3 2 2
5	8	18%	2	Analyse	L4	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11	PO1: Apply (L3) PO2: Analyse (L4) PO3: Design (L3) PO4: Analyse (L4) PO5: Apply (L3) PO6: Thumb rule PO7: Thumb rule PO8: Thumb rule PO9: Thumb rule PO10: Thumb rule PO11: Thumb rule	3 3 3 2 3 3 3 3 3 3 3
	43	100 %						

Justification Statements :

CO1: Understand the fundamental concepts of computer networks and the Internet
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2: Review (L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO1 Action verb is less than PO5 verb by one level. Therefore, the correlation is medium (2)
PO10: **Thumb rule**
CO1 supports effective communication in documentation and presentation. Therefore, the correlation is medium (2)
CO2: Analyze the design issues and protocols of the data link layer
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L3)
CO2 Action verb is greater than PO3 verb by one level. Therefore, the correlation is medium (2)
PO4: Analyze (L4)
CO2 Action verb is same level as PO4 verb. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO2 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)
PO8: Team Work (L3)
CO2 includes teamwork in LAN/protocol analysis. Therefore, the correlation is high (3)
PO11: **Thumb rule**
CO2 Action verb is greater than PO11 verb by one level. Therefore, the correlation is high (3)
CO3: Evaluate routing algorithms and internetworking principles
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO3 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Design (L3)
CO3 Action verb is greater than PO3 verb by two levels. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than PO4 verb by one level. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO3 Action verb is greater than PO5 verb by two levels. Therefore, the correlation is high (3)
PO6: **Thumb rule**
CO3 Action verb is greater than PO6 verb by one level. Therefore, the correlation is high (3)
PO7: **Thumb rule**
CO3 involves routing decisions with ethical implications. Therefore, the correlation is high (3)
PO8: **Thumb rule**
CO3 requires collaboration in simulations. Therefore, the correlation is high (3)
PO9: **Thumb rule**
CO3 supports communication through evaluation reports. Therefore, the correlation is high (3)
PO11: **Thumb rule**
CO3 supports life-long learning in evolving protocols. Therefore, the correlation is high (3)
CO4: Apply transport protocols including TCP and UDP
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Design (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is medium (2)
PO4: Analyze (L4)
CO4 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO4 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO4 involves simulation teamwork. Therefore, the correlation is medium (2)

PO11: **Thumb rule**

CO4 helps in adapting tools. Therefore, the correlation is medium (2)

CO5: Analyze the principles behind network applications

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO5 Action verb is greater than PO1 verb by one level. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO5 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3: Design (L3)

CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO5 Action verb is same level as PO4 verb. Therefore, the correlation is medium (2)

PO5: Apply (L3)

CO5 Action verb is greater than PO5 verb by one level. Therefore, the correlation is high (3)

PO6: **Thumb rule**

CO5 considers societal/ethical impact. Therefore, the correlation is high (3)

PO7: **Thumb rule**

CO5 involves ethical aspects in application use. Therefore, the correlation is high (3)

PO8: **Thumb rule**

CO5 requires teamwork for application development. Therefore, the correlation is high (3)

PO9: **Thumb rule**

CO5 involves communication in web/email protocols. Therefore, the correlation is high (3)

PO10: **Thumb rule**

CO5 requires planning and management. Therefore, the correlation is high (3)

PO11: **Thumb rule**

CO5 supports emerging applications and life-long learning. Therefore, the correlation is high (3)

Subject Code	Subject Name	L	T/CLC	P	CREDITS
23AOE0103	**DISASTER MANAGEMENT** (Open Elective-II)	**2**	**1**	**0**	**3**

Course Outcomes: After studying the course, students will be able to

CO1	Understand the fundamental concepts of natural disasters, their occurrence and disaster risk reduction strategies.
CO2	Understand the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction
CO3	Understand engineering principles and computational techniques in designing wind-resistant structures
CO4	Understand earthquake effects on buildings and develop strategies for seismic retrofitting.
CO5	Understand seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	**fundamental concepts of natural disasters, their occurrence**		disaster risk reduction strategies	L2
2	Understand	**impact of cyclones on structures and explore retrofitting techniques**	for adaptive reconstruction	using various strain gauge techniques.	L2
3	Understand	**engineering principles and computational techniques**		in designing wind-resistant structures	L2
4	Understand	**earthquake effects on buildings and develop strategies**		for seismic retrofitting	L2
5	Understand	**seismic safety planning, design considerations, and innovative construction materials**		for disaster-resistant structures	L2

UNIT-I

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT-II

Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

UNIT-III

Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

UNIT-IV

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epi center, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.

UNIT-V
Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

TEXTBOOKS:
1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.

REFERENCES:
1. Ben Wisner, J.C. Gaillard, andIlanKelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.
3. BimalKanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020.

WEB RESOUCES:

https://nptel.ac.in/courses/124107010
https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
4				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
5				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

JUSTIFICATION STATEMENTS:

CO1: **Understand the fundamental concepts of natural disasters, their occurrence and disaster risk reduction strategies.**

Action Verb: Understand (L2)

PO1: Apply(L3)

CO1 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO2: **Understand the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.**

Action Verb: Understand (L2)
PO1: Apply(L3)
CO2 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO3: **Understand engineering principles and computational techniques in designing wind-resistant structures**
Action Verb: Understand (L2)
PO1: Apply(L3)
CO3 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO3 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO4: **Understand earthquake effects on buildings and develop strategies for seismic retrofitting.**
Action Verb: Understand (L2)
PO1: Apply(L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO4 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO4 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).
CO5: **Understand seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures**
Action Verb: Understand (L2)
PO1: Apply(L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO5Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

III YEAR   I SEMESTER

Subject Code	Subject Name	L	T/CLC	P	CREDITS
23AOE0104	**SUSTAINABILITY IN ENGINEERING PRACTICES** (Open Elective-II)	**2**	**1**	**0**	**3**

Course Outcomes: After studying the course, students will be able to

CO1	Understand concept of sustainability in the context of construction and CO_2 contribution of building materials along with their environmental impact
CO2	Understand the relation between construction materials and indoor air quality
CO3	Apply concepts to calculate embodied energy for commonly used construction materials using standard methodologies
CO4	Apply concepts of energy codes and green building rating systems for building envelops
CO5	Understand the environmental impacts and control methods of non-renewable energy sources

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	**Concept of sustainability and CO_2 contribution of building materials along with their environmental impact**		in the context of construction	L2
2	Understand	**The relation between construction materials and indoor air quality**			L2
3	Apply	**concepts to calculate embodied energy for commonly used construction materials**	using standard methodologies		L3
4	Apply	**concepts of energy codes and green building rating systems**		for building envelops	L3
5	Understand	**the environmental impacts and control methods**		of non-renewable energy sources	L2

UNIT-I

INTRODUCTION

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2 Contribution from Cement and Other Construction Materials.

