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

AK23 - REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./ Branch and Innovations

B.Tech. –I Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/C LC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical & Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
Total				9	4	15	20.5	320	630	950

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

AK23-REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– I Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credit s	CI E	SEE	Total
				L	T/CL C	P	C			
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basics of Civil & Mechanical Engineering	2	1	0	3	30	70	100
5	PC	23APC0203	Network Analysis	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0204	Network Analysis and Simulation Laboratory	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and Wellness, Yoga and Sports	0	0	1	0.5	50	-	50
Total				10	4	11	19.5	320	630	950

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

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B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.–II Year I Semester

S. No.	Category	Course code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CL C	P	C			
1	BS	23ABS9912	Probability and Complex Variables	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	ES	23AES0401	Signals, Systems and Stochastic Processes	2	1	0	3	30	70	100
4	PC	23APC0401	Electronic Devices and Circuits	2	1	0	3	30	70	100
5	PC	23APC0402	Digital Circuit Design	2	1	0	3	30	70	100
6	PC	23APC0403	Electronic Devices and Circuits Lab	0	0	3	1.5	30	70	100
7	PC	23APC0404	Digital Circuits and Signal Simulation Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
Total				10	6	8	20	240	560	800

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

AK23-REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– II Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	ES	23AES0203	Linear Control Systems	2	1	0	3	30	70	100
3	PC	23APC0405	EM Waves and Transmission Lines	2	1	0	3	30	70	100
4	PC	23APC0406	Electronic Circuits Analysis	2	1	0	3	30	70	100
5	PC	23APC0407	Analog and Digital Communications	2	1	0	3	30	70	100
6	PC	23APC0408	Electronic Circuits Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0409	Analog and Digital Communications Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	Soft Skills Lab	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking & Innovation	1	0	2	2	30	70	100
10	Audit Course	23AMC9901	Environmental Science	2	0	0	0	30	-	30
			Total	13	5	10	21	300	630	930
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation										

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

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B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– III Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PC	23APC0410	Analog and Digital IC Applications	2	1	0	3	30	70	100
2	PC	23APC0411	Antennas & Wave Propagation	2	1	0	3	30	70	100
3	PC	23APC0412	Microprocessors and Microcontrollers	2	1	0	3	30	70	100
4	ES	23AES0504	Introduction to Quantum Technology and Applications	2	1	0	3	30	70	100
4	PE	23APE0401	**Professional Elective-I** Computer Architecture & Organization	2	1	0	3	30	70	100
		23APE0402	Information theory and coding							
		23APE0403	Detection and Estimation Theory							
	OE		***Open Elective-I**	2	1	0	3	25	75	100
6	PC	23APC0413	Analog & Digital IC Applications Lab	0	0	3	1.5	30	70	100
7	PC	23APC0414	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0401	**Skill oriented course -III** PCB Design and Prototype development.	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	PR	23APR0401	Community Service Project	-	-	-	2	100	-	100
			Total	12	7	10	26	395	705	1100

Open Elective – I

S.No.	CourseCode	CourseName	Offeredbythe Dept.
1	23AOE0101	Green Buildings	CIVIL
2	23AOE0102	Construction Technology and Management	
3	23AOE0201	Electrical Safety Practices and Standards	EEE
4	23AOE0301	Sustainable Energy Technologies	ME
5	23AOE0501	Java Programming	CSE&Allied/IT
6	23AOE0502	Introduction to Artificial Intelligence	
7	23AOE0503	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	23AOEMB01	Entrepreneurship and New Venture Creation	MBA

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B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– III Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PC	23APC0415	Digital Signal Processing	2	1	0	3	30	70	100
2	PC	23APC0416	Microwave and Optical Communications	2	1	0	3	30	70	100
3	PC	23APC0417	VLSI Design	2	1	0	3	30	70	100
4	PE		**Professional Elective-II**	2	1	0	3	30	70	100
		23APE0405	Electronic Measurements and Instrumentation							
		23APE0406	Embedded systems & IOT							
		23APE0407	Speech Processing							
5	PE		**Professional Elective-III**	2	1	0	3	30	70	100
		23APE0408	Digital Image Processing							
		23APE0409	Artificial Intelligence & Machine learning							
		23APE0410	Satellite Communications							
6	OE		***Open Elective-II**	2	1	0	3	25	75	100
7	PC	23APC0418	Microwave and Optical Communications Lab	0	0	3	1.5	30	70	100
8	PC	23APC0419	VLSI Design Lab	0	0	3	1.5	30	70	100
9	SC	23ASC0402	**Skill oriented course -IV** Machine Learning and DSP	0	1	2	2	30	70	100
10	AMC	23AMC9902	Technical Paper Writing & IPR	2	0	0	0	30	-	-
11	SC	23ASC0403	Workshop	-	-	-	-	-	-	-
			Total	14	7	8	23	295	635	930
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	23AOE0202	Renewable Energy Sources	EEE
4	23AOE0302	Automation and Robotics	ME
5	23AOE0504	Operating Systems	CSE& Allied/IT
6	23AOE0505	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

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B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– IV Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PC	23APC0420	Data Communications and Networking	2	1	0	3	30	70	100
2	PE	23AHMMB05 23AHMMB04 23AHMMB06	**Management Course-II** Entrepreneur ship and Incubation Management Science Human Resource Management	2	0	0	2	30	70	100
4	PE	23APE0411 23APE0412 23APE0413	**Professional Elective-IV** Radar Engineering DSP Processors & Architectures Cellular & Mobile Communications	2	1	0	3	30	70	100
5	PE	23APE0414 23APE0415 23APE0416	**Professional Elective-V** Low Power VLSI Design Wireless Sensor Networks 5G Communications	2	1	0	3	30	70	100
6	OE		***Open Elective-III**	2	1	0	3	30	70	100
7	OE		***Open Elective-IV**	2	1	0	3	30	70	100
8	SC	23ASC0404 23ASC0405	**Skill oriented course - V** RF System Design tools Industrial IOT & Automation	0	1	2	2	30	70	100
9	AMC	23AMC9903	**Audit Course** Gender Sensitization	2	0	0	-	30	-	30
10	PR	23APR0402	Industry Internship (Short Term)	0	-	-	2	100	-	100
			Total	14	6	2	21	340	490	830

