ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	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	MC	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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

I Year – I Semester										
S.No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**CIE**	**SEE**	**Total**
				L	**T/CLC**	**P**	**C**			
1	Humanities & Social Sciences	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	Basic Sciences	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	Basic Sciences	23ABS9904	Linear Algebra & Calculus	2	1	0	3	30	70	100
4	Engineering Sciences	23AES0101	Basic Civil & Mechanical Engineering	2	1	0	3	30	70	100
5	Engineering Sciences	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	Humanities & Social Sciences	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	Basic Sciences	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	Engineering Sciences	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	Engineering Sciences	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	Humanities & Social Sciences	23AHM9903	Health and wellness, Yoga and Sports	-	-	1	0.5	50	-	50
			Total	**10**	**04**	**11**	**19.5**	**320**	**630**	**950**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

I Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Basic Sciences	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	Basic Sciences	23ABS9905	Differential Equations & Vector Calculus	2	1	0	3	30	70	100
3	Engineering Sciences	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	Engineering Sciences	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	Engineering Sciences	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	Professional Core	23APC0201	Electrical Circuit Analysis-1	2	1	0	3	30	70	100
7	Basic Sciences	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	Engineering Sciences	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	Professional Core	23APC0202	Electrical Circuits Lab	0	0	3	1.5	30	70	100
10	Humanities & Social Sciences	23AHM9904	NSS/NCC/Scouts& Guides/ Community Service	-	-	1	0.5	50	-	50
			Total	**09**	**04**	**15**	**20.5**	**320**	**630**	**950**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

II Year – I Semester										
S.No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**CIE**	**SEE**	**Total**
				L	**T/CLC**	**P**	**C**			
1	Basic Sciences	23ABS9910	Complex Variable & Numerical Methods	2	1	0	3	30	70	100
2	Humanities & Social Sciences	23AHM9905	Universal Human Values - Understanding Harmony	2	1	0	3	30	70	100
3	Professional Core	23APC0205	Electromagnetic Field Theory	2	1	0	3	30	70	100
4	Professional Core	23APC0206	Electrical Circuit Analysis-II	2	1	0	3	30	70	100
5	Professional Core	23APC0207	DC Machines & Transformers	2	1	0	3	30	70	100
6	Professional Core	23APC0208	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0209	DC Machines & Transformers Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement Courses	23ASC0502	Data Structures	0	1	2	2	30	70	100
9	Mandatory course	23AMC9901	Environmental Sciences	2	0	0	-	30	-	30
			Total	**12**	**06**	**08**	**20**	**270**	**560**	**830**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

II Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Management Course-I	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	Engineering Sciences	23AES0403	Analog Circuits	2	1	0	3	30	70	100
3	Professional Core	23APC0210	Power Systems-I	2	1	0	3	30	70	100
4	Professional Core	23APC0211	Induction and Synchronous Machines	2	1	0	3	30	70	100
5	Professional Core	23APC0212	Control Systems	2	1	0	3	30	70	100
6	Professional Core	23APC0213	Induction and Synchronous Machines Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0214	Control Systems Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement Courses	23ASC0501	Python Programming	0	1	2	2	30	70	100
9	Engineering Sciences	23AES0304	Design Thinking & Innovation	1	0	2	2	30	70	100
			Total	**11**	**05**	**10**	**21**	**270**	**630**	**900**
Mandatory Community Service Project of 08 weeks duration during summer vacation										

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

III Year – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Professional Core	23APC0215	Power Electronics	2	1	0	3	30	70	100
2	Professional Core	23APC0421	Digital Circuits	2	1	0	3	30	70	100
3	Professional Core	23APC0216	Power Systems-II	2	1	0	3	30	70	100
4	Professional Elective- I	23APE0404	Signals and Systems	2	1	0	3	30	70	100
		23APE0201	Electrical safety and Risk Management							
		23APE0202	Utilization of Electrical Energy							
5	Open Elective -I		***Open Elective-I**	2	1	0	3	25	75	100
6	Professional Core	23APC0217	Power Electronics Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0422	Analog and Digital Circuits Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement course	23ASE9901	Soft Skills	0	1	2	2	30	70	100
9	Skill Enhancement course Lab	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	Engineering Sciences	23AES0504	Introduction to Quantum Technology and Applications	2	1	0	3	30	70	100
11	Community Service Project	23APR0201	Evaluation of Community Service Internship	-	-	-	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	23AOE0301	Sustainable Energy Technologies	ME
4	23AOE0401	Electronic Circuits	ECE
5	23A0E0501	Java Programming	CSE & Allied/IT
6	23A0E0502	Fundamentals of Artificial Intelligence	
7	23A0E0503	Quantum Technologies and Applications	
8	23AOE9901	Mathematics for Machine Learning and AI	Mathematics
9	23AOE9906	Materials Characterization Techniques	Physics
10	23AOE9911	Chemistry of Energy Systems	Chemistry
11	23AOE9915	English for Competitive Examinations	Humanities
12	23A0EMB01	Entrepreneurship and New Venture Creation	

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

III Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Professional Core	23APC0218	Electrical Measurements and Instrumentation	2	1	0	3	30	70	100
2	Professional Core	23APC0412	Microprocessors and Microcontrollers	2	1	0	3	30	70	100
3	Professional Core	23APC0219	Power System Analysis	2	1	0	3	30	70	100
4	**Professional Elective- II**	23APE0203	AI&ML for Electrical Engineering	2	1	0	3	30	70	100
		23APE0204	Programmable Logic Controllers							
		23APE0205	Switchgear and Protection							
5	**Professional Elective- III**	23APC0424	Communication systems	2	1	0	3	30	70	100
		23APE0206	Electric Drives							
		23APE0207	Renewable and Distributed Energy Technologies							
6	**Open Elective-II**		***Open Elective-II**	2	1	0	3	25	75	100
7	Professional Core	23APC0220	Electrical Measurements and Instrumentation Lab	0	0	3	1.5	30	70	100
8	Professional Core	23APC0414	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	Skill Enhancement course	23ASE0201	Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2	30	70	100
10	Audit Course	23AMC9902	Technical Paper Writing & IPR	2	0	0	-	30	70	100
11	Skill Enhancement course	23ASE0202	Workshop	-	-	-	-	-	-	-
			Total	**14**	**07**	**08**	**23**	**295**	**705**	**1000**

Mandatory Industry Internship of 08 weeks duration during summer vacation

Note: Workshop can be conducted either in 3-1 or 3-2 and the participation certificate with 90% and above attendance on it shall be submitted to the Department /Examination Section before 3-2 Regular Exam notification is released.

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	23AOE0301	Automation and Robotics	ME
4	23AOE0402	Digital Electronics	ECE
5	23AOE0504	Operating Systems	CSE & Allied/IT
6	23AOE0505	Introduction to Machine Learning	
7	23AOE9902	Advanced Operations Research	Mathematics
8	23AOE9903	Mathematical Foundation Of Quantum Technologies	
9	23AOE9907	Physics Of Electronic Materials And Devices	Physics
10	23AOE9912	Chemistry Of Polymers And Applications	Chemistry
11	23AOE9916	Academic Writing and Public Speaking	Humanities

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

IV Year – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/ CLC	P	C			
1	Professional Core	23APC0221	Power System Operation and Control	2	1	0	3	30	70	100
2	Management Course- II Elective	23AHMMB02	Business Ethics and Corporate Governance	2	0	0	2	30	70	100
		23AHMMB03	E-Business							
		23AHMMB04	Management Science							
3	Professional Elective-IV	23APC0415	Digital Signal Processing	2	1	0	3	30	70	100
		23APE0208	Electric Vehicle Technology							
		23APE0209	HVDC & FACTS							
4	Professional Elective-V	23APE0210	Modern Control Theory	2	1	0	3	30	70	100
		23APE0211	Switched Mode Power Conversion							
		23APE0212	Electrical Distribution System							
5	Open Elective - III		***Open Elective - III**	2	1	0	3	25	75	100
6	Open Elective - IV		***Open Elective - IV**	2	1	0	3	25	75	100
7	Skill Enhancement Course	23ASE0203	Power Systems and Simulation Lab	0	0	4	2	30	70	100
8	Audit Course	23AMC9903	Gender Sensitization	2	0	0	0	30	-	30
9	Internship	23APR0202	Evaluation of Industry Internship	-	-	-	2	100	-	100
			Total	**14**	**05**	**04**	**21**	**330**	**500**	**830**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

***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	23AOE0303	3D Printing Technologies	ME
4	23APC0412	Microprocessors and Microcontrollers	ECE
5	23AOE0506	Data Base Management Systems	CSE & Allied/IT
6	23AOE0507	Cyber Security	
7	23AOE9904	Wavelet Transforms and its Applications	Mathematics
8	23AOE9908	Smart Materials and Devices	Physics
9	23AOE9909	Introduction to Quantum Mechanics	
10	23AOE9913	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
11	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	23AOE0304	Total Quality Management	ME
4	23AOE0403	Transducers and Sensors	ECE
5	23AOE0508	Introduction to Computer Networks	CSE & Allied/IT
6	23AOE0509	Internet of Things	
7	23AOE0510	Introduction to Quantum Computing	
8	23AOE9905	Financial Mathematics	Mathematics
9	23AOE9910	Sensors And Actuators for Engineering Applications	Physics
10	23AOE9914	Chemistry of Nanomaterials and Applications	Chemistry
11	23AOE9918	Literary Vibes	Humanities

IV Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Internship	23APR0203	Industry Internship	-	-	-	4	100	-	100
2	Project	23APR0204	Final Year Project	-	-	-	8	60	140	200
			Total	**-**	**-**	**-**	**12**	**160**	**140**	**300**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

MINOR DEGREE IN ELECTRICAL ENGINEERING FOR CE, ME, ECE, CSE & AI

NOTE: Students of other programs to get "**Minor in Electrical Engineering**" shall pass a few SWAYAM-NPTEL courses listed below (**S.No:1 To 15**) which are approved by BOS and obtain **15 credits** and submitting a minor discipline project in Electrical Engineering for scoring **3 credits** is compulsory and all together total credits required for minor degree is **18**.

S. No	CODE	COURSE NAME	WEEKS	CREDITS
1.	23AMN0201	Basic Electrical Circuits	12	3
2.	23AMN0202	Electrical Machines	12	3
3.	23AMN0203	Electrical Machines-I	12	3
4.	23AMN0204	Electrical Machines-II	12	3
5.	23AMN0205	Power system engineering	12	3
6.	23AMN0206	Power system Analysis	12	3
7.	23AMN0207	Fundamental of power electronics	12	3
8.	23AMN0208	Control Engineering	12	3
9.	23AMN0209	Electrical measurement and electronic instruments	12	3
10.	23AMN0210	Power system protection	12	3
11.	23AMN0211	Power quality	12	3
12.	23AMN0212	Smart grid: basics to advanced technologies	12	3
13.	23AMN0213	Economic Operations and Control of Power Systems	12	3
14.	23AMN0214	Control and tuning methods in Switched mode power converters	12	3
15.	23AMN0215	Advance Power Electronics	12	3
16.	23AMN0216	**Minor Project on Electrical Engineering**	-	**3**
		Total	-	**18**

COURSES OFFERED FOR HONORS DEGREE IN EEE (ELECTRIC VEHICLES)

NOTE: - Student of EEE should register & pass all the courses below to get 18 credits & to obtain honors in EEE (Electrical Vehicles)

S. No	CODE	COURSE NAME	CREDITS
1	23AHN0201	E - Mobility	3
2	23AHN0202	Battery Management Systems	3
3	23AHN0203	Special Machines for Electric Vehicles	3
4	23AHN0204	Grid Interface of Electric Vehicles	3
5	23AHN0205	EV Charging Technologies	3
6	23AHN0206	Project on Electric Vehicles	3
		Total	**18**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	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	MC	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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

I Year – I Semester										
S.No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**CIE**	**SEE**	**Total**
				L	**T/CLC**	**P**	**C**			
1	Humanities & Social Sciences	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	Basic Sciences	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	Basic Sciences	23ABS9904	Linear Algebra & Calculus	2	1	0	3	30	70	100
4	Engineering Sciences	23AES0101	Basic Civil & Mechanical Engineering	2	1	0	3	30	70	100
5	Engineering Sciences	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	Humanities & Social Sciences	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	Basic Sciences	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	Engineering Sciences	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	Engineering Sciences	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	Humanities & Social Sciences	23AHM9903	Health and wellness, Yoga and Sports	-	-	1	0.5	50	-	50
			Total	**10**	**04**	**11**	**19.5**	**320**	**630**	**950**

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

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

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

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
AK-23 Regulations
*3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated

Course Title	Course Outcomes COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
Communicative English	CO1									2		
	CO2								2	2		
	CO3									3		
	CO4									3		
	CO5									3		

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 PO11 as high (3).

AK23 Regulations

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

(Autonomous)

(Effective for the batches admitted from 2023-24)

Year: I B.Tech **Common to I Sem- CSE,CSD, CIC& EEE, II Sem ECE,AI&DS,AI&ML**

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

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 O2 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

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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).

AK23 Regulations

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

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

Course Outcomes (CO): Student will be able to

1. Analyze the matrix algebraic techniques for engineering applications.
2. Understand the concept of Eigen values, Eigen vectors and quadratic forms.
3. Analyzethe mean value theorems for real timeapplications.
4. Apply the concepts of partial differentiation to functions of several variables.
5. 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 oflinear 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 (bydouble 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. RajnishVerma, S. ChandPublications,2014, Third Edition (Reprint 2021)

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 toPO2verb ; 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).

I YEAR I SEMESTER

Subject Code	Subject Name	L	T/ CLC	P	CREDITS
23AES0101	BASICS OF CIVIL & MECHANICAL ENGINEERING	2	1	0	3

Course Outcomes

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, KhannaPublishers, Delhi 2023. 38th Edition
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012

BASICS OF MECHANICAL ENGINEERING (PART-B)

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.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2
	CO1	2	2				2							
	CO2	3	2				2							
	CO3	2	2				2							
	CO4	**2**					**2**							
	CO5	**2**					**2**							
	CO6	**2**				**2**	**2**							

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 PO6	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 PO6	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 PO6	Identify-L3 Thumb Rule	2 2
6	9/30	30	3	Understand	L2	PO1 PO5 PO6	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)

PO6 Verb: **Thumb Rule**

CO1 correlates medium with PO6. 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)

PO6 Verb: **Thumb Rule**

CO3 correlates medium with PO6. 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)

PO6 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)

PO6 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)

PO6 Verb: **Thumb Rule**

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

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

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

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	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) PO11: 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	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3)	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)

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

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

Subject Code 23AHM9902	Subject Name **COMMUNICATIVE ENGLISH LAB**	L T/CLC P 0 0 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: Evaluateandexhibitprofessionalisminparticipatingindebatesandgroupdiscussions.
CO5:Analyze themselves 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 ofTopics:

1. Vowels & Consonants (CO3)
2. Non Verbal Communication (CO2)
3. Communication Skills(CO2)
4. Role Play or 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 *Academic English*(B2).CUP,2012.
4. J. Sethi &P.V. Dhamija. *A Course in Phonetics and Spoken English*,(2nd Ed),Kindle,2013.

WebResources:

SpokenEnglish:

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	9	Thumb Rule	2
2				Apply	L3	8,9	Thumb Rule	2,2
3				Analyze	L4	9	Thumb Rule	3
4				Evaluate	L5	8,9	Thumb Rule	3,3
5				Analyze	L4	9	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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
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Year: I B.Tech (Common to EEE, ECE, CSE & allied branches) Semester: I &II

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

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

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 Publicationsby 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	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)**
	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

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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Detailed Syllabus for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2023-24)
MECHANICAL ENGINEERING (ME)

Year: I **Semester: I/II** **Branch of Study: Common to all Branches**

Subject Code	Subject Name	L	T/ CLC	P	Credits
23AES0302	Engineering Workshop	0	0	3	1.5

Course Outcomes:

CO: 1 Apply the wood working skills to prepare different joints.
CO: 2 Analyze the sheet metal and fitting operations to prepare various components
CO: 3 Apply the basic electrical engineering knowledge for house wiring practice.
CO: 4 Apply the Welding process for Lap and Butt Joints.
CO: 5 Understand the various plumbing pipe joints

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms 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 metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

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MECHANICAL ENGINEERING (ME)

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.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Engineering Workshop	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

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	-	-	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)

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

Course Code	Year & Sem	COMPUTER PROGRAMMING LAB	L	T/CLC	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	

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	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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)

I B. TECH **AK 23 REGULATION**

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	T/CLC	P	C
		0	0	1	0.5

Course Objectives:

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

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

1. Understand the health & fitness by diet
2. Understand the importance of yoga.
3. Apply The yoga practices including Surya Namaskar
4. Understand the importance of sports.
5. 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 SurvivingAnywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, Inc.2014

General Guidelines:

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

Evaluation Guidelines:

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

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)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

I Year – II Semester										
S.No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**CIE**	**SEE**	**Total**
				L	**T/CLC**	**P**	**C**			
1	Basic Sciences	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	Basic Sciences	23ABS9905	Differential Equations & Vector Calculus	2	1	0	3	30	70	100
3	Engineering Sciences	23AES0201	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
4	Engineering Sciences	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	Engineering Sciences	23AES0503	IT Workshop	0	0	2	1	30	70	100
6	Professional Core	23APC0201	Electrical Circuit Analysis-1	2	1	0	3	30	70	100
7	Basic Sciences	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	Engineering Sciences	23AES0202	Electrical and Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	Professional Core	23APC0202	Electrical Circuits Lab	0	0	3	1.5	30	70	100
10	Humanities & Social Sciences	23AHM9904	NSS/NCC/Scouts& Guides/ Community Service	-	-	1	0.5	50	-	50
			Total	**09**	**04**	**15**	**20.5**	**320**	**630**	**950**

Annamacharya Institute of Technology & Sciences (Autonomous), Tirupati

AK23 Regulations

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

1. **Understand the intensity variation of light due to interference, diffraction, and polarization.**
2. **Analyze the fundamentals of crystallography and X-ray diffraction.**
3. **Apply the basic concepts of dielectric and magnetic materials for engineering applications.**
4. **Analyze the fundamentals of Quantum mechanics and interpret the nanomaterials for engineering problems.**
5. **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).

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).

AK 23 Regulations

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

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

Course Outcomes (CO): Student will be able to

1. Apply the concepts of ordinary differential equations of first order and first degree.
2. Apply themethods of linear differential equations related to various engineering problems.
3. Analyzethe solutions of partial differential equations using Lagrange's method.
4. Understand the different operators and identities in the vector calculus.
5. Evaluatethe 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	Themethods 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.

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)

PO1Verbs: 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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year-Sem	I-I/II	Branch of Study: Common to all Branches				
Subject Code		Subject Name	L	T/CLC	P	Credits
23AES0201		BASIC ELECTRICAL & ELECTRONICS ENGINEERING	2	1	0	3

PART-A
BASIC ELECTRICAL ENGINEERING

After completion of the course, students 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
CO1	Understand	The fundamentals laws of A. C circuits and D.C circuits.		A. C circuits and D. C circuits	L2
CO2	Understand	Operating principles of motors, generators and measuring instruments.			L2
CO3	Understand	The fundamentals of Power generation, costing and safety measures.			L2

SYLLABUS

UNIT-I

TITLE: 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

TITLE: 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

TITLE: 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

Text 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

Reference books:

1 Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition.
2 Principles of Power Systems, V.K. Mehtha, S. Chand Technical Publishers, 2020**.**
3 Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.
4 Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

PART-B
BASIC ELECTRONICS ENGINEERING

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
CO4	Understand	Fundamental concepts of diodes, transistors and its applications			L2
CO5	Analyze	Concepts of rectifiers, power supplies and amplifiers in electronics			L4
CO6	Analyze	Concepts of Number Systems, Boolean Functions, Logic Gates and Digital Circuits			L4

SYLLABUS

UNIT-I

TITLE: 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

TITLE: 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

TITLE: 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)

Text books:

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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2				1						2	
CO2	2	1				1						1	
CO3	2	1				2						1	2
CO4	2	3											
CO5	3	3											
CO6	3	3											
Levels of correlation, viz., 1. Low, 2. Moderate, 3. High													

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 (0-3)
	Lesson Plan (Hrs.)	%	correlation	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: Identify (L3) PO6: Thumb Rule	2 1 1
3	10	38	3	**Understand**	**L2**	PO1, PO2,PO6	PO1: Apply (L3) PO2: Identify (L3) 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)
Detailed Syllabus for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2023-24)
MECHANICAL ENGINEERING (ME)

Year: I **Semester: I/II** **Branch of Study: Common to all Branches**

Subject Code	Subject Name	L	T/ CLC	P	Credits
23AES0301	Engineering Graphics	1	0	4	3

Course Outcomes:

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 planeand 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 shapeof section,

Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial linedevelopment. 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 Transformationsusing 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.

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

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 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
2	15	20	2	Understand	L2	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	2 2 3
3	15	20	2	Analyze	L4	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
4	15	20	2	Analyze	L4	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 3
5	12	16	2	Apply	L3	PO1 PO2 PO10	Apply (L3) Develop (L3) Thumb Rule	3 3 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)

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

Course Code	Year & Sem	IT workshop	L	T/CLC	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

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	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)
PO12: 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)
PO12: 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)
Department of Electrical and Electronics Engineering

Year/Sem	I/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0201		ELECTRICAL CIRCUIT ANALYSIS-I	2	0	1	3

After completion of the course, students will be able to:	
CO1	Understand the basic electrical elements and different fundamental laws. CO2:
CO2	Understand Network theorems and reduction techniques.
CO3	Understand the concept of self- inductance and mutual inductance of the magnetic circuits.
CO4	Analyze steady state response, different circuit topologies and phasor diagrams of series & parallel single-phase circuits with R, L & C components.
CO5	Apply mathematical concepts to obtain various and graphical representations of series and parallel resonance circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Remember	The basic electrical elements and different fundamental laws.			L1
CO2	Understand	Evaluation of Network theorems.		reduction techniques	L2
CO3	Understand	The concept of self- inductance and mutual inductance of the magnetic circuits.			L2
CO4	Analyze	Analyze steady state response, different circuit topologies and phasor diagrams of series & parallel single-phase circuits.	with R, L & C components.		L4
CO5	Apply	Mathematical concepts to obtain various and graphical representations.	of series and parallel resonance circuits.		L3

SYLLABUS

UNIT-I

TITLE: INTRODUCTION TO ELECTRICAL CIRCUITS

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

UNIT-II

TITLE: NETWORK THEOREMS (DC & AC EXCITATIONS)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

UNIT-III

TITLE: MAGNETIC CIRCUITS

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction - concept of self and mutual inductance, Dot convention coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic

circuits.

UNIT-IV

TITLE: SINGLE PHASE CIRCUITS

Characteristics of periodic functions, Average value, R.M.S. value, form factor, representation of a sine function, concept of phasor and phasor diagrams. Steady state analysis of R, L and C circuits to sinusoidal excitations-response of pure resistance, inductance, capacitance, series RL circuit, series RC circuit, series RLC circuit, parallel RL circuit, parallel RC circuit.

UNIT-V

TITLE: RESONANCE AND LOCUS DIAGRAMS

Series Resonance: Characteristics of a series resonant circuit, Q-factor, selectivity and bandwidth, expression for half power frequencies; Parallel resonance: Q-factor, selectivity and bandwidth; Locus diagram: RL, RC, RLC with R, L and C variables.

Text books:

1 Engineering Circuits Analysis, Jack Kemmerly, William Hayt and Steven Durbin, Tata Mc Graw Hill Education, 2005, sixth edition.
2 Network Analysis, M. E. Van Valkenburg, Pearson Education, 2019, Revised Third Edition.

Reference books:

1 Fundamentals of Electrical Circuits, Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India), 2013, Fifth Edition
2 Electric Circuits (Schaum's outline Series), Mahmood Nahvi, Joseph Edminister, and K. Rao, Mc Graw Hill Education, 2017, Fifth Edition.
3 Electric Circuits, David A. Bell, Oxford University Press, 2009, Seventh Edition..
4 Introductory Circuit Analysis, Robert L. Boylestad, Pearson Publications, 2023, Fourteenth Edition.
5 Circuit Theory: Analysis and Synthesis, A. Chakrabarti, Dhanpat Rai & Co., 2018, Seventh Revised Edition.

Web Resources:

1 https://onlinecourses.nptel.ac.in/noc23_ee81/preview
2 https://nptel.ac.in/courses/108104139
3 https://nptel.ac.in/courses/108106172
4 https://nptel.ac.in/courses/117106108

Mapping of Course outcomes with Program outcomes

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Identify (L3) PO6: Thumb Rule	2 2 1
2				Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 1
3				Understand	L2	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 1 1
4				Analyze	L4	PO1, PO2, PO3, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO3: Design (L6) PO6: Thumb Rule	3 3 1 1
5				Apply	L3	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	3 2 1

CO1: Remembering the basic electrical elements and different fundamental laws.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO1 Action Verb is Less than PO1 verb by two level; Therefore, correlation is medium (2).
PO2: Identify (L3)
CO1 Action Verb is Less than PO2 verb by two level; Therefore, correlation is medium (2).
PO6: Using Thumb Rule, CO1 correlates to PO6 as low (1).
CO2: Understand and Evaluation of Network theorems and reduction techniques.
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 to PO6 as low (1).
CO3: Understand the concept of self- inductance and mutual inductance of the magnetic circuits.
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 to PO6 as low (1).
CO4: Analyze series and parallel circuits, steady state response, different circuit topologies (with R, L and C components) and phasor diagrams of the single-phase circuits.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by one level; Therefore, correlation is high (3).
PO2: Analyze (L4)
CO4 Action Verb is same as PO2 verb; Therefore, correlation is high (3).