UNIT-II

MATERIALS USED in SUSTAINABLE CONSTRUCTION

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT-III

ENERGY CALCULATIONS

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT-IV

GREEN BUILDINGS

Control of Energy Use in Building - ECBC Code, Codes in Neighbouring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings – Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT-V

ENVIRONMENTAL EFFECTS

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

TEXTBOOKS:
1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCES:
1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

WEB RESOUCES:

https://archive.nptel.ac.in/courses/105/105/105105157/

CORRELATION OF COS WITH THE POS & PSOS:

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

CO-PO MAPPING JUSTIFICATION:

Unit No	Course Outcomes					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3				Apply	L3	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	3 2 2 2
4				Apply	L3	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	3 2 2
5				Understand	L2	PO1 PO2 PO6	Apply (L3) Analyze (L4) Thumb Rule	2 2 2

JUSTIFICATION STATEMENTS:

CO 1: Understand concept of sustainability in the context of construction and CO_2 contribution of building materials along with their environmental impact

Action Verb: Understand (L2)

PO1: Apply(L3)

CO 1 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO 1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO 2: Understand the relation between construction materials and indoor air quality

Action Verb: Understand (L2)

PO1: Apply(L3)

CO 2 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2: Analyze (L4)

CO 2 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

CO 2 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

CO 3: Apply concepts to calculate embodied energy for commonly used construction materials using standard methodologies

Action Verb: Apply (L3)

PO1: Apply(L3)

CO 3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO 3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)

PO4: Analyze (L4)
CO 3: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)
CO 3 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO 4: Apply concepts of energy codes and green building rating systems for building envelops
Action Verb: Apply (L3)
PO1: Apply(L3)
CO 4 Action verb is equal to PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO 4: Action Verb is low to PO2 verb. Therefore, the correlation is medium (2)
CO 4 Action verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 as moderate (2).

CO 5: Understand the environmental impacts and control methods of non-renewable energy sources
Action Verb: Understand (L2)
PO1: Apply(L3)
CO 5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO 5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO 5 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO6 as moderate (2).

Year/Sem	III/II	Branch of Study: EEE				
Subject Code		**Subject Name**	**L**	**T/CLC/R**	**P**	**Credits**
23AOE0202		**RENEWABLE ENERGY SOURCES** **(Open Elective-II)**	**2**	**1**	**0**	**3**

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

CO1	Understand solar radiation concepts, solar angles, and solar energy collection and storage methods.
CO2	Analyze the working principles, technologies, characteristics, and configurations of solar PV systems.
CO3	Analyze the components, design, and performance factors of wind energy conversion systems.
CO4	Understand Geothermal energy sources, applications, and their potential in India.
CO5	Understand the working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Solar radiation concepts, solar angles, and solar energy collection and storage methods			L2
CO2	Analyze	Working principles, technologies, characteristics, and configurations of solar PV systems			L4
CO3	Analyze	Components, design, and performance factors of wind energy conversion systems			L4
CO4	Understand	Geothermal energy sources, applications, and potential in India			L2
CO5	Understand	Working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems			L2

SYLLABUS

UNIT-I

TITLE: Solar Energy

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT-II

TITLE: PV Energy Systems

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT-III

TITLE: Wind Energy

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT-IV

TITLE : **Geothermal Energy**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

	UNIT-V

TITLE: Miscellaneous Energy Technologies

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration.

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:	
1	G. D. Rai, ―Non-Conventional Energy Sources‖, 4th Edition, Khanna Publishers, 2000.
2	Chetan Singh Solanki ―Solar Photovoltaics fundamentals, technologies and applications‖ 2nd Edition PHI Learning Private Limited. 2012.
Reference books:	
1	Stephen Peake, ―Renewable Energy Power for a Sustainable Future‖, Oxford International Edition, 2018.
2	S. P. Sukhatme, ―Solar Energy‖, 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
3	B H Khan, ― Non-Conventional Energy Resources‖, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
4	S. Hasan Saeed and D.K.Sharma, ―Non-Conventional Energy Resources‖, 3rd Edition, S.K.Kataria& Sons, 2012.
5	G. N. Tiwari and M.K.Ghosal, ―Renewable Energy Resource: Basic Principles and Applications‖, Narosa Publishing House, 2004.
Web Resources:	
1	https://nptel.ac.in/courses/103103206
2	https://nptel.ac.in/courses/108108078

Mapping of Course outcomes with Program outcomes (High-3, Medium-2, Low-1)

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

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	CO Lesson Plan (Hrs.)	%	correlation	Verb	BTL	Program Outcomes(PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of correlation (1-3)
1				Understand	L2	**PO1, PO2, PO4, PO6**	**PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO6: Analyze(L4)**	2 1 1 1
2				Analyze	L4	**PO1, PO2, PO3, PO6**	**PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6:Analyze(L4)**	3 3 1 3
3				Analyze	L4	**PO1, PO2, PO3, PO6**	**PO1:Apply(L3) PO2:Analyze(L4) PO3:DesignL6) PO6:Analyze(L4)**	3 3 1 3
4				Understand	L2	**PO1, PO6**	**PO1:Apply(L3) PO6:Analyze(L4)**	2 1

5				Understand	L2	**PO1, PO6**	PO1:Apply(L3) PO6:Analyze(L4)	2 1

CO1: Understand solar radiation concepts, solar angles, and solar energy collection and storage methods.
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO1 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO2 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO4 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs: Analyze (L4)
CO1 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
CO2: Analyze the working principles, technologies, characteristics, and configurations of solar PV systems.
Action Verb: Analyze (L4)
PO1Verbs: Apply (L3)
CO2 ActionVerb is Greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verbs: Analyze (L4)
CO2 ActionVerb is Same to PO2 verb ; Therefore, correlation is High (3).
PO3Verbs: Design (L6)
CO2 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs:Analyze (L4)
CO2 ActionVerb is Same to PO6 verb ; Therefore, correlation is High (3).
CO3: Analyze the components, design, and performance factors of wind energy conversion systems.
Action Verb: Analyze (L4)
PO1Verbs: Apply (L3)
CO3 ActionVerb is Greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verbs: Analyze (L4)
CO3 ActionVerb is Same to PO2 verb ; Therefore, correlation is High (3).
PO3Verbs: Design (L6)
CO3 ActionVerb is Less than PO2 verb by two level; Therefore, correlation is low (1).
PO6 Verbs:Analyze (L4)
CO3 ActionVerb is Same to PO6 verb ; Therefore, correlation is High (3).
CO4: Understand Geothermal energy sources, applications, and their potential in India.
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO4 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO6 Verbs: Analyze (L4)
CO4 ActionVerb is less than PO2 verb by two level; Therefore, correlation is low (1).
CO5: Understand the working principles, technologies, and limitations of ocean, biomass, and fuel cell energy systems.
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO4 ActionVerb is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO6 Verbs: Analyze (L4)
CO4 ActionVerb is less than PO2 verb by two level; Therefore, correlation is low (1).