***Open Elective – III**

S.No	Course Code	Course Name	Offered by the Dept.
1	23AOE0105	Building Materials and Services	CIVIL
2	23APE0103	Environmental Impact Assessment	
3	23AOE0203	Smart Grid Technologies	EEE
4	23AOE0303	3D Printing Technologies	ME
5	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	23AOE0204	Electric Vehicles	EEE
4	23AOE0304	Total Quality Management	ME
5	23AOE0508	Computer Networks	CSE & Allied/IT
6	23AOE0509	Internet of Things	
7	23AOE0510	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

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

AK23-REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– IV Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PR	23APR0403	Industry Internship (Long Term)	-	-	-	4	100	-	100
2	PR	23APR0404	Project	-	-	-	8	60	140	200
Total				0	0	0	12	160	140	300

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

LIST OF COURSES FOR HONOURS in B.Tech -ECE

Note: Students must choose courses from the list (S. No. 1 to 10) and earn a minimum of 15 credits, based on availability on the SWAYAM-NPTEL portal. Additionally, they must earn 3 compulsory credits from the courses listed under S. No. 11 and 12. A total of 18 credits are required to obtain an Honours degree in B.Tech -E.C.E.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	23AHN0401	Automotive Electronics	12 Weeks	3
2	23AHN0402	Optimization Theory and Algorithms	12 Weeks	3
3	23AHN0403	Probability Foundations for Electrical Engineers	12 Weeks	3
4	23AHN0404	Micro Electromechanical Systems	12 Weeks	3
5	23AHN0405	VLSI Testing and Testability	12 Weeks	3
6	23AHN0406	Scripting Languages	12 Weeks	3
7	23AHN0407	Artificial Neural networks	12 Weeks	3
8	23AHN0408	System on Chip Architecture	12 Weeks	3
9	23AHN0409	Machine learning	12 Weeks	3
10	23AHN0410	Data Analysis	12 Weeks	3
11	23AHN0411	Analog and Digital IC Design Laboratory		1.5
12	23AHN0412	Physical Design Automation Laboratory		1.5
		TOTAL		18

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MINOR DEGREE IN VLSI Design FOR CSE, AIDS, AIML, CE & ME

Note: Students of CSE, AIDS, AIML, CE, and ME programs to get a **Minor in VLSI Design** must complete SWAYAM-NPTEL courses listed below (S. No. 1 to 9) and obtain a total of 15 credits. In addition, students must complete a **Minor Discipline Project in VLSI Design**, which carries 3 credits. Altogether, a total of **18 credits** is required to obtain the Minor in VLSI Design.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	23AMN0401	Semiconductor Devices and Circuits	12 Weeks	3
2	23AMN0402	Analog Electronic Circuits	12 Weeks	3
3	23AMN0403	Cryogenic Electronics for Quantum Computing	12 Weeks	3
4	23AMN0404	Micro Sensors and Nano Sensors	12 Weeks	3
5	23AMN0405	RFIC Design	12 Weeks	3
6	23AMN0406	System Design through Verilog	12 Weeks	3
7	23AMN0407	VLSI Interconnects	12 Weeks	3
8	23AMN0408	Low Voltage CMOS Circuit Operation	12 Weeks	3
9	23AMN0409	Analog VLSI Design	12 Weeks	3
10	23AMN0410	MINOR DISCIPLINE PROJECT IN VLSI Design (COMPULSORY)	-	3
		TOTAL		18

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MINOR DEGREE IN Communication and Signal Processing FOR CSE, AIDS, AIML, CE & ME

Note: Students of CSE, AIDS, AIML, CE, and ME programs to get a **Minor in Communication and Signal Processing** must complete SWAYAM-NPTEL courses listed below (S. No. 1 to 9) and obtain a total of 15 credits. In addition, students must complete a **Minor Discipline Project in Communication and Signal Processing**, which carries 3 credits. Altogether, a total of **18 credits** are required to obtain the Minor in Communication and Signal Processing.

S.NO	SUB.CODE	COURSE NAME	WEEKS	CREDITS
1	23AMN0411	Principles Digital Communications	12 Weeks	3
2	23AMN0412	Mathematical methods and Techniques in Signal Processing	12 Weeks	3
3	23AMN0413	Neural Networks for Signal Processing-1	12 Weeks	3
4	23AMN0414	Signal Processing for mm wave communication for 5G and beyond	12 Weeks	3
5	23AMN0415	5G Wireless Standard Design	12 Weeks	3
6	23AMN0416	Simulation of Communication Systems using MATLAB	12 Weeks	3
7	23AMN0417	Signal Processing Algorithms and Architectures	12 Weeks	3
8	23AMN0418	Digital Speech Processing	12 Weeks	3
9	23AMN0419	Spread Spectrum Communications and Jamming	12 Weeks	3
10	23AMN0420	MINOR DISCIPLINE PROJECT IN Communication and Signal Processing (COMPULSORY)	-	3
		TOTAL		18

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

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B.Tech. –I Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	BS	23ABS9903	Engineering Physics	2	1	0	3	30	70	100
2	BS	23ABS9904	Linear Algebra and Calculus	2	1	0	3	30	70	100
3	ES	23AES0201	Basic Electrical & Electronics Engineering	2	1	0	3	30	70	100
4	ES	23AES0301	Engineering Graphics	1	0	4	3	30	70	100
5	ES	23AES0501	Introduction to Programming	2	1	0	3	30	70	100
6	ES	23AES0503	IT Workshop	0	0	2	1	30	70	100
7	BS	23ABS9908	Engineering Physics Lab	0	0	2	1	30	70	100
8	ES	23AES0202	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
9	ES	23AES0502	Computer Programming Lab	0	0	3	1.5	30	70	100
10	HM	23AHM9904	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5	50	-	50
Total				9	4	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 nano materials 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 effectand its applications – Applications of semiconductors.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G. Kshirsagar & TVS ArunMurthy, 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	PSO 1	PSO 2
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).