PO3: Design (L6)
CO4 Action Verb is Less than PO3 verb by two level; Therefore, correlation is low (1)
PO6: Using Thumb Rule, CO4 correlates to PO6 as low (1).

CO5: Apply the concepts to obtain various mathematical and graphical representations of series and parallel resonance.

Action Verb: Apply (L3)

PO1: Apply (L3)
CO5 Action Verb is same as PO1 verb; Therefore, correlation is high (3).
PO2: Analyze (L4)
CO5 Action Verb is Less than by PO2 verb by one level; Therefore, correlation is moderate (2).
PO6: Using Thumb Rule, CO5 correlates to PO6 as low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY SCIENCES: TIRUPATI

(Autonomous)

I B.Tech **AK23 Regulations**

Common to I Sem ECE/ AI&DS/AI&ML/CE/ME & II Sem CSE/CIC/EEE/CSD

Subject Code:23ABS9908	Subject Name: **Engineering Physics Lab**	L T/CLC P 0 0 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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year-Sem	I-I/II	Branch of Study: Common to all Branches				
Subject Code		Subject Name	L	T/ CLC	P	Credits
23AES0202		ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	0	0	3	1.5

PART A
ELECTRICAL ENGINEERING LAB

After completion of the course, students 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

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 Wheatstone 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 Mc Graw Hill,2019,First Edition
2 Power System Engineering, P.V.Gupta, M.L.Soni, U.S.Bhatnagarand , A.Chakrabarti, DhanpatRai&Co,2013
3 Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014,Third Editio

Note: Minimum Six Experiments to be performed.

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering

PART B
ELECTRONICS ENGINEERING LAB

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

PART B
ELECTRONICS ENGINEERING LAB

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.

Reference books:

1 R.L.Boylestad&LouisNashlesky,ElectronicDevices&CircuitTheory,Pearson Education, 202
2 R.P.Jain,ModernDigitalElectronics,4thEdition,TataMcGrawHill,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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
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Department of Electrical and Electronics Engineering

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											
Levelsofcorrelation,viz.,1.Low,2.Moderate,3.High													

Mapping of Course outcomes with Program outcomes Justification Table								
CO No.	**CO**					**Program Outcomes (PO)**	**PO(s): Action verb and BTL(for PO1 toPO5)**	**Level of correlation(0-3)**
	Lesson Plan(Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1, PO2, PO4, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO9:ThumbRule	2 1 1 1
2				Apply	L3	PO1, PO2, PO4, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO9:ThumbRule	3 2 2 1
3				Design	L6	PO2, PO4, PO9	PO2:Analyze(L4) PO4:Design(L6) PO9:ThumbRule	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).
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)
CO3ActionVerbissameasPO4verb;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)
CO4ActionVerb 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)

PO1Verbs: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)

PO1Verbs: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)
Department of Electrical and Electronics Engineering

Year/Sem	I/II	Branch of Study: EEE				
Subject Code		Subject Name	L	T/CLC	P	Credits
23APC0202		ELECTRICAL CIRCUITS LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Understand the concepts of fundamental laws, node and mesh networks.
CO2	Apply various theorems to compare practical results obtained with theoretical calculations.
CO3	Evaluate self, mutual inductance's and coefficient of coupling values, parameters of choke coil.
CO4	Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.
CO5	Analyze self, mutual inductance's, and coefficient of coupling with the help of magnetic circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The concepts of fundamental laws, node and mesh networks.			L2
CO2	Apply	Various theorems to compare practical results obtained with theoretical calculations.			L3
CO3	Evaluate	Self, mutual inductance's and coefficient of coupling values, Parameters of choke coil.			L5
CO4	Create	Locus diagrams of RL, RC series circuits and examine series and parallel resonance.			L6
CO5	Analyze	Self, mutual inductance's, and coefficient of coupling with the help of magnetic circuits.			L4

List of Experiments:

1. Verification of Kirchhoff's circuit laws- (CO1).
2. Verification of node and mesh analysis- (CO1).
3. Verification of network reduction techniques- (CO1).
4. Determination of cold and hot resistance of an electric lamp- (CO1).
5. Determination of Parameters of a choke coil- (CO3).
6. Determination of self, mutual inductance's, and coefficient of coupling- (CO3).
7. Series and parallel resonance- (CO4).
8. Locus diagrams of R-L(L Variable) and R-C(C Variable) series circuits- (CO4).
9. Verification of Superposition theorem- (CO2).
10. Verification of Thevenin's and Norton's Theorems- (CO2).
11. Verification of Maximum Power Transfer Theorem- (CO2).
12. Verification of Compensation Theorem- (CO2).
13. Verification of Reciprocity and Millman's Theorems- (CO2).

Reference books:

1 Engineering Circuits Analysis, JackKemmerly, William Haytand Steven Durbin, Tata McGraw Hill Education, 2005, sixth edition.
2 Network Analysis, M.E.Van Valkenburg, Pearson Education, 2019, Revised Third Edition.

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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

MappingofCourseoutcomeswithProgramoutcomesJustificationTable								
CO No.	**CO**					**Program Outcomes (PO)**	**PO(s): Actionverb and BTL(for PO1 toPO5)**	**Level ofcorrelation(0-3)**
	Lesson Plan(Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1 PO2 PO4 PO9	PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO9:ThumbRule	2 1 1 1
2				Apply	L3	PO1 PO2 PO4 PO9	PO1:Apply(L3) PO2:Analyze(L4) PO4:Analyze(L4) PO9:ThumbRule	3 2 2 1
3				Evaluate	L5	PO2 PO4 PO9	PO2:Analyze(L4) PO4:Design(L6) PO9:ThumbRule	3 2 1
4				Create	L6	PO2 PO4 PO9	PO2:Analyze(L4) PO4:Design(L6) PO9:ThumbRule	3 3 1
5				Analyze	L4	PO1 PO2 PO4 PO9	PO1:Apply(L3) PO2:Analyze(L4) PO4:Design(L6) PO9:ThumbRule	3 3 1 1

CO1: Understand the concepts of fundamental laws, node and mesh networks.
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 various theorems to compare practical results obtained with theoretical calculations.
Action Verb: Apply(L3)
PO1:Apply(L3)
CO2 ActionVerbissameasPO1verb; 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: Evaluate self, mutual inductance's and coefficient of coupling values, parameters of choke coil.
Action Verb: Evaluate(L5)
PO2:Analyze(L4)
CO3 Action Verb is greater than PO2 verb by one level; Therefore, correlation is high(3).
PO4: Design (L6)
CO3 Action Verb is Less than PO4 verb by one level; Therefore, correlation is moderate(2).
PO9: Using Thumb Rule, CO3 correlates to PO9 as low (1).
CO4: Create locus diagrams of RL, RC series circuits and examine series and parallel resonance.
Action Verb: Create(L6)
PO2:Analyze(L4)
CO4 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high(3).
PO4: Design (L6)
CO4 Action Verb is same as PO4 verb; Therefore, correlation is high(3).
PO9: Using Thumb Rule, CO4 correlates to PO9 as low (1).
CO5: Analyze self, mutual inductances, and coefficient of coupling with the help of magnetic circuits.
Action Verb: Analyze(L4) PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore, correlation is high(3).
PO2: Analyze (L4)
CO5 Action Verb is same as PO2 verb; Therefore, correlation is high(3).
PO4: Design (L6)
CO5 Action Verb is Less than PO4 verb by two level; Therefore, correlation is low(1).
PO9: Using Thumb Rule, CO5 correlates to PO9 as low (1).

I B. TECH **AK 23 REGULATION**

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

Subject Code	Subject: Name	L	T/CLC	P	CREDITS
23AHM9904	NSS/NCC/SCOUTS&GUIDES/ COMMUNITY SERVICE	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 personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution

UNIT-II

Nature & Care

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 PopulationEducation.
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

CO-POMAPPING JUSTIFICATION:

Unit No	Course Outcomes		Program Outcome (PO)	PO(s):Action Verb and BTL(forPO1 to PO12)	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)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

II Year – I Semester										
S.No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**CIE**	**SEE**	**Total**
				L	**T/CLC**	**P**	**C**			
1	Basic Sciences	23ABS9910	Complex Variable & Numerical Methods	2	1	0	3	30	70	100
2	Humanities & Social Sciences	23AHM9905	Universal Human Values - Understanding Harmony	2	1	0	3	30	70	100
3	Professional Core	23APC0205	Electromagnetic Field Theory	2	1	0	3	30	70	100
4	Professional Core	23APC0206	Electrical Circuit Analysis-II	2	1	0	3	30	70	100
5	Professional Core	23APC0207	DC Machines & Transformers	2	1	0	3	30	70	100
6	Professional Core	23APC0208	Electrical Circuit Analysis-II and Simulation Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0209	DC Machines & Transformers Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement Courses	23ASC0502	Data Structures	0	1	2	2	30	70	100
9	Mandatory course	23AMC9901	Environmental Sciences	2	0	0	-	30	-	30
			Total	**12**	**06**	**08**	**20**	**270**	**560**	**830**

AK 23 Regulations

Year: II **Semester:**I **Branch of Study:EEE**

Subject Code: 23ABS9910	Subject Name: COMPLEX VARIABLES AND NUMERICAL METHODS	L	T/CLC	P	Credits
		2	1	0	3

Course Outcomes (CO): Students will be able to

1. Apply the differentiation for complex variable functions.
2. Evaluate the integrals and power series expansions for complex variable functions.
3. Analyze relevant numerical techniques for interpolation and concepts of curve fitting.
4. Apply the different iteration methods to solve Algebraic, Transcendental and Simultaneous Equations.
5. Evaluate different numerical methods with accuracy and efficiency for ordinary differential equations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the differentiation	for complex variable functions		L3
2	Evaluate	the integrals and power series expansions	for complex variable functions		L5
3	Analyze	relevant numerical techniques	for interpolation and concepts of curve fitting		L4
4	Apply	the different iteration methods	To solve Algebraic, Transcendental and Simultaneous Equations.		L3
5	Evaluate	different numerical methods with accuracy and efficiency	for ordinary differential equations		L5

UNITI :Complex Variable – Differentiation 10hrs

Introduction to functions of complex variable-concept of Limit, continuity &Differentiation, Cauchy-Riemann equations(cartesian and polar coordinates), analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT II:Complex Variable – Integration 10hrs

Line integral-Contour integration, Cauchy's integral theorem(Simple Case), Cauchy Integral formula. Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of integralsof the type.

(a) $\int_0^{2\pi} F(\cos\theta, \sin\theta)\, d\theta$) (b) $e^{imx}\, dx$ $\int_{-\infty}^{\infty}$

UNIT III: Interpolation 9hrs

Finiteforward and backwarddifferences-Newton's forward and Newton'sbackward interpolation formulae – Lagrange's formula.

Curve fitting: By the method of least squaresFitting of straight line, second-degree and Exponential curve.

UNIT IV:Solution of Algebraic & Transcendental Equations 9hrs

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method.

System of Algebraic equations: LU decomposition,Gauss Elimination, Jacobi methods and Gauss Seidal iterative method.

UNIT V:Solution of Initial value problems to Ordinary differential equations 9hrs

Numerical solutions of Ordinary Differential equations:Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

Textbooks:

1. B.S.Grewal,HigherEngineeringMathematics, KhannaPublishers,2017, 44th Edition
2. SSastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
3. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,2021 5th Edition(9th reprint).

ReferenceBooks:

1. ErwinKreyszig, AdvancedEngineeringMathematics, JohnWiley&Sons, 2018, 10th Edition.
2. B.V.Ramana, Higher Engineering Mathematics, by McGrew Hill publishers
3. T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganatham,M.V.V.S.N.Prasad, Engineering Mathematics volume-IV, S.Chand Publications
4. T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganatham,M.V.V.S.N.Prasad, Numerical Methods, S.Chand Publications

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
3. http://nptel.ac.in/courses/111105090

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 (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	correlation	Action Verb	BTL			
1				Apply	L3	PO1	Apply (L3)	3
2				Evaluate	L5	PO2	Analyze (L4)	3
3				Analyze	L4	PO2	Analyze (L4)	3
4				Apply	L3	PO1	Apply (L3)	3
5				Evaluate	L5	PO2	Analyze (L4)	3

CO1: Apply the differentiation for complex variable functions: Apply (L3)

PO1 Verb: Apply (L3)

CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO2: Evaluate the integrals and power series expansions for complex variable functions: Evaluate(L5)

PO2 Verb: Analyze(L4)

CO2 Action verb is high level to PO2 verb; therefore the correlation is high (3).

CO3: Analyze relevant numerical techniques for interpolation and concepts of curve fitting: Analyze(L4)

PO2 Verb: Analyze(L4)

CO4Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Apply the different iteration methods to solve Algebraic, Transcendental and Simultaneous Equations : Apply (L3)

PO1 Verb: Apply (L3)

CO3 Action Verb is equal to PO1 verb; therefore the correlation is high (3).

CO5: Evaluate different numerical methods with accuracy and efficiency for ordinary differential equations: Evaluate(L5)

PO2 Verb: Analyze(L4)

CO5 Action verb is high level to PO2 verb; therefore the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
(Autonomous)

Year: II B.Tech **Common to all branches)** Semester: I & II

Subject Code	Subject Name	L T/CLC P	Credit: 3
23AHM9905	**UNIVERSAL HUMAN VALUES**	2 1 0	

Pre-Requisites		Semester	**I & II**

Course Outcomes (CO): 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 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 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 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 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 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

Textbook and Teachers Manual

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 Resources:

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

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

Articulation matrix

10.

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND	CO1								2			2		
	CO2							3	3					
	CO3						2	2	2					
	CO4						3	3	3			3		
	CO5						2	2	2			2		

CO-PO mapping justification:

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	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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/I	Branch of Study: EEE				
Subject Code		Subject Name	L	T/CLC	P	Credits
23APC0205		ELECTROMAGNETIC FIELD THEORY	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the concepts of vector algebra, vector calculus and fundamental laws of electrostatics.
CO2	Understand the concepts of the conductors, dielectrics and capacitance in electric field.
CO3	Analyze the properties of magnetic fields using various magneto static laws.
CO4	Analyze the properties of self and mutual inductances in solenoid, toroid, coaxial cables, straight long and square loop wires.
CO5	Understand the electromagnetic induction characteristics with respect to time varying field.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The concepts of vector algebra, vector calculus and fundamental laws of electrostatics.			L2
CO2	Understand	The concepts of the conductors, dielectrics and capacitance in electric field.			L2
CO3	Analyze	The properties of magnetic fields.	Using various magnetostatic laws.		L4
CO4	Analyze	The properties of self and mutual inductances solenoid, toroid, coaxial cables, straight long an			L4
CO5	Understand	The electromagnetic induction characteristics	with respect to time varying field		L2

SYLLABUS

UNIT-I

TITLE: Vector Analysis & Electrostatics
Vector Analysis:

Vector Algebra: Scalars and Vectors, Unit vector, Vector addition and subtraction, Position and distance vectors, Vector multiplication, Components of a vector.
Coordinate Systems: Rectangular, Cylindrical and Spherical coordinate systems.
Vector Calculus: Differential length, Area and Volume. Del operator, Gradient of a scalar, Divergence of a vector and Divergence theorem (definition only). Curl of a vector and Stoke's theorem (definition only), Laplacian of a scalar.
Electrostatics:
Coulomb's law and Electric field intensity (EFI) – EFI due to Continuous charge distributions (line and surface charge), Electric flux density, Gauss's law (Maxwell's first equation, $\nabla . \vec{D} = \rho$), Applications of Gauss's law, Electric Potential, Work done in moving a point charge in an electrostatic field (second Maxwell's equation for static electric fields, $\nabla \times \vec{E} = 0$), Potential gradient, Laplace's and Poison's equations.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

UNIT-II

TITLE: Conductors – Dielectrics and Capacitance

Behavior of conductor in Electric field, Electric dipole and dipole moment – Potential and EFI due to an electric dipole, Torque on an Electric dipole placed in an electric field, Current density-conduction and convection current densities, Ohm's law in point form, Behavior of conductors in an electric field, Polarization, dielectric constant and strength, Continuity equation and relaxation time, Boundary conditions between conductor to dielectric, dielectric to dielectric and conductor to free space, Capacitance of parallel plate, coaxial and spherical capacitors, Energy stored and density in a static electric field, Coupled and decoupled capacitors.

UNIT-III

TITLE: Magneto statics, Ampere's Law and Force in magnetic fields

Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Magnetic flux density and Maxwell's second Equation ($\nabla . \vec{} \vec{} = 0$), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation ($\nabla \times \vec{} \vec{} = \vec{}$).

Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, Magnetic dipole, Magnetic torque, and moment.

UNIT-IV

TITLE: Self and mutual inductance

Self and mutual inductance – determination of self-inductance of a solenoid, toroid, coaxial cable and mutual inductance between a straight long wire and a square loop wire in the same plane – Energy stored and energy density in a magnetic field.

UNIT-V

TITLE: Time Varying Fields

Faraday's laws of electromagnetic induction, Maxwell's fourth equation ($\nabla \times \vec{} \vec{} = -\frac{\partial}{\partial t}\vec{}\vec{}$), integral and point forms of Maxwell's equations, statically and dynamically induced EMF, Displacement current, Modification of Maxwell's equations for time varying fields, Poynting theorem and Poynting vector.

Text books:

1 "Elements of Electromagnetics" by Matthew N O Sadiku, Oxford Publications, 7th edition, 2018.
2 "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7th Editon.2006.

Reference books:

1 "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition.
2 "Electromagnetic Field Theory" by Yaduvir Singh, Pearson India, 1st edition, 2011.
3 "Fundamentals of Engineering Electromagnetics" by Sunil Bhooshan, OxfordUniversity Press, 2012.
4 Schaum's Outline of Electromagnetics by Joseph A. Edminister, Mahamood Navi, 4th Edition, 2014.

Web Resources:

1 https://archive.nptel.ac.in/courses/108/106/108106073/
2 https://nptel.ac.in/courses/117103065

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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

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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1, PO2	Apply (L3) Identify (L3)	2 2
2				Understand	L2	PO1, PO2	Apply (L3) Identify (L3)	2 2
3				Analyze	L4	PO1, PO2	Apply (L3) Analyze (L4)	3 3
4				Analyze	L4	PO1, PO2	Apply (L3) Analyze (L4)	3 3
5				Understand	L2	PO1, PO2	Apply (L3) Identify (L3)	2 2

CO1: Understand the concepts of vector algebra, vector calculus and fundamental laws of electrostatics.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO2 Verb: Identify (L3)
CO1 Action verb level is less than PO2 verb by one level; Therefore, correlation is Moderate (2).
CO2: Understand the concepts of the conductors, dielectrics and capacitance in electric field.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO2 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO2 Verb: Identify (L3)
CO2 Action verb level is less than PO2 verb by one level; Therefore, correlation is Moderate (2).
CO3: Analyze the properties of magnetic fields using various magneto static laws.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO3 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO3 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).
CO4: Analyze the properties of self and mutual inductances in solenoid, toroid, coaxial cables, straight long and a square loop wires.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

CO4 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).

PO2 Verb: Analysis (L4)

CO4 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).

CO5: Understand the electromagnetic induction characteristics with respect to time varying field.

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

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

PO2 Verb: Identify (L3)

CO5 Action verb level is less than PO2 verb by one level; Therefore, correlation is Moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0206		ELECTRICAL CIRCUIT ANALYSIS-II	2	1	0	3

After completion of the course, students will be able to:	
CO1	Analyze the three phase balanced and unbalanced circuits for different configurations.
CO2	Analyze the response of RLC circuits using differential equation and laplace transform approaches
CO3	Evaluate the Z, Y, H and ABCD parameters of a two port electrical network.
CO4	Apply the Fourier series to the electrical circuits with periodic excitation.
CO5	Analyze the Design procedure of various filters in electrical circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Three Phase Balanced And Unbalanced Circuits,	Different Circuit Configurations.		L4
CO2	Analyze	the response of RLC circuits using	Differential equation and laplace transform approaches.		L4
CO3	Evaluate	the Z, Y, H and ABCD parameters of a two port electrical network.			L5
CO4	Apply	Fourier series for the electrical circuits	With periodic excitation		L4
CO5	Analyze	various filters	in electrical circuits		L4

SYLLABUS

UNIT-I

TITLE: Analysis of three phase balanced circuits & unbalanced circuits

Analysis of three phase balanced circuits:

Phase sequence, star and delta connection of sources and loads, relation between line and phase quantities, analysis of balanced three phase circuits, and measurement of active and reactive power.

Analysis of three phase unbalanced circuits:

Loop method, Star-Delta transformation technique, two-wattmeter method for measurement of three phase power.

UNIT-II

TITLE: Laplace Transforms & Transient Analysis

Laplace Transforms:

Definition and Laplace transforms of standard functions– Shifting theorem – Transforms of derivatives and
integrals, Inverse Laplace transforms and applications.

Transient Analysis:

Transient response of R-L, R-C and R-L-C circuits (Series and parallel combinations) for D.C. and sinusoidal excitations – Initial conditions-Solution using differential equation approach and Laplace transform approach.

UNIT-III

TITLE: Network Parameters

Impedance parameters, Admittance parameters, Hybrid parameters, Transmission (ABCD) parameters, conversion of Parameters from one form to other-Conditions for Reciprocity and Symmetry-Interconnection of Two Port networks in Series, Parallel and Cascaded configurations- problems.

UNIT-IV

TITLE: Analysis of Electric Circuits with Periodic Excitation

Fourier series and evaluation of Fourier coefficients, Trigonometric and complex Fourier series for periodic waveforms, Application to Electrical Systems – Effective value and average value of non-sinusoidal periodic waveforms, power factor, effect of harmonics.

UNIT-V

TITLE: Filters

Classification of filters-Low pass, High pass, Band pass and Band Elimination filters, Constant-k filters -Low pass and High Pass, Design of Filters.

Text books:

1 Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, 8th Edition McGraw-Hill, 2013
2 Fundamentals of Electric Circuits, Charles K. Alexander, Mathew N. O. Sadiku, 3rdEdition, Tata McGraw- Hill, 2019.

Reference books:

1 Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2019.
2 Circuit Theory: Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., 2018, 7thRevised Edition.
3 Network Theory, N. C. Jagan and C. Lakshminarayana, 1st Edition, B. S. Publications,2012.
4 Circuits and Networks Analysis and Synthesis, A. Sudhakar, Shyam Mohan S. Palli,5th Edition, Tata McGraw-Hill, 2017.
5 Engineering Network Analysis and Filter Design (Including Synthesis of One Port Networks)- DurgeshC.KulshreshthaGopal G. Bhise, Prem R. Chadha ,UmeshPublications 2012.

Web Resources:

1 https://archive.nptel.ac.in/courses/117/106/117106108/2.
2 https://archive.nptel.ac.in/courses/108/105/108105159/

Mapping of Course outcomes with Program outcomes													
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	2										2	2
CO2	2	2										1	1
CO3	3	3										3	3
CO4	3	2										3	3
CO5	2	2										3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Analyze	L4	PO1, PO2	Apply (L3) Identify(L3)	3 3
2				Analyze	L4	PO1, PO2	Apply (L3) Identify (L3)	3 3
3				Evaluate	L5	PO1, PO2	Apply (L3) Analyze (L4)	3 3
4				Apply	L3	PO1, PO2	Apply (L3) Analyze (L4)	3 2
5				Analyze	L4	PO1 PO2	Apply (L3) Identify (L3)	3 3

CO1: Analyze the three phase balanced and unbalanced circuits for different configurations.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO1 Action verb level is level is greater than PO1 verb by one level ; Therefore, correlation is High (3).
PO2 Verb: Identify (L3)
CO1 Action verb level is level is greater than PO2 verb by one level; Therefore, correlation is High (3).

CO2: Analyze the response of RLC circuits using differential equation and laplace transform approaches.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO2 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Identify (L3)
CO2 Action verb level is greater than PO2 verb by one level; Therefore, correlation is High (3).

CO3: Evaluate the Z, Y, H and ABCD parameters of a two port electrical network.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO3 Action verb level is greater than PO1 verb by two level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO3 Action verb level is greater than PO2 verb level by one level; Therefore, correlation is High (3).

CO4: Apply the Fourier series to the electrical circuits with periodic excitation.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO4 Action verb level is level is equal to PO1 verb: Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO4 Action verb level is less than PO2 verb level by one level; Therefore, correlation is Moderate (2).

CO5: Analyze the Design procedure of various filters in electrical circuits.
Action Verb: Design (L6)
PO1 Verb: Analyze (L4)
CO5 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO3 Verb: Identify (L3)
CO5 Action verb level is level is greater than PO2 verb by one level; Therefore, correlation is High (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/I	Branch of Study: EEE				
Subject Code		Subject Name	L	T/CLC	P	Credits
23APC0207		DC MACHINES & TRANSFORMERS	2	0	1	3

After completion of the course, students will be able to:	
CO1	Understand the process of voltage build-up in D.C generators and its characteristics.
CO2	Analyze the process of starting DC motors and speed control using various tests.
CO3	Analyze the performance of single phase transformer.
CO4	Apply direct and indirect testing methods to transformers for their characteristics.
CO5	Analyze the various configurations of three-phase transformers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The process of voltage build-up in D.C generators and its characteristics.			L2
CO2	Analyze	The process of starting DC motors and speed control using various tests.			L4
CO3	Analyze	The performance of single phase transformer.			L4
CO4	Apply	Direct and indirect testing methods to transformers and study the characteristics of Transformers.			L3
CO5	Analyze	Various configurations of three-phase transformers			L4

SYLLABUS

UNIT-I

TITLE: DC Machines

Electro mechanical energy conversion series and parallel magnetic circuits - Construction and principle of operation of D.C Generator and D.C Motor – EMF equation for generator – Excitation techniques– characteristics of D.C generators –applications of D.C Generators, Back-EMF and torque equations of D.C motor – Armature reaction and commutation, Applications of D.C Motors.