Subject Code	Subject Name	L	T	P	Credits
23APE0322	**Automation and Robotics** **(Open Elective-II)**	2	1	0	3

Course Outcomes:

CO: 1	Explain the need, types, and elements of automation systems and analyze different levels of automation strategies in industry.
CO: 2	Demonstrate the operation of automated flow lines and apply methods for assembly line balancing and optimization.
CO: 3	Identify robotic components and describe their configuration, degrees of freedom, and industrial applications in various processes.
CO: 4	Apply transformation techniques and D-H notation to solve problems in robot kinematics and evaluate actuator and sensor selection.
CO: 5	Analyze robot dynamics using Jacobians and Euler formulations and develop suitable trajectories for obstacle-free motion.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	structure and functions of automated		manufacturing systems	L2
CO2	Analyze	automated flow lines with or without buffer storage		assembly line balancing	L3
CO3	Understand	robot configurations	production efficiency		L2
CO4	Apply	kinematic and dynamic modeling		real-world industrial scenario	L3
CO5	Create	program, and implement robotic systems		Manufacturing.	L6

Unit I: Introduction to Automation: Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Unit II
Automated flow lines: Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Unit III
Introduction to Industrial Robotics: Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers. Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Unit IV
Manipulator Kinematics: Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics. Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Unit V
Robot Programming: Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages. Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:
1. Automation, Production systems and CIM, M.P. Groover /4thEdition, Pearson education (2016)
2. Industrial Robotics - M.P. Groover, TMH (1996)

Reference Books:
1. Robotics, Fu K S, McGraw Hill, 4th edition, 2010.

2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal, Oxford Press, 1/e, 2006
5. Robotics and Control, Mittal R K & Nagrath I J, TMH.

Online Resources:
1. https://nptel.ac.in/courses/107106090

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Automation & Robotics	CO1	3	3				3							
	CO2	3	3											
	CO3	3	3			3	2							
	CO4	3	3	3		2								
	CO5	3	3			3	1							

Correlation Matrix

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Lesson Plan (Hrs)	%	Correlation	Verb	BTL			
1				Understand	L2	PO1	Apply (L3)	2
						PO2	Identify (L3)	2
						PO6	Develop (L3)	2
2				Analyze	L3	PO1	Apply (L3)	3
						PO2	Identify (L3)	3
3				Understand	L2	PO1	Apply (L3)	2
						PO2	Identify (L3)	2
						PO5	Select (L1)	3
						PO6	Apply (L3)	2
4				Apply	L3	PO1	Apply (L3)	3
						PO2	Identify (L3)	3
						PO3	Create (L6)	3
						PO5	Create (L6)	3
5				Create	L6	PO1	Apply (L3)	3
						PO2	Identify (L3)	3
						PO5	Create (L6)	3
						PO6	Apply (L3)	3

Justification Statements:

CO1: Understand the structure and functions of automated manufacturing systems for efficient production.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO1: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO6 Verb: **Develop (L3)**
CO1 Action verb is same level as PO6 verb. Therefore, the correlation is high (3)

CO2: Analyze automated flow lines with or without buffer storage, perform quantitative evaluations, assembly line balancing techniques.
Action Verb: Understand (L2)
PO1 Verb: **Apply (L3)**
CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

CO3: Understand robot configurations and select suitable actuators and sensors to optimize production efficiency and flexibility.
Action Verb: **Creating (L6)**
PO1 Verb: **Apply (L3)**
CO3: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO3: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)

PO5 Verb: **select (L6)**
CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: **Apply (L3)**
CO3: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)

CO4: Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario.
Action Verb: **Evaluate (L5)**
PO1 Verb: **Apply (L3)**
CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: **Creating (L6)**
CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO5 Verb: **Creating (L6)**
CO3: Action verb is same level as PO5 verb. Therefore, the correlation is high (3)
CO5: Create program, and implement robotic systems to perform manufacturing tasks.
Action Verb: **Creating (L6)**
PO1 Verb: **Apply (L3)**
CO2: Action verb is same level (greater) as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Identify (L3)**
CO2: Action verb is same level (greater) as PO2 verb. Therefore, the correlation is high (3)
PO5 Verb: **Creating (L6)**
CO3: Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO6 Verb: **apply (L3)**
CO3: Action verb is same level as PO6 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	DIGITAL ELECTRONICS	L	T/CLC	P	C
23AOE0402	III-I	(Open Elective-II)	2	1	0	3

Course Outcomes:

CO1: Understand the logic gates and minimization of Boolean functions using K-Maps.
CO2: Analyze the design procedure of Arithmetic circuits and code conversions using logic gates.
CO3: Analyze the design concepts of combinational logic circuits using logic gates.
CO4: Analyze the design aspects of sequential logic circuits using flip flops.
CO5: Understand various programmable logic devices and digital ICs.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the logic gates and minimization of Boolean functions using K-Maps.	using K-Maps		L2
CO2	Analyze	the design procedure of Arithmetic circuits and code conversions using gates.	using logic gates.		L4
CO3	Analyze	the design concepts of combinational logic circuits	using logic gates.		L4
CO4	Analyze	the design aspects of sequential logic circuits using flip flops.	using flip flops.		L4
CO5	Understand	various programmable logic devices and digital ICs.			L2

UNIT - I		21Hrs

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II		12Hrs

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display

UNIT - III		19Hrs

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT - IV		12Hrs

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers

UNIT - V		11Hrs

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL).
Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de- multiplexer (74x155), comparator (74x85).