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Year-Sem: I-I

Subject Code	Subject Name	L	T/C	L C	P	Credits
23ABS9904	Linear Algebra and Calculus	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. Analyze the mean value theorems for real time applications.
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	Bloom s level
1	Analyze	the matrix algebraic techniques	for engineering applications.		**L4**
2	Understand	the concept of eigen values, eigen vectors and quadratic forms.	-		**L2**
3	Analyze	the mean value theorems	for real time applications.		**L4**
4	Apply	the concept of Maxima and Minima	to functions of several variables.		**L3**
5	Apply	the multivariable integral calculus	for computation of Area and volume.		**L3**

Unit I: Matrices **12hrs**

Rank of a matrix by Echelon form, Normal form, Cauchy-Binet formula (without proof).Inverse of Non-singular matrices by Gauss-Jordan method, system of linear equations: solving system of Homogeneous and Non- homogeneous equations by Gauss Elimination method, Jacobi and Gauss Seidel Iteration methods.

Unit II: Eigen values, Eigen vectors and Orthogonal Transformation **9hrs**

Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton theorem (without proof),finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and Nature of the Quadratic forms, Reduction of quadratic form to canonical forms by Orthogonal Transformation.

Unit III: Calculus **9hrs**

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

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

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

Unit V: Multiple Integrals **10hrs**

Double integrals, triple integrals change of order of integration, change of Variables to polar, Cylindrical and Spherical coordinates, Finding areas(by double integrals) and volumes (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, Pearson publishers, 2018, 5 th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, ,Pearson publishers, 9 th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
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

Justification Statements

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).

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Year-Sem	I-I	Branch of Study: Common to all Branches				
Subject Code		**Subject Name**	**L**	**T**	**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

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.

2 Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference books:

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

2 Principles of Power Systems, V.K. 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

Online learning resourses:

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

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

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

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

References:

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

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

Subject Code	Subject Name	L	T	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: Poly hedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to

vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Unit IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Unit V

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

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using AutoCAD (*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 McGrawHill,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	PO 4	PO5	PO6	PO7	PO8	PO 9	PO10	PO1 1	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)
PO1Verb:**Apply(L3)**

CO1 Action verbissamelevelasPO1 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) PO10Verb: 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)

ELECTRONICS AND COMMUNICATION ENGINEERING

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

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

Correlation matrix

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

Justification Statements :

CO1: Understand the computer Programming concepts and Algorithms.
Action Verb: Understand
(L2) PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Review (L2)
CO1 Action verb is same as than as PO2 verb by two level. Therefore, the correlation is High (3)
PO3 Verb: Develop (L3)
CO1 Action verb is less than as PO2 verb by one level. Therefore, the correlation is moderate (2)
CO2: Analyze the control structures to implement basic programs**. Action Verb: Analyze (L4)**
PO1: Apply (L3)
CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is equal to PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO2 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
Some of the flow of control statements knowledge are used to solve various problems. Therefore, the correlation is moderate (2)
CO3:Understand the concept of Arrays and string to manipulate the stored data.
Action Verb: Understand(L2)
PO1: Apply (L3)
CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2: Review (L2)
CO3 Action verb is Same as PO2 verb. Therefore, the correlation is High (3)
PO11: Thumb rule
For some matrix operations array and string concepts were used Therefore, the correlation is moderate (2)
CO4: Create the dynamic memory allocation using pointers and structures.
Action Verb: Create
(L6) PO1: Apply (L3)
CO4 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
For some mathematical operations Pointers and structures are used to manipulate the memory references. Therefore, the correlation is moderate (2)
CO5: Create the user defined functions and files for modifying stored data.
Action Verb: Create (L6)
PO1: Apply (L3)
CO5 Action verb is greater than PO1 verb by two levels. Therefore, the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO11: Thumb rule
In today's world file handling techniques were used in most of the areas. Therefore, the correlation is high (3)

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

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

Course Outcomes:

After studying the course, student will be able to

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

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

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

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

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

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

List of Experiments

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.[CO1]

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

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

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.[CO1]

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

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area

Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is
no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.[CO2]

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.[CO2]

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student. [CO2]

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms. [CO2]

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word. [CO3]

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word. [CO3]

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes. [CO3]

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word. [CO3]

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources. [CO4] **Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text[CO4]

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, [CO4] **LOOKUP/VLOOKUP**

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

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint. [CO4]

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

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides. [CO4]

AI TOOLS – ChatGPT

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

how the model completes them. [CO5]

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

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas[CO5]

• Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are. [CO5]

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

Reference Books:

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

Mapping of course outcomes with program outcomes

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

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

Correlation matrix

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

				PO11: Thumb rule	
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 forcustomizing web pages and search engines

Action Verb: Analyze (L4)

PO1: Apply (L3)

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

PO2: idetify(L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

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

PO5: Apply (L3)

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

CO 3: Apply The basic editing function, formatting text & objects on a required content.

Action Verb: Apply

(L3) PO1: Apply (L3)

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

PO2: Review(L2)

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

PO3: Develop(L3)

CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)

PO4: Analyze (L4)

CO3 Action verb is less than as PO4 verb. Therefore, the correlation is moderate (2)

PO5: Apply (L3)

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

Documentation and presentation is learning process to find the solution better manner the correlation is high (3)

CO 4: Apply the formulas, functions and visualizations to manage the data.

Action Verb: Apply

(L3) PO1: Apply (L3)

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

PO2: identify(L3)

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

PO3: Develop (L3)

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

PO4: Analyze (L4)

CO4 Action verb is less than as PO4 verb by one level. Therefore, the correlation is moderate (2)

PO5: Apply (L3)

CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

PO11: Thumb rule

Spread sheets in Excel is the trending approach in the current days Therefore, the correlation is high (3)

CO 5: Understand the libraries and models of chatGPT to generate information.

Action Verb: Understand

(L2) PO1 Verb: Apply (L3)

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

PO2 Verb: Identify(L3)

CO1 Action verb is same as PO2 verb. Therefore, the correlation is moderate (2)

Annamacharya Institute of Technology & Sciences (Autonomous), Tirupati

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 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	Bloom s 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	PO 1, PO 4	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							

Statements:

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 & Sciences (Autonomous), Tirupati
AK23 Regulations

Year-Sem	**I-I**	**Branch of Study: Common to all Branches**			
Subject Code	**Subject Name**	**L**	**T**	**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.