UNIT-II

TITLE: Starting, Speed Control And Testing Of D.C Machines

Characteristics of D.C motors – losses and efficiency – Separation of iron and friction losses. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of D.C machines – brake test, Swinburne's test –Hopkinson's test–Field Test.

UNIT-III

TITLE: Single-Phase Transformers

Introduction to single-phase Transformers (Construction and principle of operation)–EMF Equation – Operation on no-load and on load –Lagging, Leading and Unity Power Factors Loads –Phasor Diagrams– Equivalent Circuit –Regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency, Applications.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

UNIT-IV

TITLE: Testing Of Transformers

Open Circuit and Short Circuit tests – Sumpner's test – separation of losses–– Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.

UNIT-V

TITLE: Three-Phase Transformers

Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages– Parallel operation–three winding transformers- transients in switching –off load and on load tap changers–Scott connection.

Text books:

1 Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995.
2 Performanceand analysis of AC machines by M.G. Say, CBS, 2002.

Reference books:

1 Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition
2 Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011.
3 Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021.
4 Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007.
5 Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,&Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Web Resources:

1 nptel.ac.in/courses/108/105/108105112
2 nptel.ac.in/courses/108/105/108105155

Mapping of Course outcomes with Program outcomes

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

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Identify(L3) PO4:Analyze (L4) PO9: Thumb Rule	2 2 1 2
2				Understand	L2	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3
3				Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 2 3
4				Apply	L3	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Identify(L3) PO4:Analyze (L4) PO9: Thumb Rule	3 3 2 2
5				Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3

CO1: Understand the process of voltage build-up in D.C generators and its characteristics.
Action Verb: Understand (L1)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify (L3)

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

PO4 Verb: Analyze (L4)

CO1 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO1 level is 2, Using Thumb Rule its correlation is moderate (2)

CO2: Analyze the process of starting DC motors and speed control using various tests.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify (L3)

CO2 Action Verb is greater than to PO2 verb by one level; Therefore correlation is high (3).

PO4 Verb: Analyze (L4)

CO5 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO2 level is 3, Using Thumb Rule its correlation is moderate (3).

CO3: Analyze the performance of single phase transformer.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO3 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3)

CO3 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).

PO4 Verb: Analyze (L4)

CO3 Action Verb is less than to PO4 verb by one level; Therefore correlation is moderate (2).

Based on students' participate in CLC activities. From this: CO3 level is 4, Using Thumb Rule its correlation is high (3).

CO4: Apply direct and indirect testing methods to transformers and study the characteristics of transformers.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

CO4 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3)

CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

PO4 Verb: Analyze (L4)

CO4 Action Verb is less than to PO4 verb by one level; Therefore correlation is moderate (2).

Based on students' participate in CLC activities. Here, CO4 level is 3, by Using Thumb Rule its correlation is moderate (2).

CO5: Analyze various configurations of three-phase transformers.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO5 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3)

CO5 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).

PO4 Verb: Analyze (L4)

CO5 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO5 level is 4, Using Thumb Rule its correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0208		ELECTRICAL CIRCUIT ANALYSIS-II & SIMULATION LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Evaluate the active and reactive powers in three phase circuits.
CO2	Analyze the transient response of electrical circuits.
CO3	Evaluate the two port network parameters of electrical circuits using V labs.
CO4	Analyze the properties of electrical circuits using simulation tools.
CO5	Apply the network theorems to electrical circuits using simulation tools.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	the active and reactive powers	three phase circuits		L5
CO2	Analyze	the transient response of electrical circuits.			L4
CO3	Evaluate	the two port network parameters of electrical circuits	Using V labs.		L5
CO4	Analyze	the properties of electrical circuits	Using software tools.		L4
CO5	Apply	the network theorems to electrical circuits	using simulation tools		L3

SYLLABUS

LIST OF EXPERIMENTS

1. Measurement of Active Power and Reactive Power for balanced loads. CO1
2. Measurement of Active Power and Reactive Power for unbalanced loads. CO1
3. Simulation and analysis of transient response of RL, RC and RLC circuits. CO2
4. Determination of Z and Y parameters by using V labs. CO3
5. Determination of ABCD and hybrid parameters by using V labs. CO3
6. Verification of Kirchhoff's current law and voltage law using simulation tools. CO4
7. Verification of mesh and nodal analysis using simulation tools. CO4
8. Verification of series and parallel resonance using simulation tools. CO4
9. Verification of self-inductance and mutual inductance by using simulation tools. CO4
10. Verification of superposition and maximum power transfer theorems using simulation tools. CO5
11. Verification of Reciprocity and Compensation theorems using simulation tools. CO5
12. Verification of Thevenin's and Norton's theorems using simulation tools. CO5

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Mapping of Course outcomes with Program outcomes													
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	2										2	
CO2	3	3										3	
CO3	3	3										3	
CO4	3	3										3	
CO5	3	3										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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Evaluate	L5	PO1, PO2	Apply (L3) Identify (L3)	3 3
2				Analyze	L4	PO1, PO2	Apply (L3) Identify (L3)	3 3
3				Evaluate	L5	PO1, PO2	Apply (L3) Analyze (L4)	3 3
4				Analyze	L4	PO1, PO2	Apply (L3) Analyze (L4)	3 3
5				Apply	L4	PO1, PO2	Apply (L3) Identify (L3)	3 3

CO1: Evaluate the active and reactive powers in three phase circuits.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO1 Action verb level is greater than PO1 verb by two level; Therefore, correlation is High(3).
PO2 Verb: Identify (L3)
CO1 Action verb level is greater than PO2 verb by two level; Therefore, correlation is High (3).
CO2: Analyze the transient response of electrical circuits.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO2 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Identify (L3)
CO2 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
CO3: Evaluate the two port network parameters of electrical circuits using V labs.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO3 Action verb level is greater than PO1 verb by two level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO3 Action verb level is greater than PO2 verb by one level; Therefore, correlation is High (3).
CO4: Analyze the properties of electrical circuits using simulation tools.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO4 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO4 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).
CO5: Apply the network theorems to electrical circuits using simulation tools.
Action Verb: Apply (L4)
PO1 Verb: Apply (L3)
CO3 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Identify (L3)
CO3 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/I	Branch of Study: EEE				
Subject Code		Subject Name	L	T/CLC	P	Credits
23APC0209		DC MACHINES & TRANSFORMERS LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Evaluate the operational and speed control characteristics of D.C shunt motor.
CO2	Evaluate the characteristics of D.C machines by conducting direct and indirect tests.
CO3	Evaluate the performance parameters of a single phase transformer.
CO4	Analyze the parallel operation of a Single phase Transformers.
CO5	Analyze the Scott connection of transformers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	Operational and speed control characteristics of D.C shunt motor.			L5
CO2	Evaluate	Characteristics of D.C machines	Conducting direct and indirect tests		L5
CO3	Evaluate	The performance parameters of single phase transformer			L5
CO4	Analyze	Parallel operation of Single phase Transformers.			L4
CO5	Analyze	Scott connection of transformers.			L4

SYLLABUS

List of Experiments

Any 10 of the following experiments are to be conducted

1. Speedcontrol of D.C shunt motor by Field Current and Armature Voltage Control. CO1
2. Braketest on D.C shunt motor- Determination of performance curves. CO1
3. Hopkinson's test on D.C shunts Machines. CO1
4. Swinburne's test - Predetermination of efficiencies as DC Generator and Motor. CO2
5. Loadtest on D.C compound generator-Determination of characteristics. CO2
6. Loadtest on D.C shunt generator-Determination of characteristics. CO2
7. Fields test on D.C series machines-Determination of efficiency. CO2
8. Braketest on D.C compound motor-Determination of performance curves. CO2
9. OC & SC tests on single phase transformer. CO3
10. Sumpner's test on single phase transformer. CO3
12. Separation of core losses of a single-phase transformer . CO3
11. Parallel operation of Single-phase Transformers. CO4
13. Scott connection of transformers. CO5

Reference books:

1 https://ems-iitr.vlabs.ac.in/List%20of%20experiments.html

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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	3	3		3					3			3	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 (0-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1				Evaluate	**L5**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 3 3 3
2				Evaluate	**L5**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 3 3 3
3				Evaluate	**L5**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 2 2 2
4				Analyze	**L4**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 3 3 3
5				Analyze	**L4**	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 3 3 3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

CO1 Evaluate the operational and speed control characteristics of D.C shunt motor.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).
PO4 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO4 verb by one level; Therefore, correlation is high (3).
CO1 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

CO2 Evaluate the characteristics of D.C machines by conducting direct and indirect tests
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO4 verb by one level; Therefore, correlation is high (3).
CO2 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

CO3 Evaluate the performance parameters of a single phase transformer.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO2 verb by two level; Therefore, correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO4 verb by one level; Therefore, correlation is high (3).
CO2 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

CO4 Analyze the parallel operation of a Single phase Transformers.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO4 Action Verb is same to PO2 verb; Therefore, correlation is high (3)
PO4 Verbs: Analyze (L4)
CO4 Action Verb is same to PO4 verb; Therefore, correlation is high (3).
CO4 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO5 Analyze the Scott connection of transformers.
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: Analyze (L4)
CO5 Action Verb is greater than PO2 verb by one level; Therefore, correlation is high (3).
PO4 Verbs: Analyze (L4)
CO5 Action Verb is same to PO4 verb; Therefore, correlation is high (3).
CO5 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

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

Course Code	Year & Sem	DATA STRUCTURES (Skill Enhancement Course) (EEE)	L	T/CLC	P	C
23ASC0502	II-I		0	1	2	2

Course Outcomes:

CO1: Understand the role of data structures in organizing and accessing data
CO2: Apply the linked lists concepts for dynamic data storage
CO3: Apply the stack mechanism to develop stack applications
CO4: Understand the queue and deque dynamic data structure techniques
CO5: Apply the tree techniques for processing hierarchical data structure

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the role of data structures in organizing and accessing data			L2
CO2	Apply	the linked lists concepts		for dynamic data storage	L3
CO3	Apply	the stack mechanism		to develop stack applications	L3
CO4	Understand	the queue and deque dynamic data structure techniques			L2
CO5	Apply	the tree techniques		for processing hierarchical data structure	L3

UNIT – I		11 Hrs

Introduction to Data Structures: Definition and importance of Data structures, Abstract data types (ADTs) and its specifications, Arrays: Introduction, 1-D, 2-D Arrays, accessing elements of array, Row Major and Column Major storage of Arrays, Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Quick sort.

Sample experiments:

1. Program to find min & max element in an array.
2. Program to implement matrix multiplication.
3. Find an element in given list of sorted elements in an array using Binary search.
4. Implement Selection and Quick sort techniques.

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.

Sample experiments:

1. Write a program to implement the following operations using SLL.
   a. Insert b. Deletion c. Traversal
2. Write a program to store name, roll no, and marks of students in a class using circular double linked list.
3. Write a program to perform addition of given two polynomial expressions using linked list.

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.

Sample experiments:

1. Implement stack operations using
   a. Arrays b. Linked list
2. Convert given infix expression into post fix expression using stacks.
3. Evaluate given post fix expression using stack.
4. Write a program to reverse given linked list using stack.

UNIT – IV		10 Hrs

Queues: Introduction to queues: properties and operations, Circular queues, implementing queues using arrays and linked lists,Applications of queues scheduling, etc.

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

Sample experiments:

1. Implement Queue operations using
   a. Arrays b. Linked list
2. Implement Circular Queue using
   a. Arrays b. Linked list
3. Implement Deque using linked list.

UNIT – V		9 Hrs

Trees: Introduction to Trees, Binary trees and traversals, Binary Search Tree – Insertion, Deletion & Traversal

Sample experiments:

1. Implement binary tree traversals using linked list.
2. Write program to create binary search tree for given list of integers. Perform in-order traversal of the tree. Implement insertion and deletion operations.

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

Correlation matrix

Unit No.	CO				BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb				
1	11	23%	3	CO1: Understand	L2	PO1 PO2 PO3 PO5 PO11	PO1: Apply (L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply (L3) PO11: Thumb rule	2 3 2 2 2
2	09	19%	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	09	19%	2	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	10	20%	2	CO4: Understand	L2	PO1 PO2 PO3 PO5 PO11	PO1: Apply (L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply (L3) PO11: Thumb rule	2 3 2 2 3
5	09	19%	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
	48	100 %						

Justification Statements :

CO1: Understand the role of data structures in organizing and accessing 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 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)
PO11: Thumb rule
For some of Linear Data Structure applications like array, sorting and searching concepts are used to write programs. Therefore, the correlation is moderate (2)

CO2: Apply the linked lists concepts for dynamic data storage
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 more than 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)
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 level as PO5 verb. Therefore, the correlation is high (3)

CO3: Apply the stack mechanism to develop stack applications
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 more than 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)
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 level as PO5 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some of Stack applications like well-formed parentheses, redo, undo, expression evaluation concepts are used to solve problems. Therefore, the correlation is moderate (2)

CO4: Understand the queue and deque dynamic data structure techniques
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO4 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
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 less than PO3 verb by one level. Therefore, the correlation is moderate (2)
PO5 Verb: Apply (L3)
CO4 Action verb is less than PO5 verb by one level. Therefore, the correlation is moderate (2)
PO11: Thumb rule
For real time applications Queues are used to schedule, booking & reservation purpose. Therefore, the correlation is high (3)

CO5: Apply the tree techniques for processing hierarchical data structure
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: Review (L2)
CO5 Action verb is more than PO2 verb. Therefore, the correlation is high (3)
PO3 Verb: Develop (L3)
CO5 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO4 Verb: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2)
PO5 Verb: Apply (L3)
CO5 Action verb is same level as PO5 verb. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(Autonomous)

Year: II&III B.Tech **Semester: I&II** **AK 23 Regulations**

Branch: Common to All

Subject Code	Subject Name	L	T/CLC	P	Credits
23AMC9901	Environmental Science	2	0	0	0

Course Code			L	T/CLC	P	C
23AMC9901	**ENVIRONMENTAL SCIENCE**		**2**	**0**	**0**	**0**
Pre-Requisites	ENVIRONMENTAL SCIENCE	Semester	**II**			

Course Outcomes (CO): Student will be able to

1. Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
2. Understand the ecosystem and biodiversity to solve complex environmental problems
3. Apply various types of pollution and solid waste management and related preventive measures
4. Apply rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation.
5. Understand the population explosion

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	Multidisciplinary nature of environmental studies and various renewable and nonrenewable resources			**L2**
2	**Understand**	Ecosystem and biodiversity to solve complex environmental problems			**L2**
3	**Apply**	Various types of pollution and solid waste management and related preventive measures			**L3**
4	**Apply**	Rainwater harvesting, watershed management, ozone layer depletion and wasteland reclamation			**L3**
5	**Understand**	Population explosion			**L2**

UNIT – I **(10Hr)**

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 over utilization 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 **(15Hr)**

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 **(8Hr)**

Environmental Pollution: Definition, Causes, effects and its control measures 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: floods, earthquake, cyclone, Tsunami and landslides.

UNIT – IV **(9Hr)**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water 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 **(8Hr)**

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

TEXT BOOKS:

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

REFERENCES:

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.

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						
3						2	2						
4						2	2						
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	PO6: PO7:	2,2
2	**15**	**15**	28	3	**Understand**	**L2**	PO7	PO7:	2,2
3	**8**	**8**	15	2	**Apply**	**L3**	PO6 PO7	PO6: PO7:	2,2
4	**9**	**10**	19	2	**Apply**	**L3**	PO6,PO7	PO6: PO7:	2,2
5	**8**	**8**	15	2	**Understand**	**L2**	PO7	PO7:	2,2
	50	**53**	**100**						

CO1: Understand the multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.

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 ecosystem and biodiversity to solve complex environmental problems

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 various types of pollution and solid waste management and related preventive measures

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

Action Verb: APPLY (L3)

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

CO5: Understand the population explosion

Action Verb: Understand (L2)

CO5 Action Verb is **Understand** of BTL 2.Using Thumb rule; L2 correlates PO6 and PO7 as a moderate (2)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

II Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Management Course-I	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	Engineering Sciences	23AES0403	Analog Circuits	2	1	0	3	30	70	100
3	Professional Core	23APC0210	Power Systems-I	2	1	0	3	30	70	100
4	Professional Core	23APC0211	Induction and Synchronous Machines	2	1	0	3	30	70	100
5	Professional Core	23APC0212	Control Systems	2	1	0	3	30	70	100
6	Professional Core	23APC0213	Induction and Synchronous Machines Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0214	Control Systems Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement Courses	23ASC0501	Python Programming	0	1	2	2	30	70	100
9	Engineering Sciences	23AES0304	Design Thinking & Innovation	1	0	2	2	30	70	100
			Total	**11**	**05**	**10**	**21**	**270**	**630**	**900**

Mandatory Community Service Project of 08 weeks duration during summer vacation

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T/CLC	P	C
23AHMMB01		2	1	0	2

(Common to ALL branches of Engineering)

Course Outcomes (CO):

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.

Text books:

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. Domnick Salvatore: 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	CO1	3												
	CO2	1									1			
	CO3	3									3			
	CO4										3			
	CO5										3			

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	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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Branch: EEE

Course Code	Year & Sem	ANALOG CIRCUITS	L	T/CLC	P	C
23AES0403	II-II		2	1	0	3

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

CO1 **Understand** the concepts of Diode Clipping and Clamping circuits and transistor biasing circuits.

CO2 **Analyze** the CB, CE, CC Transistor amplifiers using hybrid model and feedback amplifier parameters.

CO3 **Evaluate** the frequency of various oscillator circuits and Operational Amplifier characteristics.

CO4 **Understand** the various applications, comparators and waveform generators using Op-Amps.

CO5 **Analyze** the operation of 555 IC Timer, PLL, VCO, D/A and A/D converters using OP-Amps.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts of Diode Clipping and Clamping circuits and transistor biasing circuits			L2
CO2	Analyze	the transistor amplifiers	using hybrid model	and feedback amplifier parameters	L4
CO3	Evaluate	the frequency of various oscillator circuits and Operational Amplifier characteristics			L5
CO4	Understand	the various applications, comparators and waveform generators	using Op-Amps		L2
CO5	Analyze	the operation of 555 IC Timer, PLL, VCO, D/A and A/D converters	using OP-Amps		L4

UNIT I

Diode clipping and clamping circuits: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, clamping circuit operation.

DC biasing of BJTs: Load lines, Operating Point, Bias Stability, Collector-to-Base Bias, Self-Bias, Stabilization against Variations in V_{BE} and β for the Self-Bias Circuit, Bias Compensation, Thermal Runaway, Thermal Stability.

UNIT II

Small Signals Modeling of BJT: Analysis of a Transistor Amplifier Circuit using h- parameters, Simplified CE Hybrid Model, Analysis of CE, CC, CB Configuration using Approximate Model, Frequency Response of CE and CC amplifiers.

Feedback Amplifiers: Classification of Amplifiers, the Feedback Concept, General Characteristics of Negative-Feedback Amplifiers, Effect of Negative Feedback upon Output and Input Resistances, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

UNIT III

Oscillator Circuits: Barkhausen Criterion of oscillation, Oscillator operation, R-C phase shift oscillator, Wien bridge Oscillator, Crystal Oscillator.

Operational Amplifiers: Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Block Diagram Representation of Typical Op-Amp, OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.

UNIT IV

OP-AMPS Applications: Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator.

Comparators and Waveform Generators: Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators.

UNIT V

Timers and Phase Locked Loop: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger, PLL block schematic, principles and description of individual blocks, 565 PLL, Applications of VCO (566).

Digital To Analog and Analog To Digital Converters: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

Textbooks:

1. Electronic Devices and Circuits- J. Millman, C.Halkias, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003.

Reference Books:

1. Electronic Devices and Circuit Theory – Robert L.Boylestad and Lowis Nashelsky, Pearson Edition, 2021.
2. Electronic Devices and Circuits–G.K. Mithal, Khanna Publisher, 23rd Edition, 2017.
3. Electronic Devices and Circuits – David Bell, Oxford, 5thEdition, 2008.
4. Electronic Principles–Malvino, Albert Paul, and David J. Bates, McGraw-Hill/Higher Education, 2007.
5. Operational Amplifiers and Linear Integrated Circuits– Gayakwad R.A, Prentice Hall India, 2002.
6. Operational Amplifiers and Linear Integrated Circuits –Sanjay Sharma, Kataria &Sons, 2nd Edition, 2010.
7. Design of Analog CMOS Integrated Circuits - Behzad Razavi

Online Resources:

1. https://nptel.ac.in/courses/122106025.
2. https://nptel.ac.in/courses/108102112.

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	Correlation	CO's Action verb	BTL			
1	15	22	3	Understand	L2	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Select(L1)	2 3 1 3
2	14	20	2	Analyze	L4	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Identify(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
3	14	20	2	Evaluate	L5	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 3
4	12	18	2	Understand	L2	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze(L4) PO5: Apply (L3)	2 3 1 2
5	14	20	2	Analyze	L4	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Identify(L3) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 3
	69	**100%**						

Justification Statements:

CO1: Understand the concepts of Diode Clipping and Clamping circuits and transistor biasing circuits

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 in the same level of PO2 verb; Therefore, the correlation is high (3).

PO4 Verbs: Analyze(L4)

CO1 Action Verb is less than PO4 verb by two levels; Therefore, the correlation is low (1).

PO5 Verbs: Select(L1)

CO1 Action Verb is greater than PO5 verb; Therefore, the correlation is high (3).

CO2: Analyze the transistor amplifiers using hybrid model and feedback amplifier parameters.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO4 Verbs: Analyze (L4)

CO2 Action Verb is same as PO4 verb; Therefore, the correlation is moderate (3).

PO5 Verbs: Apply (L3)

CO2 Action Verb is greater than PO5 verb; Therefore, the correlation is high (3).

CO3: Evaluate the frequency of various oscillator circuits and Operational Amplifier characteristics

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify (L3)

CO3 Action Verb is greater than PO2 verb; Therefore, the correlation is high (3).

PO4 Verbs: Analyze(L4)

CO3 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

PO5 Verbs: Apply (L3)

CO3 Action Verb is greater than PO5 verb; Therefore, the correlation is high (3).

CO4: Understand the various applications, comparators and waveform generators using Op-Amps.

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: Review (L2)

CO4 Action Verb is in the same level of PO2 verb; Therefore, the correlation is high (3).

PO4 Verb: Analysis (L4)

CO4 Action Verb level is less than PO4 verb by two levels; Therefore, the correlation is low (1).

PO5 Verbs: Apply (L3)

CO4 Action Verb is less than PO5 verb by one level; Therefore, correlation is moderate (2).

CO5: Analyze the operation of 555 IC Timer, PLL, VCO, D/A and A/D converters using OP-Amps

Action Verb: Analyse (L4)

PO1 Verb: Apply (L3)

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

PO2 Verb: Identify (L3)

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

PO4 verb: Analyze (L4)

CO5 Action verb is same as PO4 verb; Therefore, the correlation is high (3).

PO5 Verbs: Apply (L3)

CO5 Action Verb is greater than PO5 verb; Therefore, the correlation is high (3).

Year/Sm	II/II	Branch of Study: EEE				
Subject Code		Subject Name	L	T/CLC	P	Credits
23APC0210		POWER SYSTEMS-I	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the operation of hydroelectric and thermal power stations.
CO2	Understand the operation and pollution control of a nuclear power plant.
CO3	Understand the operation of air insulated and gas insulated substations.
CO4	Analyze thevarious distribution system and Underground cables.
CO5	Analyze the various economic aspects and tariff methods for power generation and distribution.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The operation of Hydroelectric and Thermal power stations.			L2
CO2	Understand	The operation and pollution control of a Nuclear power plant.			L2
CO3	Understand	The operation of Air Insulated and Gas Insulated substations.			L2
CO4	Analyze	The various distribution system and Underground cables.			L4
CO5	Analyze	The various economic aspects and tariff methods.	Related to power generation and distribution.		L4

SYLLABUS

UNIT-I

TITLE: Hydroelectric Power Station:

Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation.

Thermal Power Stations:

Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney. Principle of operation of Gas power station.

UNIT-II

Nuclear Power Stations:

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and

shielding, nuclear waste disposal.

UNIT-III

TITLE: Substations

Air Insulated Substations (AIS) - indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.

Gas Insulated Substations (GIS) – advantages of gas insulated substations, constructional aspects of GIS, comparison of air insulated substations and gas insulated substations.

UNIT-IV

TITLE: Distribution Systems:

Classification of Distribution systems, A.C Distribution, Overhead versus Underground system, Connection schemes of Distribution system, Requirements of Distribution system, Design considerations in Distribution system.

Underground Cables:

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.

UNIT-V

TITLE: Economic Aspects & Tariff:

Economic Aspects – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants.

Tariff Methods– Costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two part, three–part, and power factor tariff methods, Time of Day (ToD) tariff and Time of Use (ToU) tariff. Causes of low power factor and methods of improving power factor.