Textbooks:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd   Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004

Online Learning Resources:

Nptel videos

Mapping of Course Outcomes with Program Outcomes

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

Correlation matrix

Unit No.	CO Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	14	18%	2	Understand	**L2**	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	**2** **2** **2** **1**
2	18	23%	4	Analyze	**L4**	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze(L4)	**3** **3** **3** **3**
3	14	18%	**4**	Analyze	**L4**	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze(L4)	**3** **3** **3** **3**
4	16	21%	**4**	Analyze	**L4**	PO1 PO3 PO4	PO1: Apply (L3) PO3: Develop (L3) PO4: Analyze(L4)	**3** **3** **3**
5	16	20%	**2**	Understand	**L2**	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3)	**2** **2** **2**
	76	100%						

Justification Statements:
CO1: Understand the logic gates and minimization of Boolean functions using K-Maps.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2 Verbs: Identify (L3) CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO3 Verbs: Develop (L3) CO1 Action Verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).
PO4 Verbs: Analyze (L4) CO1 Action verb is less than PO4 verb by two levels. Therefore, the correlation is low (1)
CO2: Analyze the design procedure of Arithmetic circuits and code conversions using logic gates.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO2 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3)
PO2 Verbs: Identify (L3) CO2 Action verb is more than PO2 verb by one level. Therefore, the correlation is high (3)
PO3 Verbs: Develop (L3) CO2 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3)
PO4 Verbs: Analyze (L4) CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).
CO3: Analyze the design concepts of combinational logic circuits using logic gates.
Action Verb: Analyze (L4)
PO1 Verbs: CO3 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3).
PO2 Verbs: CO3 Action verb is more than PO2 verb by one level. Therefore, the correlation is high (3).
PO3 Verb: CO3 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3).

PO4 Verbs: CO3 Action Verb is equal to PO4 verb, therefore correlation is high (3).

CO4: Analyze the design aspects of sequential logic circuits using flip flops.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO4 Action verb is more than PO1 verb by one level. Therefore, the correlation is high (3).

PO2 Verb: Identify (L3) CO4 Action verb is more than PO3 verb by one level. Therefore, the correlation is high (3).

PO4 Verb: Develop (L3) CO4 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

CO5: Understand various programmable logic devices and digital ICs.

Action Verb: Understand (L2)

PO1 Verb: CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

PO2 verb: CO5 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).

PO3 verb: CO5 Action Verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

Subject Code: 23AOE9902	Subject Name: ADVANCED OPERATIONS RESEARCH (Open Elective II)	L 2	T 1	P 0	Credits 3

Course Outcomes (CO): Student will be able to

1. Understand the concepts of linear programming in solving practical problems in industry.
2. Analyze the transportation models to trace the solutions to the real-world problems.
3. Apply mathematical skills to solve nonlinear programming models arising from a wide range of applications.
4. Apply the concept of non-linear programming for solving non-linear constraints.
5. Apply the concept of unconstrained geometric programming for solving the non-linear constraints.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the concepts of linear programming	in solving practical problems in industry.		**L2**
2	**Analyze**	the transportation models	to trace the solutions	to the real-world problems.	**L4**
3	**Apply**	mathematical skills	to solve nonlinear programming models	arising from a wide range of applications.	**L3**
4	**Apply**	the concept of non-linear programming	for solving non-linear constraints.		**L3**
5	**Apply**	the concept of unconstrained geometric programming	for solving the non-linear constraints.		**L3**

UNIT – I: Linear programming I   **8 hours**

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming.

UNIT–II : Linear programming II: Duality in Linear Programming   **8 hours**

Simplex Method, Simplex Algorithm and, Big-M method. Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method.

UNIT – III : Linear programming III

Transportation Problem and assignment problem, Complementary slackness Theorem.

UNIT – IV : Non-linear programming: Unconstrained optimization techniques   **8 hours**

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method.

UNIT – V : Non-linear programming: Constrained optimization techniques   **8 hours**

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

TEXT BOOK:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

REFERENCES:
- Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
- Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web Reference:
- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				**Understand**	**L2**	PO2	**Analyze**	1
2				**Analyze**	**L4**	PO2	**Analyze**	3
3				**Apply**	**L3**	PO1	**Apply**	3
4				**Apply**	**L3**	PO1	**Apply**	3
5				**Apply**	**L3**	PO1	**Apply**	3

CO1: Understand the concepts of linear programming in solving practical problems in industry.
 Action Verb: Understand (L2)
PO2 Verbs: Analyze (L4)
     CO1 Action Verb is two levels low to PO2 verb ; Therefore correlation is low (1).

CO2: Analyze the transportation models to trace the solutions to the real-world problems.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
     CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO3: Apply mathematical skills to solve nonlinear programming models arising from a wide range of applications.
Action Verb: Apply **(L3)**
PO1 Verb: Apply (L3)
     CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO4: Apply the concept of non-linear programming for solving non-linear constraints.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
       CO4 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).

CO5: Apply the concept of unconstrained geometric programming for solving the non-linear constraints.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
     CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

Subject Code: 23AOE9903	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES (Open Elective-II)	L 2	T 1	P 0	Credits 3

Course Outcomes (CO): Student will be able to

1. Apply the applications to quantum systems through the study of vector spaces, inner products, and linear operators.
2. Analyze the transition from finite to infinite dimensional systems with linear algebra concepts to function spaces.
3. Analyze the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.
4. Evaluate the statistical interpretations through quantum mechanical principles to solve problems in simple quantum systems.
5. Create the understanding of measurement processes and modern quantum theory from the advanced concepts in composite systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Apply**	the applications to quantum systems	through the study of vector spaces, inner products, and linear operators.		**L3**
2	**Analyze**	the transition from finite to infinite dimensional systems	with linear algebra concepts to function spaces.		**L4**
3	**Analyze**	the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.	.		**L4**
4	**Evaluate**	statistical interpretations through quantum mechanical principles	to solve problems in simple quantum systems.		**L5**
5	**Create**	the understanding of measurement processes and modern quantum theory	from the advanced concepts in composite systems.		**L6**

UNIT I: Linear Algebra Foundation for Quantum Mechanics   **10 hours**
Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigen values, eigen vectors), Finite-dimensional examples (2×2 matrices, spin-1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\varphi|$, $\langle\varphi|\psi\rangle$), Change of basis (transformations, unitary matrices).

UNIT II: From Finite to Infinite Dimensions   **8 hours**
Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int \psi^*\varphi \, dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT III: Quantum Mechanical Formalism   **8 hours**
Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT IV: Applications and Statistical Interpretation   **6 hours**
Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: Advanced Topics   **8 hours**
Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Textbooks:
- David J. Griffiths, Darrell F. Schroeter, "Introduction to Quantum Mechanics", 3rd Edition, Cambridge University Press (2018).