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 flipflops 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
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

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											

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)

ELECTRONICS AND COMMIUNICATION ENGINEERING

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

Course Outcomes:

After studying the course, student will be able to

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

CO2: Create the control structure for solving complex problems.

CO3: Apply the concepts of arrays, functions, basic concepts of pointers to organize the data. **CO4: Apply** the concepts of structures, unions and linked list to manage heterogeneous data . **CO5: Create** the file applications for storing and accessing data.

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

List of Experiments:

Exercise 1: Problem-solving using Computers[CO1]

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

Exercise 2: Problem-solving using Algorithms and Flow charts.[CO1]

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

Exercise 3: Variable types and type conversions[CO2]

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

Exercise 4: Operators and the precedence and as associativity [CO2]

i) Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3

c. A+++B---A

d. J= (i++) + (++i)

ii) Find the maximum of three numbers using conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float list and perform insertion, deletion, and traversal.

Exercise 5: Branching and logical expressions[CO2]

i) Write a C program to find the max and min of four numbers using if-else.

ii) Write a C program to generate electricity bill.

iii) Find the roots of the quadratic equation.

iv) Write a C program to simulate a calculator using switch case.

v) Write a C program to find the given year is a leap year or not.

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

i) Find the factorial of given number using any loop.

ii) Find the given number is a prime or not.

iii) Compute sine and cos series

iv) Checking a number palindrome

iv) Construct a pyramid of numbers.

Exercise 7: 1 D Arrays: searching[CO3]

i) Find the min and max of a 1-D integer array.

ii) Perform linear search on1D array.

iii) The reverse of a 1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

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

i) Addition of two matrices

ii) Multiplication two matrices

iii) Sort array elements using bubble sort

iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

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

i. Write a C program to find the sum of a 1D array using malloc()

ii. Write a C program to find the total, average of n students using structures

iii. Enter n students data using calloc() and display failed students list

iv. Read student name and marks from the command line and display the student details along with the total.

v. Write a C program to implement realloc()

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

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bitfields.

iv) Write a C program to copy one structure variable to another structure of the same type.

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

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

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

i) Write a recursive function to generate Fibonacci series.

ii) Write a recursive function to find the lcm of two numbers.

iii) Write a recursive function to find the factorial of a number.

iv) Write a C Program to implement Ackermann function using recursion.

v) Write a recursive function to find the sum of series.

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

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

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

Exercise 14: File handling[CO5]

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

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

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

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Mapping of course outcomes with program outcomes

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

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

Correlation matrix

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

4	CO4: Apply	L3	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 2 2
5	CO5: Create	L6	PO1 PO2 PO3 PO4 PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Develop(L3) PO4: Analyze (L4) PO11: Thumb rule	3 3 3 3 3

Justification Statements :

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

Action Verb: Understand (L2)

PO1 Verb: Apply (L3)

CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2) PO2 Verb: Review(L2)

CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3) PO3: Develop(L3)

CO1 Action verb is less than PO3 verb by one level. Therefore, the correlation is moderate (2) PO4: Analyze(L4)

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

CO2: Create the control structure for solving complex problems.

Action Verb: Create (L6)

PO1: Apply (L3)

CO2 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3) PO2: Review (L3)

CO2 Action verb is same level PO2 verb. Therefore, the correlation is high (3) PO4: Analyze (L4)

CO2 Action verb is same as PO4 verb. Therefore, the correlation is high (3) PO5: Apply(L3)

CO2 Action verb is same as PO5 verb. Therefore, the correlation is high (3) PO11: Thumb rule

For some of Linear Data Structure applications, Linked lists concepts are used to write programs store the data. Therefore, the correlation is high (2)

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

Action Verb: Apply (L3)

PO1: Apply (L3)

CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3) PO2: Review (L3)

CO3 Action verb is same level PO2 verb. Therefore, the correlation is high (3) PO4: Analyze (L4)

CO3 Action verb is less than PO4 verb by one level. Therefore, the correlation is moderate (2) PO5: Apply(L3)

CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3) PO11: Thumb rule

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

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

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

Annamacharya Institute of Technology & Sciences (Autonomous), Tirupati

AK23 Regulations

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

Subject Code	Subject: Name	L	T	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, career guidance. Activities:
Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills Conducting orientations programs for the students –future plans-activities-releasing road map etc. Displaying success stories-motivational biopics- award winning movies on societal issues etc.
Conducting talent show in singing patriotic songs-paintings- any other contribution

UNIT-II

Nature & Care Activities:
Best out of waste competition.
Poster and signs making competition to spread environmental awareness. Recycling and environmental pollution article writing competition.
Organizing Zero-waste day.
Digital Environmental awareness activity via various social media platforms. Virtual demonstration of different eco-friendly approaches for sustainable living. Write a summary on any book related to environmental issues.

UNIT-III

Community Service Activities:
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.
Mental health, Spiritual Health, HIV/AIDS,
Conducting consumer Awareness. Explaining various legal provisions etc.
Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education. Any other programmes in collaboration with local charities, NGOs etc.
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 PO11)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Understand	L2	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 2 2
2	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3
3	Analyze	L4	PO1 PO2 PO10	Apply(L3) Analyze(L4) Thumb Rule	2 3 3

Justification Statements:

CO1: Understand the importance of discipline, character and service motto of community. Action Verb: Understand (L2)

CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2). CO1 Action Verb is of BTL 2. Using Thumb rule, L2 correlates PO10 as moderate (2).