Text books:

1 S. N. Singh, Electric Power Generation, Transmission and Distribution, PHI Learning Pvt Ltd, New Delhi, 2nd Edition, 2010.
2 J. B. Gupta, Transmission and Distribution of Electrical Power, S. K. Kataria and sons, 10th Edition, 2012.

Reference books:

1 I.J. Nagarath& D.P. Kothari, Power System Engineering, McGraw-Hill Education, 3rdEdition, 2019.
2 C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age International Publishers, 6th Edition, 2018.
3 V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand, 4th Edition, 2005.
4 Turan Gonen, Electric Power Distribution System Engineering, McGraw-Hill, 1985.
5 Handbook of switchgear, BHEL, McGraw-Hill Education, 2007.

Web Resources:

1 https://nptel.ac.in/courses/108102047

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2			1		1							
CO2	2			1		1	1						
CO3	2			1								3	3
CO4	3	3		3								3	3
CO5	3	3		3			1					3	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(0-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1				Understand	L2	PO1, PO4, PO6	Apply (L3) Analysis(L4) Thumb Rule	2 1 1
2				Understand	L2	PO1, PO4 PO6, PO7	Apply(L3) Analysis(L4) Thumb Rule Thumb Rule	2 1 1 1
3				Understand	L2	PO1, PO4	Apply (L3) Analysis(L4)	2 1
4				Analyze	L4	PO1, PO2, PO4	Apply (L3) Analyze (L4) Analysis (L4)	3 3 3
5				Analyze	L4	PO1, PO2, PO4, PO7	Apply(L3) Identify L3) Analysis(L4) Thumb Rule Thumb Rule	3 3 3 1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

CO1: Understand the operation of hydroelectric and thermal power stations.
PO1 Verb: Apply (L3)
CO1 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2). PO4 Verb:Analysis (L4)
CO1 Action verb level is less than PO4 verb by two levels; Therefore, correlation is Low (1). PO6 UsingThumb Rule, CO1 Correlated to PO6 as Low (1).
PO1 Verb: Apply (L3)
CO1 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2). PO4 Verb:Analysis (L4)
CO2: Understand the operation and pollution control of a Nuclear power plant.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO2 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2). PO4 Verb:Analysis (L4)
CO2 Action verb level is less than PO4 verb by two levels; Therefore, correlation is Low (1). PO6 UsingThumb Rule, CO2 Correlated to PO6 as Low (1).
PO7 Using Thumb Rule, CO2 Correlated to PO7 as Low (1).
PO1 Verb: Apply (L3)
CO2 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2). PO4 Verb:Analysis (L4)
CO3: Understand the operation of Air Insulated and Gas Insulated substations.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO3 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2).PO4 Verb: Analysis (L4)
CO3 Action verb level is less than PO4 verb by two levels; Therefore, correlation is Low (1).
CO4: Analyze the various distribution system and Underground cables.
PO1 Verb: Apply (L3)
CO4 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).PO2 Verb: Analyze (L4)
CO4 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).PO4 Verb: Analysis (L4)
CO4 Action verb level is equal to PO4 verb level; Therefore, correlation is High (3).
CO5: Analyze the various economic aspects and tariff methods related to power generation anddistribution.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO5 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).PO2 Verb: Identify (L3)
CO5 Action verb level is greater than PO2 verb by one level; Therefore, correlation is High (3).PO4 Verb: Analysis (L4)
CO5 Action verb level is equal to PO4 verb level; Therefore, correlation is High (3).PO7 Using Thumb Rule, CO5 Correlated to PO7 as Low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0211		INDUCTION AND SYNCHRONOUS MACHINES	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the construction and principle of operation three phase induction motors.
CO2	Analyze the performance of three phase induction motor.
CO3	Understand the construction and principle of operation single phase induction motors.
CO4	Analyze the construction and principle of operation of synchronous generator
CO5	Analyze the characteristics of synchronous generators.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Construction and principle of operation three phase induction motors.			L2
CO2	Analyze	Performance of three phase induction motor.			L4
CO3	Understand	Construction and principle of operation single phase induction motors.			L2
CO4	Analyze	Construction and principle of operation of synchronous generator.			L4
CO5	Analyze	Characteristics of synchronous generators.			L4

SYLLABUS

UNIT-I

TITLE: 3-Phase Induction Motors

Construction of Squirrel cage and Slipping induction motors– production of rotating magnetic field – principle of operation – rotor EMF and rotor frequency – rotor current and power factor at standstill and during running conditions– rotor power input, rotor copper loss and mechanical power developed and their inter-relationship –equivalent circuit – phasor diagram, Applications.

UNIT-II

TITLE: Performance Of 3-Phase Induction Motors

Torque equation – expressions for maximum torque and starting torque – torque-slip characteristics – double cage and deep bar rotors –No load, Brake test and Blocked rotor tests – circle diagram for predetermination of performance- methods of starting –starting current and torque calculations -speed control of induction motor with V/f control method, rotor resistance control and rotor EMF injection technique –crawling and cogging – induction generator operation.

UNIT-III

TITLE: Single Phase Motors

Single phase induction motors – constructional features – double revolving field theory, Cross field theory – equivalent circuit- starting methods: capacitor start capacitor run, capacitor start induction

run, split phase & shaded pole, A.C series motor. Universal Motor- Single phase Synchronous Motors, Reluctance Motor-Hysteresis Motor-Stepper Motor, Applications.

UNIT-IV

TITLE : **Synchronous Generator**

Constructional features of non-salient and salient pole type alternators- armature windings – distributed and concentrated windings – distribution& pitch factors – E.M.F equation – armature reaction – voltage regulation by synchronous impedance method – MMF method and Poitier triangle method –two reaction analysis of salient pole machines -methods of synchronization- Slip test – Parallel operation of alternators.

UNIT-V

TITLE: Synchronous Motor

Synchronous motor principle and theory of operation – Effect of excitation on current and power factor– synchronous condenser –expression for power developed –hunting and its suppression – methods of starting, Applications.

Text books:

1 Electrical Machinery, Dr. P.S. Bhimbra, Khanna Publishing, 2021, First Edition.
2 Performance and analysis of AC machines by M.G. Say, CBS, 2002.

Reference books:

1 Electrical machines, D.P. Kothari and I.J. Nagrath, McGraw Hill Education, 2017, Fifth Edition.
2 Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria& Sons,2007.
3 Electric Machinery, A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, McGraw- Hill, 2020, Seventh edition.

Web Resources:

1 https://nptel.ac.in/courses/108/105/108105131
2 https://nptel.ac.in/courses/108106072

Mapping of Course outcomes with Program outcomes

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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(0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand		PO1,PO2, PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb Rule	2 2 1 2
2				Analyze		PO1,PO2, PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3
3				Understand		PO1,PO2, PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb Rule	2 2 1 2
4				Analyze		PO1,PO2, PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3
5				Analyze		PO1,PO2, PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3

CO1: Understand the construction and principle of operation three phase induction motors.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO1 Action Verb is less than to PO2 verb by one level; Therefore correlation is moderate (2).
PO4 Verb: Analyze (L4)
CO1 Action Verb is less than to PO4 verb by two level; Therefore correlation is low (1).
Based on students' participate in CLC activities. From this: CO1 level is 2, Using Thumb Rule its correlation is moderate (2).
CO2 : A0nalyze the performance of three phase induction motor.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO2 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO2 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO3 level is 4, Using Thumb Rule its correlation is high (3).
CO3: Understand the construction and principle of operation single phase induction motors.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO3 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO3 Action Verb is less than to PO2 verb by one level; Therefore correlation is moderate (2).
PO4 Verb: Analyze (L4)
CO3 Action Verb is less than to PO4 verb by two level; Therefore correlation is low (1).
Based on students' participate in CLC activities. From this: CO1 level is 2, Using Thumb Rule its correlation is moderate (2).
CO4 : Analyze the construction and principle of operation of synchronous generator.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO4 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).
PO1 Verbs: Apply (L3)
CO4 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
Based on students' participate in CLC activities. From this: CO4 level is 4, Using Thumb Rule its correlation is high (3).
CO5: Analyze the characteristics of synchronous generators.
Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO5 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).

PO2 Verb: Identify (L3)

CO5 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).

PO4 Verb: Analyze (L4)

CO5 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO5 level is 4, Using Thumb Rule its correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0212		CONTROL SYSTEMS	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the concept of block diagram reduction and signal flow graph methods, transfer function of D.C Servo motor, A.C Servo motor and Synchros.
CO2	Analyze the time response of first order system, transient response of second order system, steady state errors and controllers.
CO3	Analyze the stability of a system in time domain using the root locus and Routh- Hurwitz stability criteria.
CO4	Analyze the stability of a system in frequency domain using Bode, Polar and Nyquist plots.
CO5	Evaluate the response of continuous systems using state space models.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The concept of block diagram reduction and signal flow graph methods, transfer function of D.C Servo motor, A.C Servo motor and Synchros.			L2
CO2	Analyze	The time response of first order system, transient response of second order system, steady state errors and controllers.			L4
CO3	Analyze	The stability of a system in time domain.	Using the root locus and Routh-Hurwitz stability criteria.		L4
CO4	Analyze	The stability of a system in frequency domain	Using Bode, Polar and Nyquist plots.		L4
CO5	Evaluate	The response of continuous systems	Using state space models.		L5

SYLLABUS

UNIT-I

TITLE: Control systems concepts

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros.

UNIT-II

TITLE: Time response analysis

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications –

Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

UNIT-III

TITLE: Stability analysis in time domain

The concept of stability – Routh's stability criterion – Stability and conditional stability –limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT-IV

TITLE: Frequency response analysis

Introduction, Frequency domain specifications - Bode diagrams - Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin - Stability Analysis. Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

UNIT-V

TITLE: State space analysis of continuous systems

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Text books:

1 Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010
2 Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

Reference books:

1 Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2 Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3 Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud & Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4 Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000
5 Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Web Resources:

1 https://nptel.ac.in/courses/108102043
2 https://nptel.ac.in/courses/108106098.

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1, PO2	Apply (L3), Analyze (L4)	2 1
2				Analyze	L4	PO1, PO2	Apply (L3), Analyze (L4)	3 3
3				Analyze	L4	PO1, PO2, PO3	Apply (L3), Analysis (L4), Design (L6)	3 3 1
4				Analyze	L4	PO1, PO2, PO3	Apply (L3), Analyze (L4), Design (L6)	3 3 1
5				Evaluate	L5	PO1, PO2, PO3	Apply (L3), Analyze (L4), Design (L6)	3 3 2

CO1 Understand the concept of block diagram reduction and signal flow graph methods, transfer function of D.C Servo motor, A.C Servo motor and Synchros.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb level is less than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO2 Verb: Analyze (L4)
CO1 Action verb level is less than PO2 verb by two level; Therefore, correlation is Low (1).
CO2: Analyze the time response of first order system, transient response of second order system, steady state errors and controllers.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO2 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Analyze (L4)
CO2 Action verb level is equal to PO2 verb; Therefore, correlation is High (3).
CO3 Analyze the stability of a system in time domain using the root locus and Routh-Hurwitz stability criteria
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO3 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO3 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).
PO3 Verb: Design (L6)
CO3 Action verb level is less than PO3 verb by two levels; Therefore correlation is Low (1).
CO4 Analyze the stability of a system in frequency domain using Bode, Polar and Nyquist plots.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO4 Action verb level is greater than PO1 verb by one level; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO4 Action verb level is equal to PO2 verb level; Therefore, correlation is High (3).
PO3 Verb: Design (L6)
CO4 Action verb level is less than PO3 verb by two levels; Therefore correlation is Low (1).
CO5: Evaluate the response of continuous systems using state space models.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO5 Action verb level is greater than PO1 verb by two levels; Therefore, correlation is High (3).
PO2 Verb: Analysis (L4)
CO5 Action verb level is greater than PO2 verb by one level; Therefore, correlation is High (3).
PO3 Verb: Design (L6)
CO5 Action verb level is less than PO3 verb by one level; Therefore, correlation is Moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0213		INDUCTION AND SYNCHRONOUS MACHINES LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Analyze the various performance characteristics of three-phase and single-phase induction motors.
CO2	Evaluate the performance of equivalent circuit of single phase induction motor.
CO3	Apply the Power Factor Improvement Methods of Single Phase Induction Motor.
CO4	Analyze the regulation of three Phase Alternator by using different methods.
CO5	Analyze the performance of synchronous machines and A.C Series Motor.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Various performance characteristics of three-phase and single-phase induction motors.			L4
CO2	Evaluate	Performance of equivalent circuit of single phase induction motor.			L5
CO3	Apply	Power Factor Improvement Methods		Single Phase Induction Motor	L3
CO4	Analyze	Regulation of 3 Phase Alternator	Using different methods.		L4
CO5	Analyze	Performance of synchronous machines and A.C Series Motor.			L4

List of Experiments:

1. Brake test on three phase Induction Motor **CO1**
2. Speed control of three phase induction motor by V/f method. **CO1**
3. Circle diagram of three phase induction motor. **CO1**
4. Load test on single phase induction motor. **CO2**
5. Equivalent circuit of single-phase induction motor. **CO2**
6. Power factor improvement of single-phase induction motor by using capacitors. **CO3**
7. Regulation of a three -phase alternator by synchronous impedance &MMF methods. **CO4**
8. Regulation of three-phase alternator by Poitier triangle method. **CO4**
9. V and Inverted V curves of a three-phase synchronous motor. **CO5**
10. Determination of X_d, X_q& Regulation of a salient pole synchronous generator. **CO5**
11. Determination of efficiency of 3- phase alternator by loading with 3- phase induction motor **CO4**
12. Parallel operation of three-phase alternator under no-load and load conditions. **CO4**
13. Determination of efficiency of a single-phase AC series Motor by conducting Brake test **CO5**

Reference books:

1 https://em-coep.vlabs.ac.in/List%20of%20experiments.html

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Mapping of Course outcomes with Program outcomes													
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		2					3			3	3
CO4	3	3		3					3			3	3
CO5	3	3		3					3			3	3

Mapping of Course outcomes with Program outcomes Justification Table								
CO No.	**CO**					**Program Outcomes (PO)**	**PO(s): Actionverb and BTL(for PO1 to PO5)**	**Level of correlation (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3
2				Evaluate	L5	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3
3				Apply	L3	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Identify (L3) PO4:Analyze(L4) PO9: Thumb Rule	3 3 2 3
4				Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3
5				Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3

CO1 Analyze the various performance characteristics of three-phase and single-phase induction motors.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3). PO2 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO1 verb; Therefore, correlation is high (3). PO4 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).

CO1 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3). PO2 Verbs: Analyze (L4)

CO2 Evaluate the performance of equivalent circuit of single phase induction motor.

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

CO2 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3). PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore, correlation is high (3). PO4 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO4 verb; Therefore, correlation is high (3).

CO2 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 high (3)

PO1 Verbs: Apply (L3)

CO2 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3). PO2 Verbs: Analyze (L4)

CO3 Apply the Power Factor Improvement Methods of Single Phase Induction Motor.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

CO3 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).

PO2 Verbs: identify (L4)

CO3 Action Verb is equal to PO2 verb; Therefore, correlation is high (3).

PO4 Verbs: Analyze (L4)

CO2 Action Verb is less than PO4 verb one level; Therefore, correlation is moderate (2).

CO3 Action Verb is of BTL3. Using Thumb rule, L3 correlates PO6 to PO12 and PSOs as moderate (2).

CO4 Analyze the regulation of three Phase Alternator by using different methods.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).

PO2 Verbs: Analyze (L4)

CO4 Action Verb same to PO2 verb; Therefore, correlation is high (3).

PO4 Verbs: Analyze (L4)

CO4 Action Verb same to PO4 verb; Therefore, correlation is high (3).

CO4 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO5 Analyze the performance of synchronous machines and A.C Series Motor
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: Analyze (L4)
CO5 Action Verb same to PO2 verb; Therefore correlation is high (3). PO4 Verbs: Analyze (L4)
CO5 Action Verb same to PO4 verb; Therefore correlation is high (3).
CO5 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	II/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0214		CONTROL SYSTEMS LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Analyze the time response and characteristics of second order system, A.C and DC servo motors.
CO2	Analyze the characteristics of Synchros and magnetic amplifiers.
CO3	Apply MATLAB and study the effect of poles and zeros location on transient and steady state behaviour of second order systems.
CO4	Understand the design of truth tables for logic gates and speed control of motor using programmable logic controller.
CO5	Understand the performance of P, PI, PID controllers, lag-lead compensation technique and temperature control using PID controller.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The time response and characteristics of second order system, A.C and DC servo motors			L4
CO2	Analyze	The characteristics of Synchros and magnetic amplifiers.			L4
CO3	Apply	MATLAB and study the effect of poles and zeros location on transient and steady state behaviour of second order systems.			L3
CO4	Understand	The design of truth tables for logic gates and speed control of motor	Using programmable logic controller		L2
CO5	Understand	The performance of P, PI, PID controllers, lag-lead compensation technique and temperature control.	Using PID controller		L2

LIST OF EXPERIMENTS

1. Analyze the Time response of Second order system. **CO1**
2. Analyze the effect of feedback on DC servo motor. **CO1**
3. Analyze the Transfer function of DC Machine. **CO1**
4. Analyze the Characteristics of AC servo motor **CO1**
5. Plot the response of a unity feedback system for different values of damping ratio and also plot its rise time, settling time, % maximum overshoot when the inputs applied to the system are the unit step and unit impulse **CO1**
6. Analyze the Characteristics of Synchros. **CO2**
7. Characteristics of magnetic amplifiers. **CO2**
8. Linear system analysis (Time domain analysis, Error analysis) using MATLAB. **CO3**
9. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB. **CO3**
10. State space model for classical transfer function using MATLAB. **CO3**
11. Programmable logic controller - Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor **CO4**
12. Study the system response of a permanent magnet D.C motor **CO1**
13. Effect of P, PD, PI, PID Controller on a second order system. **CO5**

14. Lag and lead compensation - Magnitude and phase plot **CO5**
15. Temperature controller using PID **CO5**

Reference books:	
1	M. H. Rashid, "Simulation of Electrical and electronics Circuits", using PSPICE, M/s PHI Publications.
2	PSPICE A/D user's manual - Microsim, USA
3	PSPICE reference guide - Microsim, USA.
4	MATLAB and its Tool Books user's manual and – Math works, USA

Mapping of Course outcomes with Program outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1				3					1			3	
CO2				3					1			3	
CO3				2	3				1			3	1
CO4				1					1			3	
CO5				1					1			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 (0-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1				Analyze	L4	PO4, PO9	Analysis (L4) Thumb Rule	3 1
2				Analyze	L4	PO4, PO9	Analysis (L4) Thumb Rule	3 1
3				Apply	L3	PO4, PO5, PO9	Analysis (L4) Apply (L3) Thumb Rule	2 3 1
4				Understand	L2	PO4, PO9	Analysis (L4) Thumb Rule	1 1
5				Understand	L2	PO4, PO9	Analysis (L4) Thumb Rule	1 1

CO1: Analyze the time response and characteristics of second order system, A.C and DC servo motors.
Action Verb: Analyze (L4)
PO1 Verb: Analysis (L4)
CO1 Action verb level is equal to PO4 verb; Therefore, correlation is High (3).
Using Thumb Rule CO1 is correlated with PO9 is Low (1).
CO2: Analyze the characteristics of Synchros and magnetic amplifiers
Action Verb: Analyze (L4)
PO4 Verb: Analysis (L4)
CO2 Action verb level is equal to PO4 verb; Therefore, correlation is High (3).
Using Thumb Rule CO1 is correlated with PO9 is Low (1).
CO3 Apply MATLAB and study the effect of poles and zeros location on transient and steady state behaviour of second order systems.
Action Verb: Apply (L3)
PO4 Verb: Analysis (L4)
CO3 Action verb level is less than PO4 verb by one level; Therefore, correlation is Moderate (2).
PO5 Verb: Apply (L3)
CO3 Action verb level is equal to PO5 verb level; Therefore, correlation is High (3).
Using Thumb Rule CO3 is correlated with PO9 is Low (1).
CO4 Understand the design of truth tables for logic gates and speed control of motor using programmable logic controller.
Action Verb: Understand (L2)
PO4 Verb: Analysis (L4)
CO4 Action verb level is less than PO4 verb by two levels; Therefore, correlation is Low (1).
Using Thumb Rule CO4 is correlated with PO9 is Low (1).
CO5: Understand the performance of P, PI, PID controllers, lag-lead compensation technique and temperature control using PID controller.
Action Verb: Understand (L2)
PO4 Verb: Analysis (L4)
CO5 Action verb level is less than PO4 verb by two levels; Therefore, correlation is Low (1).
Using Thumb Rule CO4 is correlated with PO9 is Low (1).

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

Course Code	Year & Sem	PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE) (EEE)	L	T/CLC	P	C
23ASC0501	II-II		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:

31. Write a program to find the largest element among three Numbers.
32. Write a Program to display all prime numbers within an interval
33. Write a program to swap two numbers without using a temporary variable.
34. 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
35. Write a program to add and multiply complex numbers
36. 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:

37. Write a program to define a function with multiple return values.

38. Write a program to define a function using default arguments.
39. Write a program to find the length of the string without using any library functions.
40. Write a program to check if the substring is present in a given string or not.
41. Write a program to perform the given operations on a list:
    i.Addition ii. Insertion iii. slicing
42. 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:

43. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
44. Write a program to count the number of vowels in a string (No control flow allowed).
45. Write a program to check if a given key exists in a dictionary or not.
46. Write a program to add a new key-value pair to an existing dictionary.
47. 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:

48. 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.
49. Python program to print each line of a file in reverse order.
50. Python program to compute the number of characters, words and lines in a file.
51. Write a program to create, display, append, insert and reverse the order of the items in the array.
52. Write a program to add, transpose and multiply two matrices.
53. 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:

54. Python program to check whether a JSON string contains complex object or not.
55. Python Program to demonstrate NumPy arrays creation using array () function.
56. Python program to demonstrate use of ndim, shape, size, dtype.
57. Python program to demonstrate basic slicing, integer and Boolean indexing.
58. Python program to find min, max, sum, cumulative sum of array
59. 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:
    c) Apply head () function to the pandas data frame
    d) Perform various data selection operations on Data Frame
60. 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:

4. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
5. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024

6. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
Online Learning Resources/Virtual Labs
3. https://www.coursera.org/learn/python-for-applied-data-science-ai 4. 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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
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 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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Detailed Syllabus for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2023-24)
MECHANICAL ENGINEERING (ME)

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

Subject Code	Subject Name	L	T/CLC	P	Credits
23AES0304	Design Thinking & Innovation	1	0	2	2

Course Outcomes:

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, historyof 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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Detailed Syllabus for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2023-24)
MECHANICAL ENGINEERING (ME)

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:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview

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

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

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	Apply (L3) Identify (L3)	3 3

						PO3 PO6	Develop (L3) Thumb Rule	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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

III Year – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Professional Core	23APC0215	Power Electronics	2	1	0	3	30	70	100
2	Professional Core	23APC0421	Digital Circuits	2	1	0	3	30	70	100
3	Professional Core	23APC0216	Power Systems-II	2	1	0	3	30	70	100
4	Professional Elective- I	23APE0404	Signals and Systems	2	1	0	3	30	70	100
		23APE0201	Electrical safety and Risk Management							
		23APE0202	Utilization of Electrical Energy							
5	Open Elective -I		***Open Elective-I**	2	1	0	3	25	75	100
6	Professional Core	23APC0217	Power Electronics Lab	0	0	3	1.5	30	70	100
7	Professional Core	23APC0422	Analog and Digital Circuits Lab	0	0	3	1.5	30	70	100
8	Skill Enhancement course	23ASE9901	Soft Skills	0	1	2	2	30	70	100
9	Skill Enhancement course Lab	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	Engineering Sciences	23AES0504	Introduction to Quantum Technology and Applications	2	1	0	3	30	70	100
11	Community Service Project	23APR0201	Evaluation of Community Service Internship	-	-	-	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	23AOE0301	Sustainable Energy Technologies	ME
4	23AOE0401	Electronic Circuits	ECE
5	23A0E0501	Java Programming	CSE & Allied/IT
6	23A0E0502	Fundamentals of Artificial Intelligence	
7	23A0E0503	Quantum Technologies and Applications	
8	23AOE9901	Mathematics for Machine Learning and AI	Mathematics
9	23AOE9906	Materials Characterization Techniques	Physics
10	23AOE9911	Chemistry of Energy Systems	Chemistry
11	23AOE9915	English for Competitive Examinations	Humanities
12	23A0EMB01	Entrepreneurship and New Venture Creation	

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0215		POWER ELECTRONICS	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the V-I Characteristics and Gate Drive Requirements of Power Devices Including Diodes, Thyristors, MOSFETs, and IGBTs.
CO2	Design Single-Phase and Three-Phase Rectifiers with Different Load Conditions and Evaluate Power Factor and Source Inductance Effects.
CO3	Apply Duty Ratio Control and Analyze Steady-State Waveforms of Buck, Boost, and Buck-Boost Converters.
CO4	Analyze the Operation of Inverters, AC Voltage Controllers, and Cyclo Converters with Various Load Conditions and Commutation Techniques.
CO5	Explore advanced power electronic devices like GaN and SiC, understanding their applications in modern power systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's Level
CO1	Understand	Knowledge of characteristics and gate drive requirements of power semiconductor devices like Diodes, Thyristors, MOSFETs, and IGBTs.	Given data sheets, circuit diagrams, and theoretical concepts	Given data sheets, circuit diagrams, and theoretical concepts.	L2
CO2	Design	Knowledge of design and analysis of single-phase and three-phase rectifiers under different load conditions.	With R, RL, and RLE loads and varying source inductance	With R, RL, and RLE loads and varying source inductance.	L6
CO3	Apply	Knowledge of duty cycle control techniques and steady-state analysis of Buck, Boost, and Buck-Boost converters.	For continuous and discontinuous conduction modes.	For continuous and discontinuous conduction modes.	L3
CO4	Analyze	Knowledge of inverter operation and analysis of AC voltage controllers and cycloconverters under different load and commutation conditions.	Under different load conditions and commutation methods (natural & forced).	Under different load conditions and commutation methods (natural & forced).	L4
CO5	Analyze	Knowledge of wide bandgap semiconductor devices such as GaN and SiC, and their application in modern power systems.	In applications related to high-frequency and high-efficiency power conversion.	In applications related to high-frequency and high-efficiency power conversion	L4

SYLLABUS
UNIT-I
TITLE: Power Switching Devices:
Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction

to Galium Nitride and Silicon Carbide Devices.
UNIT-II
TITLE: Rectifiers
Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems
UNIT-III
TITLE: DC-DC Converters:
Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.
UNIT-IV
TITLE : **Inverters:**
Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.
UNIT-V
TITLE: AC Voltage Controllers & Cyclo Converters:
AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

Text books:	
1.	M. H. Rashid, —Power Electronics: Circuits, Devices and Applications‖, 2nd edition, Prentice Hall of India, 1998
2.	P.S. Bimbhra, —Power Electronics‖, 4th Edition, Khanna Publishers, 2010.
3.	M. D. Singh & K. B. Kanchan Dhani- Power Electronics, Tata Mc Graw Hill Publishing Company,1998.
Reference books:	
1.	Ned Mohan, —Power Electronics‖, Wiley, 2011.
2.	Robert W. Erickson and Dragan Maksimovic, —Fundamentals of Power Electronics‖ 2nd Edition, Kluwer Academic Publishers, 2004.
3.	Vedam Subramanyam, —Power Electronics‖, New Age International (P) Limited, 1996.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Mapping of Course outcomes with Program outcomes													
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2											2	2
CO2	3		3	3								3	2
CO3	3	2		2	3							3	3
CO4	3	3	1									2	3
CO5	3	3	1									2	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(0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Understand	L2	PO1	Apply-L3	2
2				Design	L6	PO1 PO3	Apply-L3 Design-L6	3 3
3				Apply	L3	PO1 PO2	Apply-L3 Analyze-L4	3 2
4				Analyze	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Design-L6	3 3 1
5				Explore	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Design-L6	3 3 1

CO1: Understand the V-I Characteristics and Gate Drive Requirements of Power Devices Including Diodes, Thyristors, MOSFETs, and IGBTs.