- R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

Reference Books:
- George. F. Simmons, "Introduction to Topology and Modern Analysis",MedTech Science Press.
- Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
- John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).

Web Resources

1. https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf

2. https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf

Mapping of COs to POs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				**Apply**	**L3**	PO1	**Apply**	3
2				**Analyze**	**L4**	PO2	**Analyze**	3
3				**Analyze**	**L4**	PO2	**Analyze**	3
4				**Evaluate**	**L5**	PO3	**Evaluate**	3
5				**Create**	**L6**	PO3	**Create**	3

CO1: Apply the applications to quantum systems through the study of vector spaces, inner products, and linear operators.
 Action Verb: Apply(L3)
PO1 Verbs: Apply (L3)
        CO1 Action Verb is equal to PO1 verb ; Therefore correlation is high(3).
CO2: Analyze the transition from finite to infinite dimensional systems with linear algebra concepts to function spaces.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
        CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO3: Analyze the quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
        CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO4: Evaluate the statistical interpretations through quantum mechanical principles to solve problems in simple quantum systems.
Action Verb: Evaluate (L5)
PO3 Verb: Evaluate (L5)
         CO4 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
CO5: Create the understanding of measurement processes and modern quantum theory from the advanced concepts in composite systems.
Action Verb: Create (L6)
PO3 Verb: Create (L6)
        CO5 Action verb is equal to PO3 verb; therefore the correlation is high (3).

Course Code	**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES**	L	T	P	C
23AOE9907	**(Open Elective-II)**	**3**	**0**	**0**	**3**
Regulation: **AK23**	Common to all branches				

Course Outcomes (CO): At the end of the course students will be able to

1. **Understand the fundamentals of crystal growth and thin films.**
2. **Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.**
3. **Understand the basics of Semiconductors for Engineering Applications.**
4. **Analyze the concepts of excitons and luminescence in Semiconductors.**
5. **Apply the fundamentals of semiconductors for various display devices.**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	**The fundamentals of crystal growth and thin films.**			**L2**
2	**Analyze**	**The charge carrier dynamics in semiconductors by implementing the equations of state.**			**L4**
3	**Understand**	**The basics of Semiconductors for Engineering Applications.**			**L2**
4	**Analyze**	**The concepts of excitons and luminescence in Semiconductors.**			**L4**
5	**Apply**	**The fundamentals of semiconductors for various display devices.**			**L3**

UNIT I   Fundamentals of Materials Science   9 Hrs

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II Semiconductors   9 Hrs

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor Devices: 9 Hrs

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence: 9 Hrs

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials. Photoluminescence : General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot. Electro-luminescence : General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V Display devices :   9 Hrs

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4thedition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012. 4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

NPTEL course links:

1. **https://nptel.ac.in/courses/113/106/113106062/**
2. **https://onlinecourses.nptel.ac.in/noc20_ph24/preview**

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Verb	BTL			
1				Understand	L2	PO1, PO5	PO1: Apply (L3)	2
2				Analyze	L4	PO1, PO2	PO1: Apply (L3)	3
3				Understand	L2	PO1, PO5	PO1, PO5: Apply (L3)	2
4				Analyze	L4	PO1, PO5	PO1, PO5: Apply (L3)	3
5				Apply	L3	PO1	PO1: Apply (L3)	3

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO1: Understand the fundamentals of crystal growth and thin films.
Action Verb: Understand (L2)
PO1 & PO5 Verbs: Apply (L3)
CO1 Action Verb is lesser than PO1 and PO5 verbs by one level; Therefore, correlation is moderate (2).
CO2: Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.
Action Verb: Analyze (L4)
PO1 & PO2 Verbs: Apply (L3)
   CO2 Action Verb is greater than PO1 and PO2 verbs; Therefore correlation is high (3).
CO3: Understand the basics of Semiconductors for Engineering Applications.
Action Verb: Understand (L2)
PO1 and PO5 Verbs: Apply (L3)
   CO3 Action Verb is less than PO1 and PO5 verb by one level; Therefore correlation is moderate (2).
CO4: Analyze the concepts of excitons and luminescence in Semiconductors.
Action Verb: Analyze (L4)
PO1 Verb and PO5 verbs: Apply (L3)
    CO4 Action Verb is greater than PO1 and PO5 verbs by one level; Therefore, correlation is high (3).
CO5: Apply the fundamentals of semiconductors for various display devices.
Action Verb: Analyze (L4)
PO1 : Apply (L3)
    CO5 Action verb is equal to PO1 verb; therefore, the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
(Autonomous)
(Effective for the batches admitted from 2023-24)

Year: III-II B.Tech		Common to All				

Subject Code 23AOE9912	Chemistry of Polymers and Applications (Open Elective-II)	L	T/CLC	P	Credits:3
		2	1	0	

Course Outcomes (CO): At the end of the course students will be able to
6. Understand polymer fundamentals and classification systems.
7. Analyze the chemical and physical properties of natural polymers and their applications.
3. Apply the knowledge of thermoplastic and thermoset polymers in practical situations.
4. Understand the fundamental principles of hydrogel in polymer networks.
5. Analyze the preparation and mechanism of conducting and degradable polymers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	polymer fundamentals and classification systems.			L2
2	**Analyze**	the chemical and physical properties of natural polymers and their applications.			L4
3	**Apply**	the knowledge of thermoplastic and thermoset polymers in practical situations			L3
4	**Understand**	the fundamental principles of hydrogel in polymer networks.			L2
5	**Analyze**	the fundamental principles of hydrogel in polymer networks			L4

Unit – I: Polymers-Basics and Characterization:-

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

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

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

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:

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.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References 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.