CO2: Analyze the activities need to be done for nature protection Action Verb: Analyze (L4)

CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2). CO2 Action Verb is same as PO2 verb, Therefore correlation is High (3)
CO2 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

CO3: Analyze the social issues in a community and address it through the base camps Action Verb: Analyze (L4)

CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is moderate (2). CO3 Action Verb is same as PO2 verb, Therefore correlation is High (3)
CO3 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO10 as moderate (4).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES:: TIRUPATI
(AUTONOMOUS)
AK23-REGULATIONS
B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– I Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	HM	23AHM9901	Communicative English	2	0	0	2	30	70	100
2	BS	23ABS9901	Chemistry	2	1	0	3	30	70	100
3	BS	23ABS9905	Differential Equations and Vector Calculus	2	1	0	3	30	70	100
4	ES	23AES0101	Basics of Civil & Mechanical Engineering	2	1	0	3	30	70	100
5	PC	23APC0203	Network Analysis	2	1	0	3	30	70	100
6	HM	23AHM9902	Communicative English Lab	0	0	2	1	30	70	100
7	BS	23ABS9906	Chemistry Lab	0	0	2	1	30	70	100
8	ES	23AES0302	Engineering Workshop	0	0	3	1.5	30	70	100
9	PC	23APC0204	Network Analysis and Simulation Laboratory	0	0	3	1.5	30	70	100
10	HM	23AHM9903	Health and Wellness, Yoga and Sports	0	0	1	0.5	50	-	50
Total				10	4	11	19.5	320	630	950

Annamacharya Institute of Technology & Sciences :: Tirupati
(Autonomous)
AK23 Regulations
(Effective for the batches admitted from 2023-24)

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

Subject Code 23AHM9901	**Subject Name** COMMUNICATIVE ENGLISH	**L T 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:

www.bbc.co.uk/learningenglish
https://dictionary.cambridge.org/grammar/british-grammar/ www.eslpod.com/index.html
https://www.learngrammar.net/
https://english4today.com/english-grammar-online-with-quizzes/
https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY
https://www.youtube.com/c/DailyVideoVocabulary/videos
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**

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

Annamacharya Institute of Technology & Sciences :: Tirupati (Autonomous)

AK23 Regulations

(Effective for the batches admitted from 2023-24)

Year: I B.Tech **Common to ECE,AI&DS,AI&ML II Sem**

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

Statements:

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).

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

Subject Code:23ABS9905	Subject Name: Differential Equations and Vector Calculus	L T /CLC P 2 1 0	Credits 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 the methods of linear differential equations related to various engineering problems.
3. Analyze the solutions of partial differential equations using Lagrange's method.
4. Understand the different operators and identities in the vector calculus.
5. Evaluate the surface integral and volume integral in the vector calculus using various theorems.

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

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

UNIT II: Equations Reducible to Linear Differential Equations and Applications 9 hrs Definitions, homogeneous and non-homogeneous , complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and simple Harmonic motion.

UNIT III: Partial Differential Equations **9 hrs**
Introduction and formation of partial differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV: Vector differentiation **9 hrs**
Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: Vector integration **9 hrs**
Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems. **Text Books :**

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

2011.

References:

1. Dr.T.K.V.Iyengar, Engineering Mathematics-I,S.Chand publishers
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmipublication,2008
4. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.

Mapping of COs to POs

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

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I YEAR **II SEMESTER**

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

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.

Course Outcomes

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	PO10	PO11	PSO1	PSO2
BASICS OF CIVIL & MECHANICAL ENGINEERING	CO1	2	2				2							
	CO2	3	2				2							
	CO3	2	2				2							
	CO4	2					2							
	CO5	2					2							
	CO6	2				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	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).

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Course Name: NETWORK ANALYSIS Course Code: 23APC0203
I B. Tech II Sem

L	T	P	Credits
2	1	0	3

COURSE OUTCOMES:

CO1: Understand the basic electrical circuits and simplification using nodal & mesh analysis related theorems.
CO2: Analyze the transient response of R-L, R-C, and R-L-C.
CO3: Understand the Steady state analysis & A. C circuits with R-L, R-C, and R-L-C. CO4: Analyze the series and parallel resonance circuits and coupled circuits.
CO5: Analyze the parameters of a two-port network.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	The Basic electricalcircuits and simplification using nodal & mesh analysis related theorems.	nodal & mesh analysis related theorems		L2
2	Analyze	Transient response of A. C & D. C circuits.	circuits with R- L, R-C, and R- L-C components		L4
3	Understand	Steady state analysis A. C circuits with R-L, R-C, and R-L-C components.	circuits with R- L, R-C, and R-L-C components		L2
4	Analyze	The series and parallel resonance circuits and coupled circuits.			L4
5	Analyze	The parameters of a two-port network.			L4

SYLLABUS:

UNIT I: Basics of Electrical circuits

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples.
Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens problem solving using dependent sources also.

UNIT II: Transients.

First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogeneous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots.
Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT III: Steady State Analysis of A.C Circuits

Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using

mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT IV: Resonance

Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies.

Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT V: Two-port Networks

Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also.

Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

TEXTBOOKS:

1. Network Analysis - ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

REFERENCE BOOKS:

1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO11	PSO1	PSO2
NETWORK ANALYSIS	CO1	2	2				1						3	
	CO2	3	3				1						3	
	CO3	2	1				1						3	
	CO4	3	3	1			1						3	
	CO5	3	3				1						3	

Justification Table:

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

							Rule	
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				Analyze	**L4**	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	3 3 1

CO1: Understand the basic electrical circuits and simplification using nodal & mesh analysis related theorems.

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 to PO6 as Low (1).

CO2: Analyze the transient response of R-L, R-C, and R-L-C.

Action Verb: Analyze

(L4) PO1: Apply (L3)

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

CO2 Action Verb is same as PO2 verb; Therefore, correlation is high (3). PO6: Using thumb rule, CO2 correlates to PO6 as Low (1).

CO3: Understand the Steady state analysis & A. C circuits with R-L, R-C, and R-L-C.

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 the series and parallel resonance circuits and coupled 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: Analyze the parameters of a two-port network.

Action Verb: Analyze

(L4) PO1: Apply (L3)

CO5 Action Verb is Greater than PO1 verb one level; Therefore, correlation is high (3). PO2: Analyze (L4)

CO5 Action Verb is same as PO2 verb; Therefore, correlation is high (3). PO6: Using thumb rule, CO5correlates to PO6 as Low (1)

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(Effective for the batches admitted from 2023-24)

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

Subject Code 23AHM9902	Subject Name COMMUNICATIVE ENGLISH LAB	L T 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 of Topics:

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	PSO1	PSO2
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).

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(Effective for the batches admitted from 2023-24)

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

Subject Code: 23ABS9906	Subject Name: Chemistry Lab	L	T	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).