Action Verb: Understand-L2

PO1 Verb: Apply-L3

The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is Moderate, level 2.

CO2: Design Single-Phase and Three-Phase Rectifiers with Different Load Conditions and Evaluate Power Factor and Source Inductance Effects.

Action Verb: Design-L6

PO1: Apply – L3

The BTL of CO action verb is greater than BTL of PO action verb by 3. Therefore, the correlation is High, level 3.

PO3: Design – L6

The BTL of CO action verb is equal to BTL of PO action verb by 1. Therefore, the correlation is High, level 3.

CO3: Apply Duty Ratio Control and Analyze Steady-State Waveforms of Buck, Boost, and Buck- Boost Converters.

Action Verb: Apply – L3
PO1: Apply L3 The BTL of CO action verb is equal to BTL of PO action verb by 3. Therefore, the correlation is High, level 3. **PO2: Analyze L4** The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is Moderate, level 2.
CO4: Analyze the Operation of Inverters, AC Voltage Controllers, and Cyclo Converters with Various Load Conditions and Commutation Techniques.
Action Verb: Analyze – L4
PO1: Apply L3 The BTL of CO action verb is higher than BTL of PO action verb by 3. Therefore, the correlation is High, level 3. **PO2: Analyze L4** The BTL of CO action verb is higher than BTL of PO action verb by 3. Therefore, the correlation is High, level 3. **PO3: Design L6** The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.
CO5: Analyze advanced power electronic devices like GaN and SiC, understanding their applications in modern power systems.
Action Verb: Analyze – L4
PO1: Apply L3 The BTL of CO action verb is higher than BTL of PO action verb by 3. Therefore, the correlation is High, level 3. **PO2: Analyze L4** The BTL of CO action verb is higher than BTL of PO action verb by 3. Therefore, the correlation is High, level 3. **PO3: Design L6** The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS
Common to EEE

Course Code	Year & Sem	Digital Circuits	L	T/CLC	P	C
23APC0421	III-I		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 converts using gates.
CO3: Analyze the design procedure of data transmission circuits using gates.
CO4: Analyze the sequential logic circuits design using flip flops.
CO5: Understand the programmable logic devices and various digital Ic's.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	Understand the logic gates and minimization of Boolean functions using K-Maps.			L2
CO2	Analyze	Analyze the design procedure of Arithmetic circuits and code converts using gates.			L4
CO3	Analyze	Analyze the design procedure of data transmission circuits using gates.			L4
CO4	Analyze	Analyze the sequential logic circuits design using flip flops.			L4
CO5	Understand	Understand the programmable logic devices and various digital Ic's.			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	2	2	2	3									2	2
CO3	2	2	2	3									2	2
CO4	2	2	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 fundamentals of data communications and computer networks.
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).
CO2: Understand the concepts of different network models and transmission media used in data communication

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 PO1 verb by one level; Therefore correlation is moderate (2).

PO3 Verbs: Develop (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

CO3: Analyze data link layer and medium access techniques.

Action Verb: Analyze (L4)

PO1 Verbs: 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 PO1 verb by one level; Therefore correlation is moderate (2).

PO3 Verb: Develop (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO4 Verbs: Interpret(L2) CO4 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO5 Verbs: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

CO4: Understand the functioning of network and transport layer protocols.

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 Verb: Identify (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO3 Verb: Develop (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO5 Verb: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

CO5: Apply the knowledge on various service protocols offered by application layer.

Action Verb: Apply (L3)

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 PO1 verb by one level; Therefore correlation is moderate (2).

PO3 verb: Develop(L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

PO5 verb: Apply (L3) CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).

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Year/Sem	III/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0216		POWER SYSTEMS-II	2	1	0	3

After completion of the course, students will be able to:	
CO1	Analyze the transmission line parameters and constants.
CO2	Analyze transmission line performance.
CO3	Analyze the properties of overhead line insulators, corona, sag and tension in transmission lines.
CO4	Understand the concepts of cables and transients in transmission lines
CO5	Apply load compensation techniques to control reactive power.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Transmission line parameters and constants			L4
CO2	Analyze	Transmission line performance			L4
CO3	Analyze	The properties of overhead line insulators, corona, sag and tension in transmission lines			L4
CO4	Understand	the concepts of cables and transients	in transmission lines		L2
CO5	Apply	Load compensation techniques	To control reactive power		L3

SYLLABUS

UNIT-I

TITLE: Transmission Line Parameters

Types of Conductors - Calculation of Resistance for Solid Conductors, Bundle Conductors, Skin effect, Proximity effect, Concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, Single and Double circuit lines, Symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of Capacitance for 2 wire and 3 wire systems, effect of ground on Capacitance, Capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems

UNIT-II

TITLE: Performance of Transmission Lines

Classification of Transmission Lines-Short, medium and long line and their models representation - Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. Ferranti effect and Charging Current

UNIT-III

TITLE: Overhead Line Insulators, Sag and Tension and Corona

Types of Insulators, String efficiency and Methods for improvement, – Voltage Distribution, Calculation of String efficiency, Capacitance Grading and Static Shielding., Numerical Problems.
Sag and Tension Calculations with equal and unequal heights of towers, Effect of wind and ice on weight of conductor, Stringing chart, Sag template and its applications Numerical Problems.
Corona- factors affecting corona, critical voltages and Power loss due to Corona. Radio Interference.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

UNIT-IV
TITLE : Underground Cables and Power System Transients:
Comparison between Underground and Overhead systems Construction of cables, Classification, Properties of insulating materials, Insulation resistance of single core cable, Capacitance of single core cable, Grading of cable Types of system transients – Travelling or propagation of surges – Attenuation, Distortion, Reflection and Refraction co-efficients – Termination of lines with different types of conditions – Bewley's Lattice diagrams.
UNIT-V
TITLE: Voltage Control and Power Factor Improvement:
Methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods. Compensation in Power Systems: Concepts of Load compensation Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

Text books:	
1	C.L. Wadhwa, —Electrical Power Systems, New Age International Pub. Co, Third Edition, 2001.
2	D.P. Kothari and I.J. Nagrath, —Modern Power System Analysis, Tata Mc Graw Hill Pub. Co.,New Delhi, Fourth edition, 2011.
3	B.R.Gupta,-Power System Analysis and Design, S.ChandPublishing.1998.
Reference books:	
1	A. Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, —A Text book on Power System Engineering, Dhanpat Rai Publishing Company (P) Ltd, 2008.
2	John J. Grainger & W.D. Stevenson, —Power System Analysis, Mc Graw Hill International, 1994.
3	Hadi Sadat, —Power System Analysis, Tata Mc Graw Hill Pub. Co. 2002.
4	W.D. Stevenson, —Elements of Power system Analysis, McGraw Hill International Student Edition.
Web Resources:	
1	https://onlinecourses.nptel.ac.in/noc22_ee17/preview

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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				Analyze	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Create-L6	High-3 High-3 Low-1
2				Analyze	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Create-L6	High-3 High-3 Low-1
3				Analyze	L4	PO1 PO2 PO3 PO6	Apply-L3 Analyze-L4 Create-L6 Thumb Rule	High-3 High-3 Low-1 Low-1
4				Understand	L2	PO1 PO2 PO4	Apply-L3 Analyze-L4 Analyze-L4	Medium-2 Low-1 Low-1
5				Apply	L3	PO1 PO6 PO10	Apply-L3 Thumb Rule Thumb Rule	High-3 Medium-2 Low-1

CO1: Analyze the transmission line parameters and constants.
Action verb: analyze-l4
CO1 action verb level is higher than po1 action by one therefore correlation is high-3
CO1 action verb level is equal to po1 action therefore correlation is high-3
CO1 action verb level is less than po1 action by two therefore correlation is low-1
CO2: Analyze transmission line performance.
Action verb: analyze-l4
CO2 action verb is higher than po1 action by one therefore correlation is high-3
CO2 action verb is equal to po2 action therefore correlation is high-3
CO2 action verb level is less than po2 action by two therefore correlation is low-1
CO3: analyze the properties of overhead line insulators, corona, sag and tension in transmission lines.
Action verb: analyze-l4
CO3 action verb level is higher than po1 action by one therefore correlation is high-3
CO3 action verb is equal to po2 action therefore correlation is high-3
CO3 action verb is less than po3 action therefore correlation is low-1
CO3 is at level-4 and according to the thumb rule,it exhibits a low correlation-1
CO4: apply per unit system for fault analysis.
Action verb: Understand-l2
CO4 action verb is less than to po1 action therefore correlation is medium-2
CO4 action verb level is less than po2 action by two therefore correlation is low-1
CO4 action verb level is less than po4 action by two therefore correlation is low-1
CO5: apply load compensation techniques to control reactive power.
Action verb: apply-l3
CO5 action verb is equal to po1 action therefore correlation is high-3
CO5 is at level-3 and according to the thumb rule,it exhibits a medium correlation-2
CO5 is at level-3 and according to the thumb rule,it exhibits a low correlation-1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	SIGNALS AND SYSTEMS	L	T/CLC	P	C
23APE0404	III-I		2	1	0	3

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

CO1 **Understand** the representation of continuous time and discrete time signals & Systems

CO2 **Analyze** the signals in frequency domain using Fourier series

CO3 **Analyze** the signals in frequency domain using Fourier Transform

CO4 **Apply** the properties of LTI system described by differential equations

CO5 **Evaluate** Continuous Time and Discrete Time LTI systems by using Laplace and Z-Transforms.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	**Understand**	the representation of continuous time and discrete time signals			L2
CO2	**Analyze**	the signals in frequency domain		Fourier series and Fourier Transforms	L4
CO3	**Apply**	To convert continuous time signals into discrete time signals	Sampling theorem		L3
CO4	**Analyze**	the properties of systems and characteristics of LTI systems			L4
CO5	**Evaluate**	Continuous Time and Discrete Time LTI systems by using		Laplace and Z-Transforms	L5

UNIT – I		21Hrs
Signals and Systems: Continuous and Discrete Time Signals, Transformations of the Independent Variable, Elementary Signals-Unit Impulse, Unit Step Functions, Ramp Signal, Rectangular function, Signum Function, Sinc & Sa Function, Exponential and Sinusoidal Signals, Classification of Signals & Systems, Continuous and Discrete Time Systems, Basic System Properties, Linear Time Invariant (LTI) Systems, Discrete-Time LTI Systems, Convolution Sum, Continuous Time LTI Systems, Convolution Integral, Properties of LTI Systems, Causal LTI Systems described by Differential and Difference Equations, Singularity Functions.		
UNIT – II		16Hrs
Fourier series representation of periodic signals: Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous Time Periodic Signals, Trigonometric, Polar, Exponential fourier Series & related problems, Convergence of the Fourier Series, Properties of Continuous Time Fourier Series, Fourier Series Representation of Discrete Time Periodic Signals, Properties of Discrete Time Fourier Series, Fourier Series and LTI Systems.		
UNIT - III		12Hrs
The Continuous-Time Fourier Transform: Representation of aperiodic Signals, Continuous Time Fourier Transform, Fourier Transform for Periodic Signals, Properties of the Continuous Time Fourier Transform, Systems characterized by Linear constant coefficient differential equations, Discrete Time Fourier Transform - Representation of Aperiodic Signals, Discrete Time Fourier Transform, Frequency Response, Systems Characterized by Linear Constant-Coefficient Difference Equations.		
UNIT - IV		12Hrs

Time & Frequency Characterization of Signals and Systems : The Magnitude Phase Representation of the Fourier Transform, Magnitude Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency Selective Filters, Time Domain and Frequency Domain Aspects of Non-ideal Filters, Examples of Continuous time filters and Discrete time filters described by differential equations, First-Order and Second-Order Continuous and Discrete-Time Systems, Examples of Time and Frequency Domain Analysis of Systems, Sampling: Representation of a Continuous Time Signal by Its Samples, Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Effect of under sampling: Aliasing, Discrete Time Processing of Continuous-Time Signals.

UNIT - V		20Hrs

Laplace and z-Transforms : The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the Laplace Transform, Some Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform, System Function Algebra and Block Diagram Representations, Unilateral Laplace Transform, Z-Transform - Region of Convergence for the z-Transform, Inverse z-Transform, Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot, Properties of the z-Transform, Some Common z-Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, Unilateral z-Transforms.

Textbooks:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky, & S. Hamid, 2nd Edition, Pearson Higher Education, 1997.
2. Principles of Linear Systems and Signals, B.P. Lathi, 2nd Edition, Oxford University Press, 2011.

Reference Books:

1. Signals & Systems, Simon Haykin and B. Van Veen, 2nd Edition, John Wiley, 2003.
2. Signals and systems, Narayana Iyer and K Satya Prasad, 1st Edition, CENGAGE Learning, 2011.
3. Signals, Systems and Transforms, C. L. Philips, J. M. Parr and Eve A. Riskin, 4th Edition, Pearson education, 2008.

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

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%	3	Understand	L2	PO1, PO2,	PO1: Apply (L3) PO2: Review(L2)	2 3
2	16	21%	3	Analyze	L4	PO1,PO2, PO4	PO1: Apply (L3) PO2: Identify (L3) PO4:Analyze(L4)	3 3 3
3	12	16%	2	Analyze	L4	PO1,PO2	PO1:Apply(L3) PO2:Identify(L4)	3 3
4	12	16%	2	Apply	L3	PO1, PO2,PO4	PO1:Apply(L3) PO2:Identify(L3) PO4:Analyze(L4)	3 3 2
5	20	20%	2	Evaluate	L5	PO1,PO2, PO4	PO1:Apply(L3) PO2:Review(L2)	3 3

							PO4:Analyze(L4)	3
	75	**100%**						

Justification Statements:

CO1: Understand the representation of continuous time and discrete time signals
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: Review (L2)
CO1 Action Verb is equal to PO2 verb; therefore correlation is high (3).

CO2: Analyze the signals in frequency domain using Fourier series
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analysis (L4)
CO2 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

CO3 Analyze the signals in frequency domain using Fourier Transform

Action Verb: Apply(L3)

PO1 Verbs: Apply (L3)
CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

CO4: Apply the properties of LTI system described by differential equations
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Identify (L2)
CO4 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb level is less than PO4 verb; Therefore correlation is moderate (2).

CO5: Evaluate Continuous Time and Discrete Time LTI systems by using Laplace and Z-Transforms.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Identify (L2)
CO5 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APE0201		ELECTRICAL SAFETY and RISK MANAGEMENT (Professional Elective-I)	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the electrical safety principles and apply preventive measures to mitigate electrical hazards.
CO2	Apply the Safety aspects during Installation of Plant and Equipment
CO3	Apply electrical safety principles and practices to ensure safe installations and usage in residential, commercial, and agricultural settings.
CO4	Analyze electrical safety requirements for hazardous areas and specify suitable equipment and enclosures.
CO5	Apply safety management principles to ensure electrical system safety.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Electrical safety principles	To mitigate electrical hazards	Preventive measures	L2
CO2	Apply	Safety aspects during installation of plant and equipment		Safety aspects	L3
CO3	Apply	Electrical safety principles and practices	In residential, commercial, and agricultural settings	Ensure safe installations and usage	L3
CO4	Analyze	Electrical safety requirements for hazardous areas			L4
CO5	Apply	Safety management principles			L3

SYLLABUS

UNIT-I

TITLE: Introduction to Electrical Safety, Shocks and Their Prevention

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II

TITLE: Safety During Installation of Plant and Equipment

Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III

TITLE: Electrical Safety In Residential , Commercial and Agricultural Installations

Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.
UNIT-IV
TITLE : Electrical Safety in Hazardous Areas & Equipment Earthing and System Neutral Earthing
Electrical Safety in Hazardous Areas: Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations. Equipment Earthing and System Neutral Earthing: Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.
UNIT-V
TITLE: Safety Management of Electrical Systems & Review of IE Rules and Acts and Their Significance
Safety Management of Electrical Systems: Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees. Review of IE Rules and Acts and Their Significance: Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and firefighting facility. The Electricity Act, 2003, (Part1, 2, 3,4 & 5)

Text books:	
1	S. Rao, Prof. H.L. Saluja, —Electrical safety, fire safety Engineering and safety management‖, Khanna Publishers. New Delhi, 1988.(units-I to V)
2	www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)
Reference books:	
1	Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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				Analyze	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Create-L6	High-3 High-3 Low-1
2				Analyze	L4	PO1 PO2 PO3	Apply-L3 Analyze-L4 Create-L6	High-3 High-3 Low-1
3				Analyze	L4	PO1 PO2 PO3 PO6	Apply-L3 Analyze-L4 Create-L6 Thumb Rule	High-3 High-3 Low-1 Low-1
4				Apply	L3	PO1 PO2 PO4	Apply-L3 Analyze-L4 Analyze-L4	High-3 Medium-2 Medium-2
5				Apply	L3	PO1 PO6 PO10	Apply-L3 Thumb Rule Thumb Rule	High-3 Medium-2 Low-1

CO1: Understand the electrical safety principles and apply preventive measures to mitigate electrical hazards.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb level is lessthan to PO1 verb; Therefore correlation is low (1).
PO2 Verb: Identify (L3)
CO1 Action Verb level is lessthan to PO2 verb; Therefore correlation is low (1).
PO3 Verb: Develop (L3)
CO1 Action Verb level is lessthan to PO3 verb; Therefore correlation is low (1).

CO2: Apply the Safety aspects during Installation of Plant and Equipment
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb level is qual to PO1 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO2 Action Verb level is qual to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO2 level is 3, Using Thumb Rule its PO7 correlation is Moderate (2).

CO3: Apply electrical safety principles and practices to ensure safe installations and usage in residential, commercial, and agricultural settings.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb level is qual to PO1 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO2 level is 3, Using Thumb Rule its PO6 correlation is Moderate (2).
Based on students' participate in CLC activities. From this: CO2 level is 3, Using Thumb Rule its PO7 correlation is Moderate (2).

CO4: Analyze electrical safety requirements for hazardous areas and specify suitable equipment and enclosures.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb level is More than to PO1 verb; Therefore correlation is Maximum (3).
PO2 Verb: Identify (L3)
CO4 Action Verb level is More than to PO2 verb; Therefore correlation is Maximum (3).
PO3 Verb: Develop (L3)
CO4 Action Verb level is More than to PO3 verb; Therefore correlation is Maximum (3).

CO5 Apply safety management principles to ensure electrical system safety.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO5 Action Verb level is qual to PO1 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO5 level is 3, Using Thumb Rule its PO6 correlation is Moderate (2).
Based on students' participate in CLC activities. From this: CO5 level is 3, Using Thumb Rule its PO7 correlation is Moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/I	Branch of Study: EEE				
Subject Code		**Subject Name**	**L**	**T/CLC**	**P**	**Credits**
23APE0202		**Utilization of Electrical Energy** **Professional Elective- I**	2	1	**0**	**3**

After completion of the course, students will be able to:	
CO1	**Apply the appropriate electric drives for various industrial applications**
CO2	**Understand the different types of heating and welding techniques.**
CO3	**Evaluate various illumination system designs.**
CO4	**Understand the basic principle and different braking techniques of electric traction**
CO5	**Understand the basic principle and applications of the electrolytic process**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	**Apply**	Electric drives, industrial applications, motor types, control strategies	system specifications	Based on application type, efficiency, cost, and operational requirements	**L3**
CO2	**Understand**	Explain and differentiate heating and welding methods		Identify techniques, list advantages/disadvantages,	**L2**
CO3	**Evaluate**	Evaluate and compare lighting designs	Under different environmental and usage conditions	Based on efficiency, coverage, energy use, and suitability	**L5**
CO4	**Understand**	Describe and distinguish braking methods		Accuracy of explanation, relevance to traction scenarios	**L2**
CO5	**Understand**	Explain the process and its practical applications	Clarity of explanation, application mapping	In the context of industrial processes or laboratory setups	**L2**

SYLLABUS
UNIT-I
TITLE: Electric Drives:
Type of electric drives – rating and choice of motor - starting and running characteristics –particular
applications of electric drives - types of industrial loads - Continuous - intermittent and variable loads.
UNIT-II

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

TITLE: Electric Heating & Welding:
Introduction: Advantages and methods of electric heating - resistance heating - induction heating and dielectric heating.
Electric welding: Classification- resistance and arc welding - electric welding equipment - comparison between AC and DC Welding.
UNIT-III
TITLE: Illumination:
Introduction - terms used in illumination - laws of illumination - sources of light. Discharge lamps–mercury vapor and sodium vapor lamps–comparison between tungsten filament lamps and fluorescent tubes–compact fluorescent lamp–LED-Basic principles of light control-Types and design of good lighting system and practice - flood lighting.
UNIT-IV
TITLE: Electric Traction:
Traction systems: System of electric traction and track electrification - Review of existing electric traction systems in India - Special features of traction motor - Speed-time curves for different services – methods of electric braking - plugging - rheostatic braking - regenerative braking. Introduction to Magnetic Levitation vehicles.
UNIT-IV
TITLE: Electrolytic Process:
Introduction - Basic principles - Faradays laws of electrolysis - Energy efficiency –Electrode position - Factors governing deposition Processes - Deposition of Alloys –Extraction and refining of metals. Fuel cells.

Text books:	
1.	C.L Wadhwa, Generation Distribution and Utilization of Electrical Energy, New age International
	Publishers
2.	J. B. Gupta, Utilization of Electrical Power and Electric Traction, S. K. Kataria and sons, 2002
3.	G. C. Garg (2005), Utilization of Electrical Power & Electric traction, 8th edition, Khanna publishers,
	New Delhi.
4.	N. V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction
	New Age International (P) Limited, Publishers, 1996.
Reference books:	
1.	Partab (2007), Art & Science of Utilization of electrical Energy, 2nd edition, Dhanpat Rai & Sons, New.
	Delhi
2.	Alan. V. Oppenheim, Ronald. W. Schafer, John R Buck, Discrete Time Signal Processing, Prentice Hall,
	2ndedition,2006. E.Openshaw Taylor, Utilization of Electric Energy, Orient Longman,1971.
Web Resources:	
1.	**https://nptel.ac.in/courses/108105060**
2.	**https://nptel.ac.in/courses/112105221**
3.	**https://vssut.ac.in/lecture_notes/lecture1426861925.pdf**
4.	**https://vpmpee.wordpress.com/uee-3340903**

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Mapping of Course outcomes with Program outcomes													
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO 2**
CO1	**3**	**2**										**2**	**3**
CO2	**2**	**1**										**1**	
CO3	**3**	**3**	**2**									**3**	**3**
CO4	**2**											**1**	
CO5	**2**											**1**	

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 (0-3)**
	Lesson Plan (Hrs.)	**%**	**correlation**	**Verb**	**BTL**			
1				Apply	L3	**PO1, PO2**	**PO1:Appply(L3)** **PO2:Analyze(L4)**	3 2
2				Understand	L2	**PO1, PO2**	**PO1:Appply(L3)** **PO2:Analyze(L4)**	2 1
3				Evaluate	L5	**PO1, PO2, PO3**	**PO1:Appply(L3)** **PO2:Analyze(L4)** **PO3:Design(L6)**	3 3 2
4				Understand	L2	**PO1**	**PO1:Appply(L3)**	2
5				Understand	L2	**PO1**	**PO1:Appply(L3)**	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

CO1: Apply the appropriate electric drives for various industrial applications
Action Verb: Apply (L3)
PO1Verbs: Apply (L3)
CO1 Action Verb is same to PO1 verb; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
CO2 Understand the different types of heating and welding techniques.
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO2 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2 Verbs: Analyze (L4)
CO2 Action Verb is less than PO2 verb by two level; Therefore, correlation is low (1).
CO3: Evaluate various illumination system designs.
Action Verb: Evaluate (L5)
PO1Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb by two level; Therefore, correlation is high (3).
PO2Verbs: Analyze (L4)
CO3 Action Verb is greater than PO2 verb by one level; Therefore, correlation is high (3).
PO3Verbs: Design (L6)
CO3 Action Verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).
CO4: Understand the basic principle and different braking techniques of electric traction
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
CO5: Understand the basic principle and applications of the electrolytic process
Action Verb: Understand (L2)
PO1Verbs: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).