Mapping of COs to POs and PSOs

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1					**Understand**	**L2**	PO1	PO1: Apply (L3)	2
2					**Analyze**	**L4**	PO1	PO1: Apply (L3)	3
3					**Apply**	**L3**	PO1	PO1: Apply (L3)	3
4					**Understand**	**L2**	PO1	PO1: Apply (L3)	3
5					**Analyze**	**L4**	PO1	PO1: Apply (L3)	3

CO1: Understand polymer fundamentals and classification systems.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
    CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2: Analyze the chemical and physical properties of natural polymers and their applications
Action Verb: Analyze(L4)
PO1 Verbs: Apply (L3)
    CO2 Action Verb is less than PO1 verb; Therefore correlation is moderate (2).
CO3: Apply the knowledge of thermoplastic and thermoset polymers in practical situations.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
    CO3 Action Verb level is equal to PO1 verb; Therefore correlation is high (3).
CO4: Understand the fundamental principles of hydrogel in polymer networks.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
    CO3 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO5 Analyze the preparation and mechanism of conducting and degradable polymers
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
    CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

Year: III B.Tech	**(Common to all branches)**	Semester: II

Subject Code 23AOE9916	**ACADEMIC WRITING AND PUBLIC SPEAKING** **(Common to All Branches of Engineering)** **OPEN ELECTIVE - II**	L T P 2 1 0	Credit: 3

Pre-Requisites	

Course Outcomes (CO): Student will be able to

CO1: Apply the essential features of Academic Writing in scholarly works.   L3
CO2: Apply the strategies of writing skills in research paper writing without plagiarism.   L3
CO3: Create a coherent and well-organized paragraphs in essays, reports, reviews and SOP.   L6
CO4: Analyze the characteristics and strategies of public speaking skills for impactful speeches. L4
CO5: Apply non-verbal communication skills for effective public speaking..   L3

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the essential features of Academic Writing in scholarly works			L3
2	Apply	the strategies of writing skills in research paper writing without plagiarism.	without plagiarism.		L3
3	Create	a coherent and well-organized paragraphs in essays, reports, reviews and SOP			L6
4	Analyze	the characteristics and strategies of public speaking skills for impactful speeches.		for impactful speeches.	L4
5	Apply	non-verbal communication skills for effective public speaking..		for effective public speaking..	L3

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	**Academic Journal Article**	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT - III	**Essay & Writing Reviews**	Lecture Hrs

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT - IV	**Public Speaking**	Lecture Hrs

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

UNIT - V	**Public Speaking and Non-Verbal Delivery**	Lecture Hrs

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage - Signs

Textbooks:

3. *Critical Thinking, Academic Writing and Presentation Skills*: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
4. Pease, Allan & Barbara. *The Definitive Book of Body Language*RHUS Publishers, 2016

ference Books:
1. <u>Alice Savage</u>, <u>Masoud Shafiei</u> *Effective Academic Writing,**2Ed.,**2014 .sserP ytisrevinU drofxO
2. Shalini Verma, *Body Language*, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata,*Communication Skills* 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson,*Technical Communication Process and Product,* Pearson, New Delhi, 2014
5. *Elbow, Peter. Writing with Power. OUP USA, 1998*

Online Learning Resources:
1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4
5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal- aspects-of-delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

Correlation of COs with the POs & PSOs for B.Tech
AK-23 Regulations
*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated

Course Title	Course Outcomes COs	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11
ACADEMIC WRITING AND PUBLIC SPEAKING OPEN ELECTIVE - II	CO1									2		
	CO2									2		
	CO3									3		
	CO4									3		3
	CO5									2		2

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1							Thumb Rule	
2							Thumb Rule	
3							Thumb Rule	
4							Thumb Rule	
5							Thumb Rule	

CO1: Apply the essential features of Academic Writing in scholarly works.
Action Verb: Apply (L3)
CO1 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).
CO2: Apply the strategies of writing skills in research paper writing without plagiarism.
CO2 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)
CO3: Create a coherent and well-organized paragraphs in essays, reports, reviews and SOP.
 CO3 Action Verb Create is of BTL 6. Using Thumb rule, L6 correlates PO6 to PO11 as high (3).
CO4: Analyze the characteristics and strategies of public speaking skills for impactful speeches.
Action Verb: Analyze (L4)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO11 as high (3).
CO5: Apply non-verbal communication skills for effective public speaking.
Action Verb: Apply (L3)
CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).

Course Code	Year & Sem	MACHINE LEARNING LAB	L	T	P	C
23APC0519	III-II		0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Evaluate the procedures for various learning's to machine learning algorithms.

CO 2: Apply the Python programs for various Learning algorithms using Pandas and Matplotlib.

CO 3: Analyze the different data sets to the Machine Learning algorithm.

CO 4: Analyze the various types of data set for clustering using k-Means algorithm

CO 5: Apply the Machine Learning algorithms to solve real world problems

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Evaluate**	the procedures for the various learning		to machine learning	L5
CO2	**Apply**	the Python programs for various Learning algorithms	using Pandas and Matplotlib		L3
CO3	**Analyze**	the various types of data set		to the Machine Learning algorithm	L4
CO4	**Apply**	various types of data set for clustering	using k-Means algorithm		L3
CO5	**Apply**	the Machine Learning algorithms		to solve real world problems	L3

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. Datasets 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.**(CO5)**
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.**(CO5)**
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. **(CO2)**
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets. **(CO1)**
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. **(CO3)**
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. **(CO3)**
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. **(CO3)**
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. **(CO4)**
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. **(CO4)**
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. **(CO4)**

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 images		

Reference Books:

Python Machine Learning Workbook for beginners, AI Publishing, 2020

Online Learning Resources/ Virtual Labs:

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

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1: Evaluate	L5	PO1 PO2 PO4	PO1: Apply(L3) PO2: Formulate (L6) PO4: Analysis (L4)	3 2 3
2	CO2: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2
3	CO3: Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Review (L2) PO3: Design(L6) PO4: Apply(L3)	3 3 1 3
4	CO4: Analyze	L4	PO1 PO2 PO11	PO1: Apply(L3) PO2: Review (L2) PO11: Thumb rule	3 3 3
5	CO4: Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 2 3 3 2

Justification Statements:

CO 1: Evaluate the procedures for various learning's to machine learning algorithms.
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO1 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate (L6)
CO1 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate(2)
PO4: Analysis (L4)
CO1 Action verb is more than PO4 verb. Therefore, the correlation is high (3)
CO 2: Apply the Python programs for various Learning algorithms using Pandas and Matplotlib.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO2 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

PO5: Apply (L3)
CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Using orange to visualize real world solutions the correlation is moderate (2)
CO 3: Analyze the different data sets to the Machine Learning algorithm.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO3 Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO3 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Design(L6)
CO3 Action verb is less than PO3 verb by two levels. Therefore, the correlation is low (1)
PO4 Verb: Apply (L3)
CO3 Action verb is more than PO4 verb. Therefore, the correlation is high (3)
CO 4: Analyze the various types of data set for clustering using k-Means algorithm
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO4Action verb is more than PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: Review (L2)
CO4 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Using orange to visualize real world solutions . Therefore, the correlation is high (3)
CO5: Apply the Machine Learning algorithms to solve real world problems
 Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO5 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Using orange to visualize real world solutions. Therefore , the correlation is moderate (2)

Course Code	Year & Sem	**CRYPTOGRAPHY AND NETWORK SECURITY LAB**	L	T	P	C
23APC0522			0	0	3	1.5

Course Outcomes:

After studying the course, student will be able to

CO 1: Understand network security concepts and classical encryption techniques.