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

Subject Code	Subject Name	L	T	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 Bridle joint
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)God own 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.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, FelixW.; Independently Published, 2019.Workshop Processes, Practices and Materials; Bruce J.Black, Routledge publishers,5thEdn.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.IbyS. K. Hajr a Choudhury & Others, Media Promoters and Publishers,Mumbai.2007,14th edition
2. Workshop Practice by H.S.Bawa, Tata-McGrawHill, 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 PO 2 PO 3 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)

PO3Verb: **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)

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AK23 Regulations

Course Name: NETWORK ANALYSIS AND SIMULATION LABORATORY

Subject Code: 23APC0204 **I B. Tech II Sem**

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

CO1: Understand the Kirchhoff's laws and network theorems.
CO2: Analyze the time constants of RL & RC circuits.
CO3: Analyze the behaviour of RLC circuit for different cases.
CO4: Design the resonant circuit for the given specifications.
CO5: Analyze the network in terms of all network parameters.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	Kirchhoff's laws and network theorems.			L2
2	Analyze	Time constants of RL & RC circuits.			L4
3	Analyze	The behaviour of RLC circuit for different cases.			L4
4	Design	Resonant circuit for the given specifications.			L6
5	Analyze	The network in terms of all network parameters.			L4

SYLLABUS:

The following experiments need to be performed using both Hardware and simulation Software. The experiments need to be simulated using software and the same need to be verified using the hardware.

1. Study of components of a circuit and Verification of KCL and KVL-(CO1).
2. Verification of mesh and nodal analysis for AC circuits-(CO1).
3. Verification of Superposition, Thevenin's & Norton theorems for AC circuits-(CO1).
4. Verification of maximum power transfer theorem for AC circuits-(CO1).
5. Verification of Tellegen's theorem for two networks of the same topology-(CO1).
6. Study of DC transients in RL, RC and RLC circuits-(CO2).
7. To study frequency response of various 1st order RL & RC networks-(CO2).
8. To study the transient and steady state response of a 2nd order circuit by varying its various parameters and studying their effects on responses-(CO3).
9. Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit-(CO4).
10. Determination of open circuit (Z) and short circuit (Y) parameters-(CO5).
11. Determination of hybrid (H) and transmission (ABCD) parameters-(CO5).
12. To measure two port parameters of a twin-T network and study its frequency response-(CO5).

HARDWARE REQUIREMENTS:

Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components.

SOFTWARE REQUIREMENTS:

Multisim/ Pspice/Equivalent simulation software tool, Computer Systems with required specifications

REFERENCES:

1. Network Analysis - ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.

Mapping of course outcomes with program outcomes.

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
NETWORK ANALYSIS AND SIMULATION LABORATORY	CO1	2	1		1					1			3	
	CO2	3	3		3					1			3	
	CO3	3	3		1					1			3	
	CO4		3		3					1			3	
	CO5	3	3		1					1			3	

Justification Table:

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

CO1: Understand the Kirchhoff's laws and network theorems.

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 PO6 as Low (1).

CO2: Analyze the time constants of RL & RC circuits.
Action Verb: Analyze
(L4) PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by one level; Therefore, correlation is high (3). PO2: Analyze (L4)
CO2 Action Verb is same as PO2 verb; Therefore, correlation is high (3). PO4: Analyze (L4)

CO2 Action Verb is same as PO4 verb; Therefore, correlation is high (3). PO9: Using Thumb Rule, CO2 correlates to PO6 as Low (1).

CO3: Analyze the behaviour of RLC circuit for different cases.
Action Verb: Analyze
(L4) PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by one level; Therefore, correlation is high (3). PO2: Analyze (L4)
CO3 Action Verb is same as PO2 verb; Therefore, correlation is high (3). PO4: Design (L6)
CO3 Action Verb is Less than PO4 verb by two level; Therefore, correlation is low (1). PO9: Using Thumb Rule, 3 correlates to PO6 as Low (1).

CO4: Design the resonant circuit for the given specifications.
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 PO6 as Low (1).

CO5: Analyze the network in terms of all network parameters.
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 PO6 as Low (1).

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(Autonomous)
AK23 Regulations
I B. TECH Common to II SEM ECE/AI&DS/AI&ML/CE/ME

Course Code: 23AHM9903	HEALTH AND WELLNESS, YOGA AND SPORTS	L T P C 0 0 1 0.5

Course Objectives:

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

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	Bloom s 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	Percentage of contact hours over the total planned contact hours				CO		Program Outcome (PO)	Level of Correlation (0-3)
	Register (Hrs)	Lesson Pla	%	corr	Verb	BTL		

		n (Hrs)						
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)
AK23-REGULATIONS
B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING
B.Tech.–II Year I Semester

S. No.	Category	Course code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	BS	23ABS9912	Probability and Complex Variables	2	1	0	3	30	70	100
2	HM	23AHM9905	Universal Human Values	2	1	0	3	30	70	100
3	ES	23AES0401	Signals, Systems and Stochastic Processes	2	1	0	3	30	70	100
4	PC	23APC0401	Electronic Devices and Circuits	2	1	0	3	30	70	100
5	PC	23APC0402	Digital Circuit Design	2	1	0	3	30	70	100
6	PC	23APC0403	Electronic Devices and Circuits Lab	0	0	3	1.5	30	70	100
7	PC	23APC0404	Digital Circuits and Signal Simulation Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0501	Python Programming	0	1	2	2	30	70	100
Total				10	6	8	20	240	560	800

Annamacharya Institute of Technology & Sciences :: Tirupati (Autonomous)
AK23 Regulations

B.Tech Year: II **Semester: I** **Branch of Study: ECE**

Subject Code 23ABS9912	Subject Name: Probability and Complex Variables	L T /CLC P 2 1 0	Credits 3

Course Outcomes (CO): Student will be able to

1) Apply the probability theory and various distributions to calculate their statistical constants.
2) Understand the concept of multiple random variables and joint distribution.
3) Apply the operations on multiple random variables.
4) Apply the differentiation for complex variable functions.
5) Evaluate the integrals and power series expansions for complex variable functions.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the probability theory and various distributions	to calculate their statistical constants		L3
2	Understand	the concept of multiple random variables and joint distribution			L2
3	Apply	th operations e	on multiple random variables		L3
4	Apply	th differentiation e	For variable compl ex functions		L3
5	Evaluate	the integrals and power series expansions	for variable compl ex functions		L5

UNIT-I : Probability & Random Variables **9 hrs**

Probability through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Independent Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem.