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

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

Subject Code 23AOE9915	**ENGLISH FOR COMPETITIVE EXAMINATIONS (Open Elective-I)** (Common to All Branches of Engineering)	**L T/CLC P** **2 1 0**	Credit: 3

Pre-Requisites		Semester	**I**

Course Outcomes (CO): Student will be able to

CO1 - Understand the basics of English grammar to develop proficiency in language skills. L2
CO2 - Apply the grammatical structures in sentences for an effective communication. L3
CO3 - Apply the use of various concepts in grammar and vocabulary in everyday use and competitive exams L3
CO4 - Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills. L4
CO5 - Create effective writing forms like essays and precise writing by using grammar and structure rules. L5

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom s 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	**Apply**	the use of various concepts in grammar and vocabulary in everyday use and competitive exams		in everyday use and competitive exams	**L3**
4	**Analyze**	Analyze unfamiliar passages to draw logical conclusions, thereby enhancing reading comprehension and vocabulary skills			**L4**
5	**Create**	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**	Lecture 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**	Lecture 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**	Lecture 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**	Lecture 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**	Lecture 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 Resources

1. **https://www.grammar.cl/english/parts-of-speech.htm**
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

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	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
ENGLISH FOR COMPETITIVE EXAMINATIONS	CO1									2		
	CO2									2		
	CO3									2		
	CO4									3		
	CO5									3		

CO-PO mapping justification:

C	Percentage of contact	CO	Progra	PO(s): Action verb and	Level of

O	hours over the total planned contact hours					m Outcome (PO)	BTL (for PO1 to PO5)	Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1							Thumb Rule	2
2							Thumb Rule	2
3							Thumb Rule	2
4							Thumb Rule	3
5							Thumb Rule	3

CO1: Understand the basics of English grammar and its importance
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 use of grammatical structures in sentences
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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/I	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0217		POWER ELECTRONICS LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Analyze the Characteristics of Power Semiconductor Devices (SCR, MOSFET, IGBT) and their Role in Power Converters.
CO2	Design and Implement Gate Firing Circuits for SCR-based Power Converters.
CO3	Evaluate the Performance of Single-phase and Three-phase Power Converters with R and RL Loads.
CO4	Apply Different Commutation Techniques to Analyze Inverter for Efficient Power Control.
CO5	Apply Different Commutation Techniques to Analyze Chopper Circuits for Efficient Power Control.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Characteristics and applications of SCR, MOSFET, IGBT in power converters	Given the datasheets and circuit diagrams of semiconductor devices	Identify and compare parameters affecting performance in power converters	L4
CO2	Design	Gate firing circuits for SCR-based converters	Using simulation tools and lab equipment	Implement working gate firing circuits meeting design specifications	L6
CO3	Evaluate	Performance of power converters with different loads (R, RL)	Given single-phase and three-phase converters connected with R/RL loads	Measure voltage, current, and waveform characteristics accurately	L5
CO4	Apply	Commutation techniques in inverters for efficient power control	Given different inverter configurations and objectives	Select and implement appropriate commutation techniques	L3
CO5	Apply	Commutation techniques in chopper circuits for efficient power control	Given circuit setup and load requirements	Demonstrate the effective use of commutation techniques	L3

List of Experiments		
CHOOSE ANY TEN FROM THE FOLLOWING LIST:		
Sl. No	**Name of the Experiment**	**CO**
1.	Study of Characteristics of SCR, MOSFET & IGBT.	CO1
2.	Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering.	CO2
3.	Single Phase AC Voltage Controller with R and RL Loads.	CO3
4.	Single Phase fully controlled bridge converter with R and RL loads	CO3
5.	Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E).	CO5
6.	DC Jones chopper with R and RL Loads.	CO5
7.	Single Phase Parallel inverter with R and RL loads.	CO4
8.	Single Phase Cycloconverter with R and RL loads.	CO3
9.	Single Phase Half controlled converter with R and RL load.	CO3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

10.	Single Phase Fully controlled converter with R and RL load.	CO3
11.	Three Phase half-controlled bridge converter with R, RL-load.	CO3
12.	Three Phase fully controlled bridge converter with R, RL-load.	CO3
13.	Single Phase Bridge converter with R and RL loads.	CO3
14.	Single Phase dual converter with RL loads	CO3

Reference books:	
1	O.P. Arora, —Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)‖, Alpha Science International Ltd., 2007.
2	M. H. Rashid, —Simulation of Electric and Electronic circuits using PSPICE‖, M/s PHI Publications.
3	PSPICE A/D user's manual – Microsim, USA.
Web Resources:	
1	http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php

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

CO No.	**CO**		**Program Outcomes(PO)**	**PO(s): Actionverb and BTL(for PO1 to PO5)**	**Level of correlation(1-3)**
	Verb	**BTL**			
1	Analyze	L4	PO3 PO4	Design: L6 Analyze: L4	1 3
2	Design	L6	PO3 PO4	Design: L6 Analyze: L4	3 3
3	Evaluate	L5	PO3 PO4	Design: L6 Analyze: L4	2 3
4	Apply	L3	PO4	Analyze: L4	1
5	Apply	L3	PO4	Analyze: L4	1

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering

CO1: Analyze the Characteristics of Power Semiconductor Devices (SCR, MOSFET, IGBT) and their Role in Power Converters.
Action Verb: Analyze – L4
PO3: Design L6 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1. **PO4: Analyze L4** The BTL of CO action verb is equal to BTL of PO action verb by 2. Therefore, the correlation is high, level 3.
CO2: Design and Implement Gate Firing Circuits for SCR-based Power Converters.
Action Verb: Design L6
PO3: Design L6 The BTL of CO action verb is equal to BTL of PO action verb by 2. Therefore, the correlation is high, level 3. **PO4: Analyze L4** The BTL of CO action verb is higher than BTL of PO action verb by 2. Therefore, the correlation is high, level 3.
CO3: Evaluate the Performance of Single-phase and Three-phase Power Converters with R and RL Loads.
Action Verb: Evaluate L5
PO3: Design L6 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is moderate, level 2. **PO4: Analyze L4** The BTL of CO action verb is higher than BTL of PO action verb by 2. Therefore, the correlation is high, level 3.
CO4: Apply Different Commutation Techniques to Analyze Inverter for Efficient Power Control.
Action Verb: Apply L3
PO4: Analyze L4 The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is moderate, level 2.
CO5: Apply Different Commutation Techniques to Analyze Chopper Circuits for Efficient Power Control.
Action Verb: Apply L3
PO4: Analyze L4 The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is moderate, level 2.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Subject Code	Year & Sem		L	T/ CLC	P	C
23APC0422	**III-I**	**ANALOG AND DIGITAL CIRCUITS LAB**	**0**	**0**	**3**	**1.5**

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

CO1: Analyze the characteristics of diodes and transistors for circuit design.
CO2: Evaluate rectifiers, amplifiers, and oscillator circuits**.**
CO3: Design of circuits using logic gates for basic Op-Amp applications, combinational and sequential circuits**.**
CO4: Design digital systems using universal gates, multiplexers, and comparators.
CO5: Evaluate fundamental digital components such as adders, subtractors, converters, flip-flops, encoders, and decoders.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	analyze	the characteristics of diodes and transistors		For circuit design	**L4**
CO2	evaluate	rectifiers, amplifiers, and oscillator circuits**.**			**L5**
CO3	Design	Basic Op-Amp applications, combinational and sequential circuits using logic gates			**L6**
CO4	Design	Digital systems using universal gates, multiplexers, and comparators			**L6**
CO5	Evaluate	fundamental digital components such as adders, subtractors, converters, flip-flops, encoders, and decoders			**L5**

PART (A): ANALOG CIRCUITS

LIST OF EXPERIMENTS :(Any 06 Experiments are to be conducted)

1. CB Characteristics (CO1)
2. CE Characteristics (CO1)
3. CE Amplifier (CO1)
4. CC Amplifier (CO1)
5. Clippers (CO1)
6. Clampers (CO1)
7. Hartley & Colpitts Oscillators (CO2)
8. RC Phase shift oscillator (CO2)
9. Astable multivibrator (CO2)
10. Monostable multivibrator (CO2)
11. A to D Converter (CO3)
12. D to A Converter
13. Op-Amp Applications-Adder, subtractor, comparator (CO3)

PART (B): DIGITAL CIRCUITS

LIST OF EXPERIMENTS :- (Any 06 Experiments are to be conducted)

1. Realization of Boolean Expressions using Gates (CO3)
2. Design and realization of logic gates using universal gates (CO3)
3. Generation of clock using NAND/ NOR gates (CO4)
4. Design a 4–bit Adder/ Subtractor (CO5)
5. Design and realization ofa4– bit Gray to Binary and Binary to Gray Converter (CO5)
6. Design and realization of8x1 MUXusing2x1 MUX(CO4)
7. Design andrealizationof4bit comparator (CO4)
8. Design and realization of Flip-Flops (CO5)
9. Design and realization of Encoders (CO5)
10. Design and realization of Decoders (CO5)
11. Design and realization of Comparator (CO4)

Note: Any 12 listed experiments are to be conducted. Out of which 6 experiments are to be conducted from part(A) and another 6 experiments are to be conducted from part (B)

Mapping of COs to POs and PSOs

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

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

CO	CO					Program Outcome (PO)	PO(s) : Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	25	2	CO1:analyze	L4	PO1 PO2 PO3	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3)	3 3 3
2	6	16	3	CO2:evaluate	L5	PO1 PO2 PO3	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3)	3 3 3
3	9	25	3	CO3:Design	L6	PO1 PO2 PO3	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3)	3 3 3
4	6	16	3	CO4:Design	L6	PO1 PO2 PO3	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3)	3 3 3
5	6	16	3	CO5: evaluate	L5	PO1 PO2 PO3	PO1: Apply(L3) PO2:Review(L2) PO3:Develop(L3)	3 3 3

	36	100%						

Justification Statements:-

CO1: **Analyze the characteristics of diodes and transistors for circuit design.(L4)**
PO1 Verbs : Apply (L3) CO 1 Action Verb is greater than the PO1 verb. Therefore, the correlation is high (3)
PO2 Verbs : Review (L2) CO1 Action Verb is greater than PO2 Verb. Therefore the correlation is high (3)
PO3 Verbs: Develop(L3) CO1 Action Verb is greater than the PO3 Verb. Therefore the correlation is High (3)

CO2: Evaluate rectifiers, amplifiers, and oscillator circuits. (L5)

PO1 Verbs : Apply (L3) CO2 Action Verb is greater to the PO1 verb. Therefore, the correlation is high (3)
PO2 Verbs : Review (L2) CO2 Action Verb is greater than PO2 Verb. Therefore the correlation is high(3)
PO3Verbs :Develop(L3) CO 2 Action Verb is greater than PO3 verb. Therefore, the correlation is high (3)

CO3 : **Design of circuits using logic gates for basic Op-Amp applications, combinational and sequential circuits. (L6)**

PO1 Verbs: Apply (L3) CO3 Action verb is equal to the PO1 verb .Therefore the correlation is high (3)
PO2 Verbs: Review (L2) CO3 Action Verb is greater than the PO2 verb. Therefore the correlation is High (3)
PO3 Verbs: Develop (L3) CO3 Action Verb is equal to the PO3 verb .Therefore the correlation is high (3)

CO4:Design digital systems using universal gates, multiplexers and comparators. (L4)

PO1 Verbs: Apply(L3) CO4 Action verb is greater than the PO1 Verb .Therefore the correlation is high (3)
PO2 Verbs: Review(L2) CO4 Action verb is greater than the PO2 Verb. Therefore the correlation is
high(3)
PO3 Verbs: Develop(L3) CO4 Action verb is greater than the PO3 Verb. Therefore the Correlation is high (3)

CO5: Evaluate fundamental digital components such as adders, subtractors, converters, flip-flops, encoders, and decoders. (L5)

PO1 Verbs: Apply (L3) CO5 Action verb is greater than the PO1 verb .Therefore the correlation is High (3)
PO2 Verbs: Review (L2)CO5 Action Verb is greater than the PO2 verb. Therefore the correlation is High(3)
PO3Verbs:Develop (L3) CO5 Action verb is greater than the PO3 verb .Therefore the correlation is High (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI
(Autonomous)

Year: II/III B.Tech **(Common to all branches)** Semester: I/II

Subject Code	Subject Name	L	T/CLC	P	Credit: 2
23ASC9901	**SOFT SKILLS LAB**	**0**	**1**	**2**	

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	PO 9	PO 10	PO 11
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	PO9	Thumb rule	2
2			CO2	ANALYZE	L4	PO8, PO9	Thumb rule	3,3
3			CO3	APPLY	L3	PO8	Thumb rule	2
4			CO4	EVALUATE	L5	PO8	Thumb rule	3
5			CO5	Apply	L3	PO8, PO9	Thumb rule	2,2

Justification Statements:

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 PO11 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 PO11 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 PO11 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 PO11 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 PO11 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS
COMMON TO ALL

Course Code	Year & Sem	TINKERING LAB	L	T/CLC	P	C
23AES0404	III-I	(Common to ALL)	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**	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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

COMPUTER SCIENCE AND ENGINEERING

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, Vision vs 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		3	2	
CO5	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	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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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)
Course Structure for the Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2023-24**)**
Department of Electrical and Electronics Engineering

III Year – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	Professional Core	23APC0218	Electrical Measurements and Instrumentation	2	1	0	3	30	70	100
2	Professional Core	23APC0412	Microprocessors and Microcontrollers	2	1	0	3	30	70	100
3	Professional Core	23APC0219	Power System Analysis	2	1	0	3	30	70	100
4	**Professional Elective- II**	23APE0203	AI&ML for Electrical Engineering	2	1	0	3	30	70	100
		23APE0204	Programmable Logic Controllers							
		23APE0205	Switchgear and Protection							
5	**Professional Elective- III**	23APC0424	Communication systems	2	1	0	3	30	70	100
		23APE0206	Electric Drives							
		23APE0207	Renewable and Distributed Energy Technologies							
6	**Open Elective-II**		***Open Elective-II**	2	1	0	3	25	75	100
7	Professional Core	23APC0220	Electrical Measurements and Instrumentation Lab	0	0	3	1.5	30	70	100
8	Professional Core	23APC0414	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
9	Skill Enhancement course	23ASE0201	Applications of Soft Computing Tools in Electrical Engineering	0	1	2	2	30	70	100
10	Audit Course	23AMC9902	Technical Paper Writing & IPR	2	0	0	-	30	70	100
11	Skill Enhancement course	23ASE0202	Workshop	-	-	-	-	-	-	-
			Total	**14**	**07**	**08**	**23**	**295**	**705**	**1000**

Mandatory Industry Internship of 08 weeks duration during summer vacation

Note: Workshop can be conducted either in 3-1 or 3-2 and the participation certificate with 90% and above attendance on it shall be submitted to the Department /Examination Section before 3-2 Regular Exam notification is released.

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	23AOE0301	Automation and Robotics	ME
4	23AOE0402	Digital Electronics	ECE
5	23AOE0504	Operating Systems	CSE & Allied/IT
6	23AOE0505	Introduction to Machine Learning	
7	23AOE9902	Advanced Operations Research	Mathematics
8	23AOE9903	Mathematical Foundation Of Quantum Technologies	
9	23AOE9907	Physics Of Electronic Materials And Devices	Physics
10	23AOE9912	Chemistry Of Polymers And Applications	Chemistry
11	23AOE9916	Academic Writing and Public Speaking	Humanities

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0218		ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand basic concepts and working of electrical measuring instruments.
CO2	Understand the principle of operation of instrument transformers, energy meters and analog instruments
CO3	Analyze the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance.
CO4	Understand the principle and working of different digital voltmeters and transducers.
CO5	Understand the working of various sensors and data acquisition systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Basic concepts and working of electrical measuring instruments.			L2
CO2	Understand	The principle of operation of instrument transformers, energy meters and analog instruments.			L2
CO3	Analyze	The principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance.			L4
CO4	Understand	The principle and working of different digital voltmeters and transducers.			L2
CO5	Understand	The working of various sensors and data acquisition systems.			L2

SYLLABUS
UNIT-I
TITLE: Measuring instruments & Digital Meters
Fundamentals: True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis- Simple problems; Statistical treatment of data-Simple problems. Indicating Instruments: Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.
UNIT-II
TITLE: Measurement Of Power, Power Factor And Energy
Instrument transformers: Types, CT and PT – Ratio and phase angle errors; (Expression only, no derivation)

Measurement of power: Principle and Operation of Single-phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations.

Measurement of power factor: Principle and operation of Single-phase Electrodynamometer Power factor meter.

Measurement of Frequency: Principle and Operation of single phase frequency meter- vibrating reed type,- ferro dynamic type meter.

Measurement of Energy: Principle and Operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading.

UNIT-III

TITLE: D.C&A.C Bridges

Measurement of Resistance: Methods of measuring low, medium and high resistances –Sensitivity of Whetstone's bridge– Kelvin's double bridge for Measuring low resistance, Megger for measurement of high resistance.
Measurement of Inductance: - Maxwell's bridge, Anderson's bridge
Measurement of Capacitance: De Sauty bridge. Wien's bridge–Scheringbridge–Numerical problems.

UNIT-IV

TITLE : Digital Volt Meters And Transducers

Digital Voltmeters: Ramp type, Dual Slope integrating type, successive approximation, Potentiometric type DVMs.
Classification of transducers: Active/passive, analog/digital- Strain Gauge-gauge factor (Elementary treatment only)-applications of strain gauge, Q-Meter.

UNIT-V

TITLE: Transducers, Sensors and Data Acquistion

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes. Optocoupler.
Silicon based micro sensors: Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only)
Introduction to PLC and SCADA Systems: Data acquisition systems (DAS) and interfacing techniques

Text books:	
1	Electrical & Electronic Measurement & Instruments by A.K. Sawhney Dhanpat Rai & Co. Publications, 2007.
2	Electrical Measurements and measuring Instruments–by E.W.Golding and F.C. Widdis, 5th Edition, Reem Publications, 2011.
3	Buckingham and Price, —Electrical Measurements‖, Prentice – Hall
Reference books:	
1	Electronic Instrumentation by H.S.Kalsi,Tata Mcgrawhill, 3rd Edition, 2011.
2	Electrical Measurements: Fundamentals, Concepts, Applications–by Reissl and, M.U, New Age International (P) Limited, 2010.
3	Electrical & Electronic Measurement & Instrumentation by R.K.Rajput, 2nd Edition, S. Chand & Co., 2nd Edition, 2013.

4	Sensor Technology: Hand Book by JonS. Wilson, ELSEVIER publications,2005
Web Resources:	
1	https://onlinecourses.nptel.ac.in/noc22_ee112/preview

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		1		1								1	
CO2		1		1								1	
CO3	3	3	1									1	
CO4		1		1								1	
CO5		1		1								1	

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	PO2 PO4	Analyze: L4 Analyze: L4	1 1
2				Understand	L2	PO2 PO4	Analyze: L4 Analyze: L4	1 1
3				Analyze	L4	PO1 PO2 PO3	Apply: L3 Analyze: L4 Design: L6	3 3 1
4				Understand	L2	PO2 PO4	Analyze: L4 Analyze: L4	1 1
5				Understand	L2	PO2 PO4	Analyze: L4 Analyze: L4	1 1

CO1: Understand basic concepts and working of electrical measuring instruments.
Action Verb: Understand-L2
PO2 Verb: Analyze-L4
The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.
PO4 Verb: Analyze-L4
The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.
CO2: Understand the principle of operation of instrument transformers, energy meters and analog instruments
Action Verb: Understand-L2
PO2 Verb: Analyze-L4
The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level

1.
PO4 Verb: Analyze-L4
The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.
CO3: Analyze the principle and working of various DC and AC bridges for the measurement of Resistance, Inductance and Capacitance.
Action Verb: Analyze-L4
PO1: Apply L3
The BTL of CO action verb is greater than BTL of PO action verb by 3. Therefore, the correlation is High, level 3. PO2: Analyze L4 The BTL of CO action verb is equal to BTL of PO action verb by 1. Therefore, the correlation is high, level 3. PO3: Design L6 The BTL of CO action verb is less than BTL of PO action verb by 2. Therefore, the correlation is low, level 1
CO4: Understand the principle and working of different digital voltmeters and transducers.
Action Verb: Understand – L2
PO2 Verb: Analyze-L4 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1. PO4 Verb: Analyze-L4 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.
CO5: Understand the working of various sensors and data acquisition systems.
Action Verb: Understand – L2
PO2 Verb: Analyze-L4 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1. PO4 Verb: Analyze-L4 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS
III-II EEE & CSE, IV-I CSE,CIC,CSD,ME,CE,AIML,AIDS

Course Code	Year & Sem	MICROPROCESSORS AND MICROCONTROLLERS	L	T/CLC	P	C
23APC0412			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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0219		POWER SYSTEM ANALYSIS	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand concepts of per unit system and formation of Y bus for a power system network.
CO2	Apply the Z bus building and modification algorithm for a power system.
CO3	Analyze the power flow using Gauss-Seidel and Newton Raphson algorithms.
CO4	Analyze the symmetrical and unsymmetrical faults occurring in a power system.
CO5	Analyze steady sate, dynamic, transient state stabilities and methods to improve system stability.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Per unit system and Ybus Formation		For A Power System Network.	L2
CO2	Apply	Zbus For a power System		Modification Of Zbus	L3
CO3	Analyze	GS & NR Algorithms	To Obtain Load Flow Solution		L4
CO4	Analyze	Symmetrical and unsymmetrical faults			L4
CO5	Analyze	Steady Sate ,Dynamic And Transient State Stabilities	To Improve System Stability		L4

SYLLABUS

UNIT-I

TITLE: P.U. SYSTEM AND Ybus FORMATION

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, YBus formation by Direct and Singular Transformation Methods (Numerical Problems).

UNIT-II

TITLE: UNIT-II FORMATION OF Zbus

Formation of ZBus - Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of ZBus for the changes in network (Numerical Problems)

UNIT-III

TITLE: POWER FLOW ANALYSIS

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart - Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses) - Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, algorithm and flowchart – Decoupled and Fast Decoupled Methods – Comparison of Different Methods.

UNIT-IV

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

TITLE : SHORT CIRCUIT ANALYSIS
Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG and LLLG faults with and without fault impedance, Numerical Problems.
UNIT-V
TITLE: STABILITY ANALYSIS
Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Text books:	
1	Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2	Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4th Edition, 2011.
Reference books:	
1	Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2	Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3	Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.
Web Resources:	
1	https://onlinecourses.nptel.ac.in/noc22_ee120/preview

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	2										1	
CO2	3	3										2	
CO3	3	3										3	
CO4	3	3				3						3	
CO5	3	3				3						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, PO2	Apply(L3) Identify(L3)	2 2
2				Apply	L3	PO1, PO2	Apply(L3) Identify(L3)	3 3

3				Analyze	L4	PO1, PO2	Apply(L3) Identify(L4)	3 3
4				Analyze	L4	PO1, PO2, PO6	Apply(L3) Analyze(L4) Thumb Rule	3 3 3
5				Analyze	L4	PO1, PO2, PO6	Apply(L3) Analyze(L4) Thumb Rule	3 3 3

CO1:- Understand concepts of Perunit system and formation of Y bus for a power system network.
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 levels; therefore correlation is moderate (2).
CO2:- Apply the Z bus building and modification algorithm for a power system.
Action Verb: Apply (L3) PO1: Apply (L3)
CO2: Action Verb is same PO1 verb; Therefore correlation is high (3). PO2: Identify (L3)
CO2: Action Verb is same PO2 verb; Therefore correlation is high (3).
CO3:- Analyze the power flow using Gauss-Seidel and Newton Raphson algorithms.
Action Verb: Analyze (L4) PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; therefore correlation is High (3). PO2: Analyze (L4)
CO3 Action Verb is same PO2 verb; therefore correlation is high (3).
CO4:- Analyze the symmetrical and unsymmetrical faults occurring in a power system.
Action Verb: Analyze (L4) PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by one level; Therefore correlation is moderate (3). PO2: Analyze (L4)
CO4 Action Verb is same PO2 verb; therefore correlation is high (3). PO6: Using Thumb Rule, CO4 Correlated to PO6 as high (3)
CO5:- Analyze steady sate, dynamic, transient state stabilities and methods to improve system stability.
Action Verb: Analyze (L4) PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is moderate (3). PO2: Analyze (L4)
CO5 Action Verb is same PO2 verb; therefore correlation is high (3). PO6: Using Thumb Rule, CO5 Correlated to PO6 as high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		**Subject Name**	**L**	**T/CLC**	**P**	**Credits**
23APE0203		**AI&ML FOR ELECTRICAL ENGINEERING**	2	1	**0**	**3**

After completion of the course, students will be able to:	
CO1	Understanding the Basics and Architecture of Artificial Intelligence
CO2	Analyze the motivation and applications of Machine Learning.
CO3	Analyze Artificial Neural Networks (ANN) Concepts
CO4	Understanding and Applying Fuzzy Logic Concepts
CO5	Design and Implementing Fuzzy Logic Applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Basics and Architecture of Artificial Intelligence			L2
CO2	Analyze	Motivation and applications of Machine Learning			L4
CO3	Analyze	Artificial Neural Networks (ANN) Concepts			L4
CO4	Understand	Fuzzy Logic Concepts			L2
CO5	Design	Fuzzy Logic Applications			L5

SYLLABUS

UNIT-I

TITLE: Introduction to Artificial Intelligence

Introduction and motivation - Approaches to AI - Architectures of AI - Symbolic Reasoning System - Rule based Systems - Knowledge Representation - Expert Systems.