CO 2: Apply number theory concepts in Public key cryptography.

CO 3: Analyze cryptographic hash functions and digital signatures

CO 4: Understand user authentications and IP security.

CO 5: Understand Transport layer security and firewalls compression.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	network security concepts and classical encryption techniques		to protect the data during transmission.	L2
CO2	Apply	number theory concepts in Public key cryptography			L3
CO3	Analyze	cryptographic hash functions and digital signatures			L4
CO4	Understand	user authentications and IP security			L2
CO5	Understand	Transport layer security and firewalls compression			L2

List of Experiments
1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result. **(CO1)**
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.**(CO1)**
3. Write a Java program to perform encryption and decryption using the following algorithms **(CO1)**   a. Ceaser cipher   b. Substitution cipher   c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic. **(CO1)**
5. Write a C/JAVA program to implement the Blowfish algorithm logic. **(CO1)**
6. Write a C/JAVA program to implement the Rijndael algorithm logic. **(CO1)**
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool. **(CO1)**
8. Write a Java program to implement RSA algorithm.**(CO2)**
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.**(CO2)**
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA. **(CO3)**
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.**(CO3)**

Reference Books:
1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	CO's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1 : Understand	L2	PO1	PO1: Apply(L3)	2
			PO2	PO2: Review(L2)	3
			PO3	PO3: Design (L6)	1
			PO5	PO5: Apply (L3)	2
			PO11	PO11:Thumb rule	2
2	CO2 : Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Design (L6)	1
			PO5	PO5: Apply (L3)	3
			PO11	PO11:Thumb rule	2
3	CO3 : Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Review(L2)	3
			PO3	PO3: Design (L6)	1
			PO5	PO5: Apply (L3)	3
4	CO4 : Understand	L2	PO1	PO1: Apply(L3)	2
5	CO5 : Understand	L2	PO1	PO1: Apply(L3)	2

Justification Statements:

CO1: Understand network security concepts and classical encryption techniques.

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

PO2 Verb : Review(L2)

CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

PO3 Verb: Design (L6)

CO1 Action verb is less than PO3 verb by four levels. Therefore the correlation is low (1)

PO5 Verb: Apply(L3)

CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (3)

PO11: Thumb rule

To understand various security algorithms is lifelong learning. Therefore the correlation is moderate(2)

CO2: Apply number theory concepts in Public key cryptography

Action Verb : Apply (L3)

PO1 Verb : Apply(L3)

CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Review(L2)

CO2 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)

PO3 Verb: Design (L6)

CO2 Action verb is less than PO3 verb by three levels. Therefore the correlation is low (1)

PO5 Verb: Apply(L3)

CO2 Action verb is same level as PO5 verb. Therefore the correlation is high (3)

PO11: Thumb rule

To understand various security algorithms is lifelong learning. Therefore the correlation is moderate(2)

CO3: Analyze cryptographic hash functions and digital signatures

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO3 Action verb is greater than PO1 verb by one level. Therefore the correlation is high (3)

PO2: Review (L2)

CO3 Action verb is greater than PO2 verb by two levels. Therefore the correlation is high (3)

PO3: Design (L6)

CO3 Action verb is less than PO3 verb by two levels. Therefore the correlation is low (1)

PO5: Apply(L3)

CO3 Action verb is greater than PO5 verb by one level. Therefore the correlation is high (3)

CO4: Understand user authentications and IP security.

Action Verb : Understand (L2)

PO1: Apply(L3)

CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

CO5: Understand Transport layer security and firewalls compression.

Action Verb : Understand (L2)

PO1: Apply(L3)

CO5 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)

Course Code	Year & Sem	FULL STACK DEVELOPMENT-II Skill Enhancement Course	L	T	P	C
23ASC0504	III-I		0	1	2	2

Course Outcomes:

After Studying the Course Student will able to

CO1: Understand the Structure and working of DOM, basic ES6 concepts.

CO2: Analyze the differences between Real DOM and Virtual DOM in terms of performance.

CO3: Apply key React.js concepts and the Fetch API to develop interactive web applications.

CO4: Apply database connectivity using MySQL in web applications.

CO5: Design dynamic backend systems by integrating MySQL databases with Express.js servers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	**the** Structure and working of DOM, basic ES6 concepts.			L2
CO2	Analyze	the differences between Real DOM and Virtual DOM		in terms of performance.	L4
CO3	Apply	key React.js concepts and the Fetch API		to develop interactive web applications.	L3
CO4	Apply	database connectivity	using MySQL in web applications.		L3
CO5	Design	dynamic backend systems by integrating MySQL databases		with Express.js servers.	L6

Sample Experiments:

1. Introduction to Modern JavaScript and DOM[CO1]

   a. Write a JavaScript program to link JavaScript file with the HTML page

   b. Write a JavaScript program to select the elements in HTML page using selectors

   c. Write a JavaScript program to implement the event listeners

   d. Write a JavaScript program to handle the click events for the HTML button elements

   e. Write a JavaScript program to With three types of functions

        i. Function declaration

        ii. Function definition

        iii. Arrow functions

2. Basics of React.js[CO1]

   a. Write a React program to implement a counter button using react class components

   b. Write a React program to implement a counter button using react functional components

   c. Write a React program to handle the button click events in functional component

   d. Write a React program to conditionally render a component in the browser

   e. Write a React program to display text using String literals

3. Important concepts of React.js[CO3]

   a. Write a React program to implement a counter button using React use State hook

   b. Write a React program to fetch the data from an API using React use Effect hook

   c. Write a React program with two react components sharing data using Props.

   d. Write a React program to implement the forms in react

   e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Node.js and Express.js[CO4]

   a. Write a program to implement the _hello world' message in the route through the browser using Express

   b. Write a program to develop a small website with multiple routes using Express.js

   c. Write a program to print the _hello world' in the browser console using Express.js

   d. Write a program to implement the CRUD operations using Express.js

   e. Write a program to establish the connection between API and Database using Express –MySQL driver

5. Introduction to MySQL[CO5]

a. Write a program to create a Database and table inside that database using MySQL Command line client

b. Write a MySQL queries to create table, and insert the data, update the data in the table

c. Write a MySQL queries to implement the subqueries in the MySQL command line client

d. Write a MySQL program to create the script files in the MySQL workbench

e. Write a MySQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API.