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation, Distribution and Density functions: Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh-their properties.

UNIT-II: Operations on Random variables **9 Hrs**

Moments-moments about the origin, Central moments, Variance and Skew, Cheby shev's inequality, moment generating function, characteristic function.

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence.

UNIT-III: Operations on Multiple Random variables **9 Hrs**

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties of Gaussian random variables.

UNIT-IV: 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-V: 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 integrals of the type.

(a) $\int_0^{2\pi} F(cos\theta, sin\theta)\, d\theta$

(b) $\int_{-\infty}^{\infty} e^{imx}\, dx$

Textbooks:

1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, TMH, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers,2017, 44th Edition
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012

Reference Books:

1. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India
3. B.V.Ramana, Higher Engineering Mathematics, McGrew Hill publishers.
4. Y.Mallikarjuna Reddy, Probability Theory and Stochastic Processes, 4th Edition, Universities Press

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
2. https://onlinecourses.nptel.ac.in/noc21_ma66/preview#:~:text=This%20course%20provides%20random%20variable,and%20simple%20Markovian%20queueing%20models.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
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**	**Action Verb**	**BTL**			
1				Apply	**L3**	PO1	**Apply (L3)**	3
2				Understand	**L2**	PO1	**Apply (L3)**	2
3				Apply	**L3**	PO1	**Apply (L3)**	3
4				Apply	**L3**	PO1	**Apply (L3)**	3
5				Evaluate	**L5**	PO2	**Analyze (L4)**	3

CO1: Apply the probability theory and various distributions to calculate their statistical constants: Apply (L3) PO1 Verb: Apply (L3)

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

CO22) Understand the concept of multiple random variables and joint distribution: Understand (L2) PO1 Verb: Apply (L3)

CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).

CO3: Apply the operations on multiple random variables: Apply (L3) PO1 Verb: Apply (L3)

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

CO4: Apply the differentiation for complex variable functions: Apply (L3) PO1 Verb: Apply (L3)

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

CO5: Evaluate the integrals and power series expansions for complex variable functions: Evaluate(L5) PO2 Verb: Analyze (L4)

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

Annamacharya Institute of Technology & Sciences :: Tirupati (Autonomous)
AK23 Regulations
Year: II B.Tech **Common to all branches** **Semester: I**

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

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 fulfill 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 Fulfillment 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,ANagaraj, 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 https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

Correlation of COs with the POs & PSOs for B.Tech AK-23 Regulations
***3: Highly Correlated, 2: Moderately Correlated, 1: Weakly Correlated**

Articulation matrix

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 – UNDERSTA	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).

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Course Code	Year & Sem		L	T/CLC	P	C
23AES0401	II-I	SIGNALS, SYSTEMS AND STOCHASTIC PROCESSES	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
CO2: **Apply** sampling theorem to convert continuous time signals to discrete time signals, different transform techniques to solve signals and system related problems.
CO3: **Analyze** the properties of systems and characteristics
of LTI systems CO4: **Understand** the Temporal
Characteristics of Random Process.
CO5: **Analyze** the Spectral Characteristics of Random Process.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO 1	Understand	the representation of continuous time and discrete time signals			L2
CO 2	Apply	sampling theorem to convert continuous time signals to discrete time signals	Different transform techniques to solve signals and system related problems.		L3
CO 3	Analyze	the properties of systems and characteristics of LTI systems			L4
CO 4	Understand	the Temporal Characteristics of Random Process.			L2
CO 5	Analyze	the Spectral Characteristics of Random Process.			L4

UNIT I
Signals & Systems: Basic definitions and classification of Signals and Systems (Continuous time and discrete time), operations on signals, Concepts of Convolution and Correlation of signals, Analogy between vectors and signals- Orthogonality, mean square error,
Fourier series: Trigonometric Fourier series, Wave symmetry, Even or Odd Symmetry, Exponential Fourier series and problems on Trigonometric Fourier Series and Exponential Fourier Series.

UNIT II
Fourier Transform: Definition, Computation and properties of Fourier transform for different types of signals and systems, Inverse Fourier transform. Sampling: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Reconstruction of signal from its samples, Effect of under sampling – Aliasing. Illustrative Problems.
Laplace Transform: Definition, ROC, Properties, Inverse Laplace transforms, the s-plane and BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions, Illustrative Problems.

UNIT III
Signal Transmission through Linear Systems: Linear system, impulse response, Response of a linear system for different input signals, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortionless transmission through a system, Signal bandwidth,

System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between bandwidth and rise time, Energy and Power spectral densities, Illustrative Problems.

UNIT IV

Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and Its Properties, Cross- Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT V

Random Processes – Spectral Characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross Correlation Function. Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.

Textbooks:

Peyton Z.Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, TMH, 2002.
A.V. Oppenheim, A.S. Wills kyand S.H. Nawab, "Signals and Systems", 2ndEdition, PHI, 2009.

Reference Books:

Signals, Systems & Communications -B.P.Lathi,2013, BSP.
Athanasios Papoulis and S.Unni krishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002
Simon Haykin and VanVeen, "Signals & Systems", 2ndEdition,Wiley, 2005.
Matthew Sadiku and Warsame H.Ali, "Signals and Systems A primer with MATLAB", CRC Press, 2016. HweiHsu, "Schaum's Outline of Signals and Systems", 4thEdition, TMH, 2019.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		1								1	
CO2	3	3		2								1	
CO3	3	3		3								2	
CO4	2	2	2	1	2							1	
CO5	3	3	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				Understand	L2	PO1,PO2, PO4,	PO1: Apply (L3) PO2: Identify(L3) PO4:Analyze(L4)	2 2 1
2				Apply	L3	PO1,PO2, PO4,	PO1: Apply (L3) PO2: Identify(L3) PO4:Analyze(L4)	3 3 2
3				Analyze	L4	PO1,PO2,	PO1: Apply (L3)	3

						PO4,	PO2: Identify(L3) PO4:Analyze(L4)	3 3
4				**Understand**	**L2**	PO1,PO2 , PO3, PO4, PO5,	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4:Analyze(L4) PO5:Apply(L3)	2 2 2 1 2
5				**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

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 Verb: Identify (L3)

CO1 Action Verb is equal to PO2 verb by one level; therefore correlation is high (2).