UNIT-II

TITLE: Overview of Machine Learning

The Motivation & Applications of Machine Learning: Learning Associations, Classification, Regression; Supervised Learning; Unsupervised Learning; Reinforcement Learning; Gradient Descent: Batch Gradient Descent, Stochastic Gradient Descent; Data preprocessing; Under fitting and Overfitting issues

UNIT-III

TITLE: Artificial Neural Networks

Basics of ANN - Comparison between Artificial and Biological Neural Networks - Basic Building Blocks of ANN - Artificial Neural Network Terminologies - McCulloch Pitts Neuron Model - Learning Rules - ADALINE and MADALINE Models - Perceptron Networks (Continuous and Discrete) – Perceptron Convergence Theorem - Back Propagation Neural Networks - Associative Memories – BAM and Hopfield networks.

UNIT-IV

TITLE : Fuzzy Logic

Classical Sets - Fuzzy Sets - Fuzzy Properties, Operations and relations - Fuzzy Logic System - Fuzzification - Defuzzification - Membership Functions - Fuzzy Rule base - Fuzzy Logic Controller Design.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

UNIT-V
TITLE: Applications of AI Techniques
Load forecasting, Load flow studies, Economic load dispatch, Speed control of DC Motor, Speed Control of Induction Motors.

Text books:	
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2	Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2012.
3	Ethem Alpaydin, —Introduction to Machine Learning‖, MIT Press, 3rd edition, 2014
4	Russell. S and Norvig. P, —Artificial Intelligence - A Modern Approach‖, 4 th edition, Pearson, 2022
Reference books:	
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2013.
2	Yung C. Shin and Chengying Xu, "Intelligent System - Modeling, Optimization & Control, CRC Press, 2009.
3	Kevin P. Murphy, —Machine Learning: A Probabilistic Perspective‖, MIT Press, 2012
Web Resources:	
1	https://nptel.ac.in/courses/127105006

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	2			2	2							
CO2	3	3			3	3							
CO3	3	3			3	3							
CO4	2	2			2	2							
CO5	3		3		3	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, PO2, PO5	Apply(L3) Identify(L3) Apply(L3)	2 2 2
2				Analyze	L4	PO1, PO2, PO5	Apply(L3) Identify(L3) Apply(L3)	3 3 3
3				Analyze	L4	PO1, PO2,	Apply(L3) Identify(L3)	3 3

						PO5	Apply(L3)	3
4				Understand	L2	PO1, PO2, PO5	Apply(L3) Identify(L3) Apply(L3)	2 2 2
5				Design	L5	PO1, PO3, PO5	Apply(L3) Design(L5) Apply(L3)	3 3 3

CO1: Understanding the Basics and Architecture of Artificial Intelligence
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 levels; therefore correlation is moderate (2).
PO5: Apply (L3)
CO1 Action Verb is less than PO5 verb by one levels; therefore correlation is moderate (2).
CO2: Analyze the motivation and applications of Machine Learning.
Action Verb: Analyze (L4) PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by one level; therefore correlation is High (3). PO2: Identify (L3)
CO2 Action Verb is Greater than PO2 verb by one level; therefore correlation is High (3).
PO5: Apply (L3)
CO2 Action Verb is Greater than PO2 verb by one level; therefore correlation is High (3).
CO3: Analyze Artificial Neural Networks (ANN) Concepts
Action Verb: Analyze (L4) PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; therefore correlation is High (3).
PO2: Identify (L3)
CO3 Action Verb is Greater than PO2 verb by one level; therefore correlation is High (3).
PO5: Apply (L3)
CO3 Action Verb is Greater than PO2 verb by one level; therefore correlation is High (3).
CO4: Understanding and Applying Fuzzy Logic Concepts
Action Verb: understand (L2) PO1: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2). PO2: Identify (L3)
CO4 Action Verb is less than PO2 verb by one levels; therefore correlation is moderate (2).
PO5: Apply (L3)
CO4 Action Verb is less than PO5 verb by one levels; therefore correlation is moderate (2).
CO5: Design and Implementing Fuzzy Logic Applications
Action Verb: Design (L5)
PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by two level; Therefore correlation is High (3).
PO3: Design (L5)
CO5 Action Verb is equal to PO3 ; Therefore correlation is High (3).
PO5: Apply (L3)
CO5 Action Verb is Greater than PO5 verb by two level; Therefore correlation is High (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		**Subject Name**	**L**	**T/CLC**	**P**	**Credits**
23APE0204		**PROGRAMMABLE LOGIC CONTROLLERS**	2	1	**0**	**3**

After completion of the course, students will be able to:	
CO1	Understand different types of PLCs, Its classification and the usage of Easy Veep software.
CO2	Analyze the hardware details of Allen Bradley PLC.
CO3	Evaluate PLC programs for various applications.
CO4	Apply PLC programming concepts in different fields of Science and Technology.
CO5	Evaluate ADD, SUB, UP, and DOWN counter instructions to ensure accurate logic in PLC applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	**Understand**	Understand different types of PLCs	Describe types, classification, and basic simulation software	Correctly classify PLCs	L2
CO2	**Analyze**	Analyze the hardware details of PLC	Analyze internal hardware structure and components	Identify and explain hardware modules accurately	L4
CO3	**Evaluate**	Evaluate PLC programs for various applications	Evaluate logic and structure of PLC programs	Provide logical justification and suggest improvements	L5
CO4	**Apply**	Apply PLC programming concepts	Under real-time or simulated control scenarios	Develop and execute PLC programs with correct output	L3
CO5	**Evaluate**	Evaluate ADD, SUB, UP, and DOWN counter instructions	Assess arithmetic and counting logic in control routines	Detect and correct errors in counter-based PLC programs	L5

SYLLABUS

UNIT-I

TITLE: Introduction to PLCs

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

UNIT-II

TITLE: PLC Computational Tool

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

UNIT-III

TITLE: PLC Development

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction. Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.
UNIT-IV
TITLE : PLC Programming
Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.
UNIT-V
TITLE: Applications
Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

Text books:	
1	Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2	PLC Hand Book (Automation direct Siemens)
Reference books:	
1	Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2	Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3	Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.
Web Resources:	
1	https://nptel.ac.in/courses/10810508

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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 PO2	Apply-L3 Analyse-L4	Medium-2 Low-1
2				**Analyze**	L4	PO1 PO2 PO3	Apply-L3 Analyse-L4 Design-L6	High-3 High-3 Low-1
3				**Evaluate**	L5	PO1 PO2 PO3	Apply-L3 Analyse-L4 Design-L6	High-3 High-3 Medium-2
4				**Apply**	L3	PO1 PO2	Apply-L3 Analyse-L4	High-3 Medium-2
5				**Evaluate**	L5	PO1 PO2	Apply-L3 Analyse-L4	High-3 High-3

CO1: Understand different types of PLCs
Action Verb: **Understand-L2**
CO1 Action verb is less than PO1action verb by 1 therefore the correlation is Medium-2 CO1 Action verb is less than PO2 action verb by 2 therefore the correlation is Low-1
CO2: Analyze the hardware details of PLC
Action Verb: **Analyze-L4**
CO2 Action verb is greater than PO1action verb by 1 therefore the correlation is High-3 CO2 Action verb is Equal to PO2 therefore the correlation is High-3 CO2 Action verb is Less Than PO3 action by 2 therefore the correlation is Low-1
CO3: Evaluate PLC programs for various applications
Action Verb: **Evaluate-L5**
CO3 Action verb is greater Than than PO1action by 2 therefore the correlation is High-3 CO3 Action verb is greater Than than PO2action by 1 therefore the correlation is High-3 CO3 Action verb is Less Than than PO3action by 1 therefore the correlation is Medium-2
CO4: Apply PLC programming concepts
Action Verb: **Apply-L3**
CO4 Action verb is Equal to PO1therefore the correlation is High-3 CO4 Action verb is Less than PO2 action by 1therefore the correlation is Medium-2
CO5: Evaluate ADD, SUB, UP, and DOWN counter instructions Action Verb: **Evaluate-L5**
CO5 Action verb is greater than PO1 action by 2therefore the correlation is High-3 CO5 Action verb is greater than PO2 action by 1 therefore the correlation is High-3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APE0205		SWITCHGEAR AND PROTECTION	2	1	0	3

After completion of the course, students will be able to:	
CO1	Understand the operation of different circuit breakers and their specifications.
CO2	Analyze the concepts of different relays which are used in real time power system operation.
CO3	Apply various protective schemes for Transformers, Generators.
CO4	Apply different protective schemes for Bus bars and Feeders.
CO5	Understand the methods of protection against over voltages and importance of neutral grounding

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The operation of different circuit breakers and their specifications.			L2
CO2	Analyze	The concepts of different relays.		Used in real time power system operation.	L4
CO3	Apply	Various protective schemes for Transformers, Generators.			L3
CO4	Apply	Different protective schemes for Bus bars and Feeders.			L3
CO5	Understand	The methods of protection against over voltages and importance of neutral grounding.			L2

SYLLABUS

UNIT-I

TITLE: Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications, Selection of CB: Types and Numerical Problems. – Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

UNIT-II

TITLE: Electromagnetic, Static and Numerical Relays

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT), Distance Relays, Impedance Relays and Reactance Relays with their Flow Charts.

UNIT-III

TITLE: Protection of Generators and Transformers

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal

Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on percentage winding unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CTs Ratio, Buchholtz relay Protection.
UNIT-IV
TITLE : **Protection of Feeders, Transmission Lines and Busbars**
Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars - Differential protection, Differential Pilot wire protection.
UNIT-V
TITLE: Protection Against Over Voltages
Generation of Over Voltages in Power Systems. -Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

Text books:	
1	Switchgear and Protection – by Sunil S Rao, Khanna Publishers.
2	Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.
Reference books:	
1	Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2	Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3	Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4	Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.
5	Power System Protection- P. M. Anderson, Wiley Publishers.
Web Resources:	
1	https://onlinecourses.nptel.ac.in/noc22_ee101/preview

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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 PO2 PO5	Apply-L3 Analyse-L4 Apply-L3	Medium-2 Low-1 Medium-2
2				Analyze	L4	PO1 PO5	Apply-L3 Apply-L3	High-3 High-3
3				Apply	L3	PO1 PO2	Apply-L3 Analyse-L4	High-3 Medium-2
4				Apply	L3	PO1	Apply-L3	High- 3
5				Understand	L2	PO1 PO2 P06 PO7	Apply-L3 Analyse-L4 Analyse-L4 Apply-L3	Medium-2 Low-1 Low-1 Medium-2

CO1: Understand the operation of different circuit breakers and their specifications.
Action Verb: Understand-L2
CO1 Action verb level is less than PO1 Action by one therefore the correlation is Medium-2 CO1 Action verb level is less than PO2 Action by two therefore the correlation is Low-1 CO1 Action verb level is less than PO5 Action by one therefore the correlation is Medium-2
CO2: Analyze the concepts of different relays which are used in real time power system operation.
Action Verb: Analyse-L4
CO2 Action verb level is greater than PO1 Action by one therefore the correlation is High-3 CO2 Action verb level is greater than PO5 Action by one therefore the correlation is High-3
CO3: Apply various protective schemes for Transformers, Generators.
Action Verb: Apply-L3
CO3 Action verb level is equal to PO1 therefore the correlation is High-3 CO3 Action verb level is less than PO2 Action by one therefore the correlation is Medium-2
CO4: Apply different protective schemes for Bus bars and Feeders.
Action Verb: Apply-L3
CO4 Action verb level is equal to PO1 Action therefore the correlation is High-3
CO5:Understand the methods of protection against over voltages and importance of neutral grounding
Action Verb: Understand-L2
CO5 Action verb level is less than PO1 Action by one therefore the correlation is Medium-2 **CO5** Action verb level is less than PO2 Action by two therefore the correlation is Low-1 **CO5** Action verb level is less than PO6 Action by two therefore the correlation is Low-1 **CO5** Action verb level is less than PO7 Action by one therefore the correlation is Medium-2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 Regulations
COMMON TO EEE

Subject Code	Year & Sem	COMMUNICATION SYSTEMS (Professional Elective-III)	L	T/CLC	P	C
23APC0424	III-II		2	1	0	3

Course Outcomes: After completing the course, the student will be able to,

CO1: Understand the fundamentals of communication systems and amplitude modulation techniques.

CO2: Analyze the angle modulation techniques and bandwidth considerations in communication systems.

CO3: Apply the knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.

CO4: Analyze pulse modulation and digital modulation techniques used in modern communication systems.

CO5: Understand wireless communication systems, cellular networks, and GSM technology.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom s level
CO1	**Understand**	the fundamentals of communication systems and amplitude modulation techniques.			L2
CO2	**Analyze**	the angle modulation techniques and bandwidth considerations in communication systems			L2
CO3	**Apply**	the knowledge on pulse analog modulation and multiple access techniques used in digital communication systems			L3
CO4	**Analyze**	pulse modulation and digital modulation techniques used in modern communication systems			L4
CO5	**Understand**	wireless communication systems, cellula networks, and GSM technology.			L5

UNIT I :
Analog communication-I: Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation (AM), Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier (DSB- SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband (SSB) transmission, VSB Modulation.

UNIT II :
Analog communication-II : Angle Modulation & Demodulation: Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM), Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

UNIT III :
Digital communications-I (Qualitative Approach only): Pulse analog modulation techniques,

Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation
Multiple Access Techniques: Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications

UNIT IV:
Digital communications-II (Qualitative Approach only): Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.

UNIT V:
Wireless communications (Qualitative Approach only): Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile (GSM), GSM services and features.

TEXT BOOKS
H Taub, D. Schilling and Gautam Sahe, —Principles of Communication Systems‖, TMH, 2007, 3rd Edition.
George Kennedy and Bernard Davis, —Electronics & Communication System‖, 4th Edition, TMH 2009.
Wayne Tomasi, —Electronic Communication System: Fundamentals Through Advanced‖, 2nd edition, PHI,2001.

REFERENCE BOOKS
Simon Haykin, —Principles of Communication Systems‖, John Wiley, 2nd Edition.
Sham Shanmugam, —Digital and Analog communication Systems‖, Wiley-India edition,2006.
Theodore. S.Rapport, —Wireless Communications‖, Pearson Education, 2nd Edition,2002.

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	3
CO2	3	3										3	3
CO3	3	3	3									3	3
CO4	3	3										3	3
CO5	2	2										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 BTL (0-3)
1	CO1:Understand	L2	PO1 PO2	PO1:Apply(L3) PO2: Identify(L3)	2 2
2	CO2:Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Identify(L3)	3 3

3	**CO3:Apply**	L3	**PO1** **PO2** **PO3**	**PO1: Apply(L3)** **PO2:Identify(L3)** **PO3:Develop(L3)**	3 3 3
4	**CO4:Analyze**	L4	**PO1** **PO2**	**PO1: Apply(L3)** **PO2: Identify(L3)**	3 3
5	**CO5:Understand**	L2	**PO1** **PO2**	**PO1: Apply(L3)** **PO2: Identify(L3)**	2 2

CO1 : understand the fundamentals of communication systems and amplitude modulation 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: Identify (L3) CO2 Action verb is less than PO2 verb. Therefore, the correlation is moderate (2).

CO2: Analyze the angle modulation techniques and bandwidth considerations in communication systems.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3) CO2 Action verb is greater than PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Identify (L3) CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)

CO3: Apply the knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3) CO3 Action verb is equal to PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Identify (L3) CO3 Action verb is equal to PO2 verb. Therefore, the correlation is high(3).
PO3 Verb: Identify (L3) CO3 Action verb is equal to PO3 verb. Therefore, the correlation is high(3).

CO4:Analyze pulse modulation and digital modulation techniques used in modern communication systems.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3) CO4 Action verb is greater than PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Identify (L3) CO4 Action verb is greater than PO2 verb. Therefore, the correlation is high(3)

CO5: Understand wireless communication systems, cellular networks, and GSM technology.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3) CO5 Action verb is less than PO1 verb by one level; Therefore, the correlation is moderate (2).
PO2 Verb: Identify (L3) CO5 Action verb is less than PO2 verb. Therefore, the correlation is moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APE0206		ELECTRIC DRIVES	2	1	0	3

After completion of the course, students will be able to:	
CO1	Evaluate the characteristics and operational aspects of drives operating in different modes.
CO2	Analyze the operational aspects of various controlled rectifiers fed DC drives operating in different sustainable modes of operation.
CO3	Analyze the operational aspects of various controlled chopper fed DC drives operating in different sustainable modes of operation.
CO4	Analyze the operational aspects of various asynchronous motor drives operating in different sustainable modes of operation.
CO5	Analyze the operational aspects of synchronous motor and stepper motor drives operating in different sustainable modes of operation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	Characteristics and operational aspects of drives	Given specifications and modes of operation	Accuracy in evaluating types of drives in various conditions	L3
CO2	Analyze	Operational aspects of controlled rectifier-fed DC drives	Under different sustainable operating modes	Correct analysis of performance parameters and control technique	L3
CO3	Analyze	Operational aspects of chopper-fed DC drives	Under different sustainable operating modes	Identification of appropriate chopper techniques and effects	L3
CO4	Analyze	Operational aspects of asynchronous motor drives	In various sustainable modes	Evaluation based on efficiency and control methods	L3
CO5	Analyze	Operational aspects of synchronous and stepper motor drives	In different sustainable modes	Comparison of operational features under specified scenario	L3

SYLLABUS

UNIT-I

TITLE: Introduction To Electric Drives

Electrical drives — block diagram, advantages of electric drive, parts of electric drives, choice of electrical drives, the status of DC and AC drives. Dynamics of electrical drives-fundamental torque equations, speed-torque conventions, and multi-quadrant operation; Equivalent values of drive parameters - loads with rotational and translational motion; Load torques — components, nature and classification. Concept of steady-state stability. Electric braking methods — regenerative, dynamic and plugging. Modes of operation of electrical drives — steady state, acceleration including starting and deceleration including stopping. Speed control and drive classifications, closed-loop control of drives — current limit control, torque control, speed control and position control (Block diagram only).

UNIT-II

TITLE: Single-Phase and Three Phase Converter Fed DC Drives

Control of DC separately excited motor by single-phase and three-phase half and full bridged converters

— voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Single phase half-controlled rectifier fed DC series motor — voltage and current waveforms for continuous and discontinuous conduction, speed-torque expressions and characteristics. Multi-quadrant operation of DC separately excited DC motor fed from fully controlled rectifier - mechanical reversible switch in armature, dual converter and field current reversal.
UNIT-III
TITLE: DC Chopper Fed Drives
Control of DC separately excited motor by one, two and four quadrant choppers - voltage and current waveforms for continuous conduction (motoring, regenerative and dynamic braking), speed-torque expressions and characteristics. Chopper control of DC series motor—operation, speed-torque expressions and characteristics. Closed loop chopper control of separately excited DC motor (Block diagram only).
UNIT-IV
TITLE : Induction Motor Drives
Three phase induction motors — Introduction, Stator variable voltage control — speed-torque characteristics, AC voltage controllers and efficiency of induction motor under voltage control. Stator variable voltage and variable frequency control — slip speed control, torque-power limitations and modes of operation. Voltage Source Inverters (VSIs) and Current Source Inverters (CSIs) fed induction motor and closed loop operation of induction motor drives (Block diagram only).Comparison of VSI and CSI fed drives. Static rotor resistance control, slip power recovery schemes – static scherbius and kramer drive, speed-torque characteristics.
UNIT-V
TITLE: Synchronous and Stepper Motor Drives
Synchronous Motor Drives: Separate control and self-control of synchronous motors — operations of self-controlled synchronous motors by VSI and CSI. Load commutated CSI fed Synchronous motor—operation and speed torque characteristics. Closed loop control operation of synchronous motor drives (Block diagram only). Stepper Motor Drives: Variable reluctance and permanent magnet operation — features of stepper motor — torques Vs stepping rate characteristics and drive circuits. BLDC motor operation and control.

Text books:	
1	Gopal K. Dubey, Fundamentals of Electric Drives, Narosa Publications, Alpha Science International Ltd, 2 nd Edition, 2002.
2	M. H. Rashid (2003), Power Electronic Circuits, Devices and applications, 3rd edition, Prentice Hall of India, New Delhi, India.
3	Krishnan, Ramu. Electric motor drives: modeling, analysis, and control, 1st Edition, Pearson, 2015.
Reference books:	
1	M. D. Singh, K. B. Khanchandani (2008), Power Electronics, 2nd Edition, Tata McGraw Hill Publications, New Delhi.
2	VedamSubramanyam (2008), Thyristor Control of Electric drives, 1st Edition, Tata McGraw Hill Publications, and New Delhi, India.
3	S. K. Pillai (2007), A First course on Electrical Drives, 2nd Edition, New Age International (P) Ltd.,NewDelhi
4	P.C. Sen, Principles of Electrical Machines and Power Electronics, Wiley, 3rdEdition, 2013.
Web Resources:	
1	https://web.iitd.ac.in/~amitjain/Drives_VTR.pdf
2	https://sde.uoc.ac.in/sites/default/files/sde_videos/Electrical%20Drives%20and%20Controls_0.pdf
3	https://nptel.ac.in/courses/108/104/108104140/

4	https://nptel.ac.in/courses/108/102/108102046/
5	https://swayam.gov.in/nd1_noc19_ee65/preview

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

Mapping of Course outcomes with Program outcomes Justification Table

CO No.	CO					Program Outcomes (PO)	PO(s): Actionverb and BTL (for PO1 to PO5)	Level of correlation (1-3)
	Lesson Plan (Hrs.)	%	correlation	Verb	BTL			
1				Evaluate	L3	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design (L6)	3 2 3
2				Analyze	L3	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design (L6)	3 2 3
3				Analyze	**L3**	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design (L6)	3 2 3
4				Analyze	**L3**	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design (L6)	3 2 3
5				Analyze	**L3**	PO1, PO2, PO3	Apply(L3) Analyze(L4) Design (L6)	3 2 3

CO1: Evaluate the characteristics and operational aspects of drives operating in different modes.
Action Verb: Evaluate(L3)
PO1 Verb: Apply (L3)
CO1 Action verb level is equal to PO1 Therefore, correlation is High (3).
PO2 Verb: Analyze(L4)
CO1 Action verb level is more than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO3 Verb: Design(L6)
CO1 Action verb level is greater than PO3 verb by three level; Therefore, correlation is High (3).
CO2: Analyze the operational aspects of various controlled rectifiers fed DC drives operating in different sustainable modes of operation

Action Verb: Analyze(L3)
PO1 Verb: Apply (L3)
CO2 Action verb level is equal to PO1Therefore, correlation is High (3).
PO2 Verb: Analyze(L4)
CO2 Action verb level is more than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO3 Verb: Design (L6)
CO2 Action verb level is greater than PO3 verb by three level; Therefore, correlation is High (3).
CO3: Analyze the operational aspects of various controlled chopper fed DC drives operating in different sustainable modes of operation**.**
Action Verb: Analyze (L3)
PO1 Verb: Apply (L3)
CO3 Action verb level is equal to PO1 Therefore, correlation is High (3).
PO2 Verb: Analyze(L4)
CO3 Action verb level is more than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO3 Verb: Design (L6)
CO3 Action verb level is greater than PO3 verb by three level; Therefore, correlation is High (3).
CO4: Analyze the operational aspects of various asynchronous motor drives operating in different sustainable modes of operation.
Action Verb: Analyze (L3)
PO1 Verb: Apply (L3)
CO4 Action verb level is equal to PO1 Therefore, correlation is High (3).
PO2 Verb: Analyze(L4)
CO4 Action verb level is more than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO3 Verb: Design (L6)
CO4 Action verb level is greater than PO3 verb by three level; Therefore, correlation is High (3).
CO5: Analyze the operational aspects of synchronous motor and stepper motor drives operating in different sustainable modes of operation.
Action Verb: Analyze (L3)
PO1 Verb: Apply (L3)
CO5 Action verb level is equal to PO1 Therefore, correlation is High (3).
PO2 Verb: Analyze(L4)
CO5 Action verb level is more than PO1 verb by one level; Therefore, correlation is Moderate (2).
PO3 Verb: Design (L6)
CO5 Action verb level is greater than PO3 verb by three level; Therefore, correlation is High (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APE0207		RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES	2	1	0	3

After completion of the course, students will be able to:	
CO1	Analyze and apply the fundamentals of solar energy and its applications.
CO2	Understand the abstraction concept of electrical energy from wind, bio-mass and Tidal energy sources.
CO3	Understand electrical energy storage along with working of Green Energy
CO4	Design and evaluate distributed generation systems and their grid integration.
CO5	Analyze and evaluate the technical, economic, and control aspects of distributed generation systems

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Fundamentals Of Solar Energy			L4
CO2	Understand	Electrical energy from wind, bio-mass and tidal energy Sources.			L2
CO3	Understand	Electrical Energy Storage Along With Working Of Green Energy			L2
CO4	Design	Distributed Generation Systems And Their Grid integration			L5
CO5	Analyze	Control Aspects Of Distributed Generation Systems			L4

SYLLABUS

UNIT-I

TITLE: Energy Scenario and Solar Energy

Introduction: Fundamentals of renewable energy sources, Types of energy, Renewable and Non-renewable energy, SWOT analysis, Global warming and climate change, World energy transformation by 2050, Prospects of renewable energy in the world, Renewable energy availability in India.
Solar Energy Fundamentals: Solar Spectrum, propagation of solar radiation from the sun to earth; solar radiation geometry: sun-earth geometry, extra-terrestrial and terrestrial radiation.
Solar Thermal: Solar Collectors, Solar parabolic trough, Solar tower, Solar cooker, Solar water heater, Solar dryer, Solar Pond.
Solar Electric Power Generation: A Generic PV Cell, PV Materials, Equivalent Circuits for PV Cells, Modules and Arrays; I-V Curve under Standard Testing Conditions; Impact of Temperature and Insolation on I-V curves; Shading Impacts on I-V curves; Maximum Power Point Trackers (MPPT).