Mapping of course outcomes with program outcomes

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

(Levels of Correlation, viz., 1-Low, 2-Moderate, 3 High)

Correlation matrix

Unit No.	Co"s Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
1	CO1:Understand	L2	PO1 PO2 PO5 PO11	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3) PO11: Thumb rule	2 3 2 2
2	CO2:Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO9	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO9: Thumb rule	3 3 3 3 3 3
3	CO3: Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Analyze (L4) PO5:Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
4	CO4:Apply	L3	PO1 PO2 PO3 PO4 PO5 PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Analyze (L4) PO5:Apply(L3) PO11: Thumb rule	3 3 3 2 3 2
5	CO5:Design	L6	PO1 PO2 PO3 PO5 PO9 PO11	PO1: Apply(L3) PO2: Analyze (L4) PO3:Create(L6) PO5: Apply (L3) PO9: Thumb rule PO11: Thumb rule	3 3 3 3 3 3

Justification Statements:

CO1: Understand the Structure and working of DOM, basic ES6 concepts.

Action Verb : Understand (L2)

PO1 Verb : Apply(L3)

CO1 Action verb is less than PO1 verb by one, Therefore the correlation is moderate (2)

PO2 Verb : Review(L2)

CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO5 Verb : Apply(L2)

CO1 Action verb is less than PO5 verb by one, Therefore the correlation is moderate (2)

PO11: Thumb rule

Recognize the structurs and working of DOM as life-long learning . Therefore the correlation is moderate (2)

CO2: Analyze the differences between Real DOM and Virtual DOM in terms of performance.

Action Verb : Analyze (L4)

PO1: Apply(L3)

CO2 Action verb is greater level of PO1 verb. Therefore, the correlation is High (3)

PO2: Review (L2)

CO2 Action verb is greater than level as PO2 verb by one. Therefore, the correlation is high (3)

PO3: Develop (L3)

CO2 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze (L4)

CO2 Action verb is same PO4 verb. Therefore the correlation is high (3)

PO5: Apply(L3)

CO2 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

PO9: Thumb rule

Communicate effectively and inclusively with real and virtual DOM learning differences . Therefore, the correlation is high (3)

CO3: Apply key React.js concepts and the Fetch API to develop interactive web applications.

Action Verb: Apply (L3)

PO1: Apply(L3)

CO3 Action verb is same level of PO1 verb. Therefore the correlation is high (3)

PO2: Review(L2)

CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L2)

CO3 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze(L2)

CO3 Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)

PO5: Apply(L3)

CO3 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

Recognize the key concepts to develop interactive web applications as life-long learning . Therefore the correlation is moderate (2)

CO4: Apply database connectivity using MySQL in web applications.

Action Verb: Apply(L3)

PO1: Apply(L3)

CO4 Action verb is same level of PO1 verb. Therefore the correlation is high (3)

PO2: Review(L2)

CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3: Develop(L2)

CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO4: Analyze(L2)

CO4 Action verb is less than of PO4 verb. Therefore the correlation is moderate (2)

PO5: Apply(L3)

CO4 Action verb is greater than PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

Learning database connectivity often requires consulting external resources, documentation, updates independently, Therefore the correlation is moderate (2)

CO5: Create dynamic backend systems by integrating MySQL databases with Express.js servers.

Action Verb: Create(L6)

PO1: Apply(L3)

CO5 Action verb is same level of PO1 verb. Therefore the correlation is high (3)

PO2: Analyze(L4)

CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)

PO3:Create(L6)

CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)

PO5: Apply (L3)

CO5 Action verb is same level of PO5 verb. Therefore the correlation is high (3)

PO9: Thumb rule

Backend projects are often team-based, requiring coordination and shared version control. Therefore the correlation is high (3)

PO11: Thumb rule

Requires continuous learning of evolving Node.js, Express, and MySQL technologies. Therefore the correlation is high (3)

Year: III B.Tech	(Common to all branches)	Semester: II

Subject Code 23AMC9902	**TECHNICAL PAPER WRITING AND INTELLECTUAL PROPERTY RIGHTS** **(Audit Course)**	L T P 2 0 0	Credit: 0

Pre-Requisites		Semester	**II**

Course Outcomes (CO): Student will be able to

CO1	Understand various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.	L2
CO2	Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.	L3
CO3	Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.	L3
CO4	Evaluate the rights and responsibilities of the holder of Intellectual Property.	L5
CO5	Apply various forms of copy rights and patents at national and international levels.	L3

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.	by avoiding confusion, repetition,unclear language and plagiarism.		L2
2	Apply	the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.	by organizing abstract, objectives, limitations, literature review to frame effective research questions.		L3
3	Apply	the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.		for paper writing.	L3
4	Evaluate	rights and responsibilities of holder of Patent, Copyright, trademark, International Trademark etc.			L5
5	Apply	various forms of copy rights and patents at national and international levels		At national and international levels	L3

UNIT :1

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:

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

UNIT – III:

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:

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights

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

UNIT – V:

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.

Textbooks:

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

2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication: Principles and practices.* O

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 Resources

1. https://theconceptwriters.com.pk/principles-of-technical-writing/

2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWritin g.h tml

3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWritin g.h tml

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

Correlation of COs with the POs & PSOs for B.Tech
AK-23 Regulations
*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated

Course Title	Course Outcomes COs	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11
TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS (Audit Course)	CO1									2		
	CO2		3									
	CO3									2		2
	CO4											3
	CO5											2

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1							Thumb Rule	
2							Thumb Rule	
3							Thumb Rule	
4							Thumb Rule	
5							Thumb Rule	

CO1: Understand various principles and styles of technical writing by avoiding confusion, repetition, unclear language and plagiarism.
Action Verb: Understand (L2)
CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO11 as moderate (2).

CO2: Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.
Action Verb: Apply (L3)
CO2 Action Verb Apply is of BTL 3. L3 is equal to PO2, then correlation is high (3)

CO3: Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.
Action Verb: Apply (L3)
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2)

CO4: Evaluate the rights and responsibilities of the holder of Intellectual Property.
Action Verb: Evaluate (L5)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L5 correlates PO6 to PO11 as high (3).

CO5: Apply various forms of copy rights and patents at national and international levels.
Action Verb: Apply (L3)
CO5 Action Verb Analyse is of BTL 4. Using Thumb rule, L3 correlates PO6 to PO11 as moderate (2).