UNIT-II

TITLE: Wind and Other Energy Systems

Wind Energy: Air, Wind, Global and Local Wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Classification of wind energy conversion system (WECS)- Horizontal axis- single, double and multiblade system. Vertical axisSavonius and darrieus types.
Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft).
Tidal Power: fundamental characteristics of tidal power, harnessing tidal energy, advantages, and

limitations.

UNIT-III

TITLE: Energy Storage and Green Energy

Energy Storage: Stationary Battery Storage – Basics of Lead-Acid batteries, Battery Storage Capacity, Coulomb efficiency instead of energy efficiency, Battery Sizing. Different Battery storage technologies and comparison of their performance. Introduction to Super capacitors.
Green Energy: Historical Development, Basic Operation of a Fuel Cell, Fuel Cell Thermodynamics, Entropy and the theoretical efficiency of Fuel Cells, Gibbs Free Energy and Fuel Cell efficiency, Electrical output of an Ideal Cell, Electrical Characteristics of Real Fuel Cells, Types of Fuel Cells, H2: Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.

UNIT-IV

TITLE : Introduction to DG and its Grid Integration

Introduction: Need for Distributed generation, renewable sources in distributed generation, current scenario in Distributed Generation, and Planning of DGs – Siting and sizing of DGs – optimal placement of DG sources in distribution systems.
Grid integration of DGs: Different types of interfaces - Inverter based DGs and rotating machine-based interfaces - Aggregation of multiple DG units. Energy storage elements: Batteries, ultracapacitors, flywheels.

UNIT-V

TITLE: Technical Impact, Economic and Control aspects of DG

Technical impacts of DGs: Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems
Economic and control aspects of DGs: Market facts, issues, and challenges - Limitations of DGs. Voltage control techniques, Reactive power control, Harmonics, Power quality issues. Reliability of DG based systems – Steady-state and Dynamic analysis.

Text books:	
1	Muhammad Kamran, Muhammad Rayyan Fazal, "Renewable Energy Conversion Systems", First Edition, Elsevier Academic Press, 2021.
2	G. D. Rai, Non-Conventional Sources of Energy, Khanna Publisher, 2004
Reference books:	
1	1. G N Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
2	2. Mukund R Patel, Wind and Solar Power Systems: Design, Analysis, and Operation, 2nd Edition, Taylor & Francis, 2006.
3	3. H. Lee Willis, Walter G. Scott, —Distributed Power Generation – Planning and Evaluation‖, Marcel Decker Press, 2000.
4	4. Gilbert M. Masters, —Renewable and Efficient Electric Power Systems‖, 2nd Edn., IEEE Press, Wiley, 2013.
5	5. N. Jenkins, J.B. Ekanayake and G. Strbac, —Distributed Generation‖, 1st Edn, The Institution of Engineering and Technology, London, 2010.
Web Resources:	
1	https://archive.nptel.ac.in/courses/121/106/121106014/#
2	https://onlinecourses.nptel.ac.in/noc22_ch27/preview
3	https://www.nptelvideos.com/lecture.php?id=8517

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

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				2	3							
CO2	2	2				2							
CO3	2	2				2							
CO4	3		3		3								
CO5	3	3				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				Analyze	L4	PO1, PO5, PO6	Apply(L3) Apply(L3) Thumb Rule	3 3 3
2				Understand	L2	PO1, PO2, PO6	Apply(L3) Identify(L3) Thumb Rule	2 2 2
3				Understand	L2	PO1, PO2, PO6	Apply(L3) Identify(L3) Thumb Rule	2 2 2
4				Design	L5	PO1, PO3, PO5	Apply(L3) Design(L5) Apply(L3)	3 3 3
5				Analyze	L4	PO1, PO2, PO6	Apply(L3) Identify(L3) Thumb Rule	3 3 3

CO1: Analyze and apply the fundamentals of solar energy and its applications.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply (L3)
CO1 Action Verb is Greater than PO5 verb by one level; Therefore correlation is high (3).
Based on students participate in CLC activities. From this: CO1 level is 4, Using Thumb Rule its PO6 correlation is High (3).
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is Less than PO1 verb by one level; Therefore correlation is Moderate (2).
PO2: Identify (L3)
CO2 Action Verb is Less than PO2 verb by one level; Therefore correlation is Moderate (2).

Based on students participate in CLC activities. From this: CO2 level is 2, Using Thumb Rule its PO6 correlation is moderate (2).
CO3: Understand electrical energy storage along with working of Green Energy
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action Verb is Less than PO1 verb by one level; Therefore correlation is Moderate (2).
PO2: Identify (L3)
CO3 Action Verb is Less than PO2 verb by one level; Therefore correlation is Moderate (2).
Based on students participate in CLC activities. From this: CO3 level is 2, Using Thumb Rule its PO6 correlation is moderate (2).
CO4: Design and evaluate distributed generation systems and their grid integration.
Action Verb: Design (L5)
PO1: Apply (L3)
CO4 Action Verb is greater than PO1 verb by two level; Therefore correlation is high (3).
PO3: Design (L5)
CO4 Action Verb is equal to PO3 ; Therefore correlation is high (3).
PO5: Apply (L3)
CO4 Action Verb is greater than PO5 verb by two level; Therefore correlation is high (3).
CO5: Analyze and evaluate the technical, economic, and control aspects of distributed Generation systems
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is High (3).
PO2: Identify (L3)
CO5 Action Verb is Greater than PO2 verb by one level; Therefore correlation is High (3).
Based on students participate in CLC activities. From this: CO5 level is 4, Using Thumb Rule its PO6 correlation is high (3).

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

Course Code	Year & Sem	INTRODUCTION TO MACHINE LEARNING (Open Elective-II)	L	T / CLC	P	C
23AOE0505	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(*k*NN), 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.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	8	19%	2	Understand	L2	PO1 PO2 PO3 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO5: Apply(L3)	2 3 2 2
2	8	19%	2	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 3
3	9	21%	3	Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO7 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6) PO4: Design (L6) PO5: Create(L6) PO7: Thumb rule PO11: Thumb rule	3 3 2 2 2 3 3
4	9	21%	3	Apply	L3	PO1 PO2 PO3 PO4 PO5 PO6	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule	3 3 3 2 3 2
5	9	21%	3	Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze(L4) PO5: Apply(L3) PO8: Thumb rule PO11: Thumb rule	3 3 3 3 3 3 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)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23APC0220		ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB	0	0	3	1.5

After completion of the course, students will be able to:	
CO1	Evaluate the unknown Resistance, Inductance and Capacitance using AC and DC bridges.
CO2	Understand the method of calibration of single-phase energy meter.
CO3	Measure the power, power factor in a single-phase circuit and real, reactive Power in a three-phase circuit.
CO4	Analyze the methods of extension of range of Ammeter and Voltmeter.
CO5	Analyze the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	the unknown Resistance, Inductance and Capacitance	using AC and DC bridges		L5
CO2	Understand	the method of calibration of single-phase energy meter			L2
CO3	Measure	the power, power factor in a single-phase circuit and real, reactive Power in a three-phase circuit			L5
CO4	Analyze	the Extend the range of Ammeter and Voltmeter			L4
CO5	Analyze	the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors			L4

List of Experiments		
CHOOSE ANY TEN FROM THE FOLLOWING LIST:		
Sl. No	**Name of the Experiment**	**CO**
1.	Measurement of resistance using Wheatstone bridge and Kelvin's Double Bridge.	CO1
2.	Measurement of inductance using Maxwell's bridge, Anderson bridge.	CO1
3.	Measurement of capacitance using De-Sauty's bridge, Schering bridge.	CO1
4.	Calibration of single-phase energy meter using direct loading method.	CO2
5.	Calibration of energy meter using Phantom load kit	CO2
6.	Measurement of Power using 3-Voltmeter and 3-Ammeter methods in a single-phase Circuit	CO3
7.	Measurement to Real and Reactive Power in a three-phase circuit.	CO3

8.	Extension of range of given Ammeter and Voltmeter.	CO4
9.	Measurement of displacement using LVDT.	CO5
10.	Study of CRO: Measurement of voltage, current, frequency using lissajous patterns.	CO5
11.	Measurement of different ranges of temperatures using i)RTD ii)Thermocouple	CO5
12.	Measurement of strain with the help of strain gauge transducers	CO5

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

CO No.	CO		Program Outcomes(PO)	PO(s): Actionverb and BTL(for PO1 to PO5)	Level of correlation (1-3)
	Verb	BTL			
1	Evaluate	L5	PO3 PO4 PO5	Design: L6 Analyze: L4 Apply: L3	2 3 3
2	Understand	L2	PO4 PO5	Analyze L4 Apply: L3	1 2
3	Measure	L5	PO1 PO3 PO4	Apply: L3 Design: L6 Analyze: L4	3 2 3
4	Analyze	L4	PO1 PO4 PO5	Apply: L3 Analyze: L4 Apply: L3	3 3 3
5	Analyze	L4	PO1 PO3 PO4	Apply: L3 Design: L6 Analyze: L4	3 1 3

CO1: Evaluate the unknown Resistance, Inductance and Capacitance using AC and DC bridges

Action Verb: Evaluate: L5

PO3: Design L6

The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is Moderate, level 1.

PO4: Analyze L4

The BTL of CO action verb is higher than BTL of PO action verb by 1. Therefore, the correlation is high, level 3.

PO5: Apply L3

The BTL of CO action verb is higher than BTL of PO action verb by 2. Therefore, the correlation is high, level 3.

CO2: Understand the method of calibration of single-phase energy meter.

Action Verb: Understand: L2
PO4: Analyze L4 The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1. **PO5: Apply L3** The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is Moderate, level 3.
CO3: Measure the power, power factor in a single-phase circuit and real, reactive Power in a three-phase circuit
Action Verb: Measure L5
PO1: Apply L3 The BTL of CO action verb is higher than BTL of PO action verb by 2. Therefore, the correlation is high, level 3. **PO3: Design L6** The BTL of CO action verb is lesser than BTL of PO action verb by 1. Therefore, the correlation is Moderate, level 2. **PO4: Analyze L4** The BTL of CO action verb is higher than BTL of PO action verb by 1. Therefore, the correlation is high, level 3.
CO4: Analyze the methods of extension of range of Ammeter and Voltmeter
Action Verb: Analyze L4
PO1: Apply L3 The BTL of CO action verb is higher than BTL of PO action verb by 1. Therefore, the correlation is high, level 3. **PO4: Analyze L4** The BTL of CO action verb is equal to BTL of PO action verb by 1. Therefore, the correlation is high, level 3. **PO5: Apply L3** The BTL of CO action verb is higher than BTL of PO action verb by 1. Therefore, the correlation is high, level 3.
CO5: Analyze the working of Transducers, Measure distance, temperature, current, voltage and humidity using sensors.
Action Verb: Analyze L4
PO1: Apply L3 The BTL of CO action verb is higher than BTL of PO action verb by 1. Therefore, the correlation is high, level 3. **PO3: Design L6** The BTL of CO action verb is lesser than BTL of PO action verb by 2. Therefore, the correlation is low, level 1. **PO4: Analyze L4** The BTL of CO action verb is equal to BTL of PO action verb by 1. Therefore, the correlation is high, level 3.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS
COMMON TO EEE

Course Code	Year & Sem		L	T/CLC	P	C
23APC0414	III-II	MICROPROCESSORS AND MICROCONTROLLERS LAB	0	0	3	1.5

Course Outcomes:

CO1: Develop various 16-bit arithmetic operations and bit-level manipulations using 8086 and 8051

CO2: Develop Array and string handling programs using 8086 processor

CO3: Design real-time applications by interfacing stepper motors, ADC/DAC modules using 8086.

CO4: Apply Timer/Counter operations in 8051 microcontroller to perform Timer controlled applications.

CO5: Develop Serial communication and display interfacing programs with 8051.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Develop	various 16-bit arithmetic operations and bit-level manipulations	using 8086 and 8051		L3
CO2	Develop	array and string handling programs	using 8086 processor		L3
CO3	Design	real-time applications by interfacing stepper motors, ADC/DAC modules	using 8086.		L6
CO4	Apply	Timer/Counter operations in 8051 microcontroller		to perform Timer controlled applications	L3
CO5	Develop	Serial communication and display interfacing programs	with 8051		L3

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Programs for 16 Bit Arithmetic Operations** (Using various addressing modes) **(CO1)**
   a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   c) Write an ALP to find square, cube and factorial of a given number.
2. **Programs Involving Bit Manipulation Instructions (CO1)**
   a) Write an ALP to find the given data is positive or negative.
   b) Write an ALP to find the given data is odd or even.
   c) Write an ALP to find Logical ones and zeros in a given data.
3. **Programs on Arrays for 8086 (CO2)**
   a) Write an ALP to find Addition/subtraction of N no_s.
   b) Write an ALP for finding largest/smallest no.
   c) Write an ALP to sort given array in Ascending/descending order.
4. **Programs on String Manipulations for 8086 (CO2)**
   a) Write an ALP to find String length.
   b) Write an ALP for Displaying the given String.
   c) Write an ALP for Comparing two Strings.
   d) Write an ALP to reverse String and Checking for palindrome.
5. **Programs for Digital Clock Design Using 8086 (CO4)**
   a) Write an ALP for Designing clock using INT 21H Interrupt.
   b) Write an ALP for Designing clock using DOS Interrupt Functions.
   c) Write an ALP for Designing clock by reading system time.

6. **Interfacing Stepper Motor with 8086 (CO3)**
   a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
   b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.
7. **Interfacing ADC/DAC with 8086 (CO3)**
   a) Write an ALP to 8086 processor to Interface ADC.
   b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Step signal.
8. **Communication between Two Microprocessors (CO5)**
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251.
9. **Programs using Arithmetic and Logical Instructions for 8051 (CO1)**
   a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
   b) Multiplication and Division.
   c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
   d) Programs related to Register Banks.
10. **Programs to Verify Timers/Counters of 8051 (CO4)**
   a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
   b) Write a program to create a delay of 50 μsec using Timer1 in mode 0 and blink all the Pins of P2.
   c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
   d) Write a program to create a delay of 80 μsec using counter1 in mode 1 and blink all the Pins of P3.
11. **UART Operation in 8051 (CO5)**
   a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
   b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
   c) Write a program to transfer a character serially with a baud rate of 2400 using UART.
12. **Interfacing LCD with 8051 (CO3)**
   a) Develop and execute the program to interface16*2 LCD to 8051.
   b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

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

Correlation matrix

	CO					Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
Expt. No.	Lesson Plan (Hrs)	%	Correlation	Action Verb	BTL			
1,2,9	3	6%		Develop	L3	PO1, PO2, PO3	PO1: Apply (L3) PO2:Identify(L3) PO3: Develop (L3)	3 3 3

3,4	**18**	33%	**3**	**Develop**	**L3**	PO1,PO3, PO4	PO1: Apply (L3) PO3: Develop (L3) O4:Analyze(L4)	**3** **3** **2**
6,7,12	**6**	**11%**	**1**	**Design**	**L6**	PO1,PO2,PO3, PO4,PO5	PO1: Apply (L3) PO2:Identify(L3) PO3: Develop (L3) PO4:Interpret(L2) PO5:Apply(L3)	**3** **3** **3** **3** **3**
5,10	**9**	**17%**	**2**	**Apply**	**L3**	PO1,PO2,PO3, PO4,	PO1: Apply (L3) PO2:Identify(L3) PO3: Develop (L3) PO4:Analyze(L4)	**3** **3** **3** **2**
8,11	**18**	**33%**	**3**	**Develop**	**L3**	PO1,PO3, PO4,PO5	PO1: Apply (L3) PO3: Develop (L3) PO4:Analyze(L4) PO5:Apply(L3)	**3** **3** **2** **3**
	54	**100%**						

Justification Statements:

CO1: Develop various 16-bit arithmetic operations and bit-level manipulations using 8086 and 8051

Action Verb: Develop(L3)

PO1 Verb: Apply (L3) CO1 Action Verb isequal to PO1 verb. Therefore, the correlation is high(3).
PO2 Verb: Identify (L3) CO1 Action Verb is equal to PO2 verb. Therefore, the correlation is high(3).
PO3 Verb: Develop (L3) CO1 Action Verb is equal to PO3 verb. Therefore, the correlation is high(3).

CO2: Develop and execute array and string handling programs using 8086 processor

Action Verb: Develop (L3)

PO1 Verb: Apply (L3) CO2Action Verb is equal to PO1 verb. Therefore, the correlation is high(3).
PO3 Verb: Develop (L3) CO2 Action Verb is equal to PO3 verb. Therefore, the correlation is high (3).
PO4 Verb: Analyze(L4) CO2 Action Verb is greater than PO4 verb. Therefore, the correlation is high(2).

CO3: Design and implement real-time applications by interfacing stepper motors, ADC/DAC modules using 8086.

Action Verb: Design (L6)

PO1 Verb: Apply (L3) CO3 Action Verb is greater than PO1 verb. Therefore, the correlation is high(3).
PO2 Verb: Identify(L3) CO3 Action Verb is greater than PO2 verb. Therefore, the correlation is high(3).
PO3 Verb: Develop (L3) CO3 Action Verb is greater than PO3 verb. Therefore, the correlation is high (3).
PO4 Verb: Interpret (L2) CO3 Action Verb is greater than PO4 verb. Therefore, the correlation is high(3).
PO5Verb: Apply(L3) CO3 Action Verb is greater than PO5verb.Therefore, the correlation is high (3).

CO4:Apply Timer/Counter instructions in 8051 microcontroller to perform Timer controlled applications.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3) CO4 Action Verb is equal to PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Identify(L3) CO4Action Verb is equal to PO2 verb. Therefore, the correlation is high (3).
PO3 Verb: Develop (L3) CO4 Action Verb is equal to PO3 verb. Therefore, the correlation is high (3).
PO4 Verb: Analyze(L4) CO4 Action Verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2).

CO5: Develop Serial communication and display interfacing programs with 8051 to implement basic embedded output systems.

Action Verb: Develop (L3)

PO1 Verb: Apply (L3) CO5 Action Verb is equal to PO1 verb. Therefore, the correlation is high(3).
PO3 Verb: Develop (L3) CO5 Action Verb is equal to PO3 verb. Therefore, the correlation is high (3).
PO4 Verb: Analyze(L4) CO5 Action Verb is less than PO4 verb. Therefore, the correlation is moderate (2).
PO5Verb: Apply(L3) CO5 Action Verb is equal to PO5verb.Therefore, the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Year/Sem	III/II	Branch of Study: EEE				
SubjectCode		Subject Name	L	T/CLC	P	Credits
23ASE0201		APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL ENGINEERING	0	1	2	2

After completion of the course, students will be able to:	
CO1	Analyze the transient behavior of electrical networks and design stable power systems.
CO2	Design and simulate power electronic converters, including DC-DC converters and inverters.
CO3	Evaluate the performance of power systems under various operating conditions, including faults and stability analysis.
CO4	Apply control techniques, including PI controllers, to improve the performance of power electronic converters and power systems.
CO5	Develop and implement advanced power system monitoring and control systems, including virtual PMUs and wide-area control systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Transient analysis, power system stability			L4
CO2	Design	Power electronic converters, simulation tools			L5
CO3	Evaluate	Power system analysis, fault studies, stability analysis			L5
CO4	Apply	Control techniques, PI controllers			L3
CO5	Develop	Advanced power system monitoring and control, virtual PMUs, wide-area control			L3

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of Simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

List of Experiments

CHOOSE ANY TEN FROM THE FOLLOWING LIST:

Sl. No	Name of the Experiment	CO
1.	Transient analysis of given electrical network	CO1
2.	Simulation of 1-phase and 3-phase transformers	CO1
3.	Study of the dynamics of second order system	CO1
4.	Implementation of buck and boost dc-dc converters	CO2
5.	Study on the design of PI controllers and stability analysis for a DC-DC buck Converter	CO4
6.	Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters	CO2
7.	Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method	CO5
8.	Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)	CO3
9.	Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)	CO3
10.	Fault studies using Zbus matrix	CO3
11.	Design of virtual PMU	CO5
12.	Wide area control of Two area Kundur system	CO5

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Web Resources:	
1	http://vem-iitg.vlabs.ac.in/
2	https://vp-dei.vlabs.ac.in/Dreamweaver/

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

CO No.	CO		Program Outcomes(PO)	PO(s): Actionverb and BTL(for PO1 to PO5)	Level of correlation (1-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO2, PO3	Apply(L3) Identify(L3) Design(L5)	3 3 2
2	Design	L5	PO1, PO3, PO5	Apply(L3) Design(L5) Apply(L3)	3 3 3
3	Evaluate	L5	PO1, PO2, PO4	Apply(L3) Identify(L3) Analyze(L4)	3 3 3
4	Apply	L3	PO1, PO3, PO5	Apply(L3) Design(L5) Apply(L3)	3 1 3
5	Develop	L3	PO1, PO3, PO5	Apply(L3) Design(L5) Apply(L3)	3 3 3

CO1: Analyze the transient behavior of electrical networks and design stable power systems.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is Greater than PO1 verb by one level; Therefore correlation is High (3).
PO2: Identify (L3)
CO1 Action Verb is Greater than PO2 verb by one level; Therefore correlation is High (3).
PO3: Design (L5)
CO1 Action Verb is less than PO3 verb by one levels; therefore correlation is moderate (2).
CO2: Design and simulate power electronic converters, including DC-DC converters and inverters.
Action Verb: Design (L5) PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by two level; Therefore correlation is High (3).
PO3: Design (L5)
CO1 Action Verb is equal to PO3 verb; Therefore correlation is High (3).
PO5: Apply (L3)
CO2 Action Verb is Greater than PO2 verb by one level; Therefore correlation is High (3).

CO3: Evaluate the performance of power systems under various operating conditions, including faults and stability analysis.
Action Verb: Evaluate (L6) PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by three level; Therefore correlation is High (3).
PO2: Identify (L3)
CO3 Action Verb is Greater than PO2 verb by three level; Therefore correlation is High (3).
PO4: Analyze (L4)
CO3 Action Verb is Greater than PO2 verb by two level; Therefore correlation is High (3).
CO4: Apply control techniques, including PI controllers, to improve the performance of power electronic converters and power systems.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action Verb is equal to PO1; Therefore correlation is High (3).
PO3: Design (L5)
CO4 Action Verb is less than PO3 verb by two levels; therefore correlation is low (1).
PO5: Apply (L3)
CO4 Action Verb is equal to PO5; Therefore correlation is High (3).
CO5: Develop and implement advanced power system monitoring and control systems,
Including virtual PMUs and wide-area control systems.
Action Verb: Develop (L3)
PO1: Apply (L3)
CO5 Action Verb is equal to PO1; Therefore correlation is High (3).
PO3: Design (L5)
CO5 Action Verb is less than PO3 verb by two levels; therefore correlation is low (1).
PO5: Apply (L3)
CO5 Action Verb is equal to PO1; Therefore correlation is High (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

(Autonomous)

(Effective for the batches admitted from 2023-24)

Year: III B.Tech **(Common to all branches)** Semester: II

Subject Code 23AMC9902	**TECHNICAL PAPER WRITING AND INTELLECTUAL PROPERTY RIGHTS (Audit Course)**	L T/CLC 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 internatio nal 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.* Oxford.

Reference Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, *Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan, *Intellectual Property Law*, 3rd Ed, Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers* Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources

1. **https://theconceptwriters.com.pk/principles-of-technical-writing/**
2. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.h tml**
3. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.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	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	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
2							Analyze	3
3							Thumb Rule	2
4							Thumb Rule	3
5							Thumb Rule	2

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)
PO2 : Verb: Analyze
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).