PO4 Verb: Analyze (L4)

CO1 Action Verb is less than PO3 verb by two level; therefore correlation is low (1).

CO2: Apply sampling theorem to convert continuous time signals to discrete time signals, different transform techniques to solve signals and system related problems.

Action Verb: Apply (L3)

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

CO3 Analyze the properties of systems and characteristics of LTI systems

Action Verb: Analyze

(L4) PO1 Verbs: Apply

(L3)

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

PO2 Verb: Identify (L3)

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

PO4 Verb: Analysis (L4)

CO3 Action Verb level is equal PO4 verb; Therefore correlation is high (3).

CO4: Understand the Temporal Characteristics of Random Process.

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: Identify (L3)

CO4 Action Verb is lesser than PO2 verb by one level; Therefore correlation is moderate (2).

PO3 Verb: Develop (L3)

CO4 Action Verb is equal to PO3 verb; The by one levels therefore correlation is moderate (2).

PO4 Verb: Analyze (L4)

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

PO5 Verb: Apply (L3)

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

CO5: Analyze the Spectral Characteristics of Random Process.

Action Verb: Analyze

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Identify (L3)

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

PO3 Verb: Develop (L3)

CO5 Action Verb is greater than PO3 verb; therefore correlation is high (3).

PO4 Verb: Analyze (L4)

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

PO5 Verb: Apply (L3)

CO5 Action Verb level is less than PO5 verb by one level; Therefore correlation is moderate (2)

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AK23 Regulations

ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem		L	T/CLC	P	C
23APC0401	II-I	Electronic Devices and Circuits	2	1	0	3

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

CO1 **Understand** the operation of PN junction diode, special electronic devices and rectifiers with & without filters.

CO2 **Analyze** the BJT characteristics in three configurations, biasing methods and thermal stabilization techniques.

CO3 **Evaluate** the transistor amplifier parameters by using small signal hybrid model for three configurations.

CO4 **Understand** the construction, operation and characteristics of JFET, E & D MOSFETs and biasing methods.

CO5 **Analyze** the MOSFET amplifier parameters by using small signal model for three configurations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom s Level
CO1	Understand	the operation of PN junction diode, special electronic devices and rectifiers	with & without filters		L2
CO2	Analyze	the BJT characteristics in three configurations, biasing methods and thermal stabilization techniques			L4
CO3	Evaluate	the transistor amplifier parameters	by using small signal hybrid model	for three configurations	L5
CO4	Understand	the construction, operation and characteristics of JFET, E & D MOSFETs and biasing methods			L2
CO5	Analyze	the MOSFET amplifier parameters	by using small signal model	for three configurations	L4

UNIT I

PN junction diode: Review, diode current equation, Diode resistance, Transition and Diffusion Capacitance, effect of temperature on PN junction diode, Quantitative analysis of Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics, Clipping and Clamping circuits, Illustrative problems.

Special Diodes: Construction, operation and VI characteristics of Tunnel Diode, Varactor Diode, LED, LCD, Photo Diode, SCR and UJT

UNIT II

Review of Bipolar Junction Transistors, Characteristics, Transistor as an Amplifier and as a Switch, BJT Configurations, Limits of Operation, BJT Specifications.

Biasing and Stabilization: Operating Point, DC and AC Load Lines, Importance of Biasing, Fixed Bias, Collector to Base Bias, Self-Bias, Bias Stability, Thermal Runaway, Thermal Stability, Illustrative problems.

UNIT III

BJT Small Signal Operation and Models- generalized analysis of transistor amplifier model using h- parameters, Current gain, Input resistance, Voltage gain, Output conductance., separating the Signal and the DC Quantities, The exact hybrid model, The approximate hybrid model Single Stage BJT Amplifiers - Common- Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common- Collector (CC) amplifier or Emitter Follower, Problem solving.

UNIT IV

Junction Field Effect Transistor (JFET): Construction, Principle of Operation, Drain and Transfer Characteristics , Comparison of BJT and FET, FET as Voltage Variable Resistor. FET biasi**ng.**

MOS Field Effect Transistors: Introduction, Device Structure and Physical Operation, Enhancement and Depletion MOSFET, Drain and Transfer Characteristics MOSFET Circuits at DC, MOSFET as an Amplifier and asa Switch. Biasing in MOS Amplifier circuits - biasing by fixing VGS with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, body effect, Problem solving.

UNIT V

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the trans-conductance, the T equivalent circuit model, Single stage MOS Amplifiers – common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, Problem Solving.

Textbooks:

Adel S.Sedraand Kenneth C.Smith, "Microelectronic Circuits–Theory and Applications", 6th Edition, Oxford Press, 2013.

J.Milliman and C Halkias,"Integratedelectronics",2ndEdition,TataMcGrawHill, 1991.

References:

Donald A Neamen, "Electronic Circuits–analysisanddesign",3rd Edition, McGraw Hill (India), 2019. Behzad Razavi,"Microelectronics",Secondedition,Wiley,2013.

R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.

Jimmie J Cathey, "Electronic Devices and Circuits," Schaum's outlines series,3rd edition, McGraw-Hill(India), 2010.

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO11	PSO1	PSO2
CO1	2	3										2	
CO2	3	3	3	3								3	
CO3	3	3	3									3	
CO4	2	2	2	1								2	
CO5	3	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	15	20	2	Understand	L2	PO1, PO2	PO1: Apply (L3) PO2: Review(L2)	2 3

2	17	22	3	Analyze	**L4**	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
3	15	20	**2**	Evaluate	**L5**	PO1, PO 2, PO 3	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3)	3 3 3
4	14	18	**2**	Understand	**L2**	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	2 2 2 1
5	15	20	**2**	Analyze	**L4**	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
	73	100 %						

Justification Statements:

CO1: Understand the operation of PN junction diode, special electronic devices and rectifiers with & without filters.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

CO1 Action Verb is equal to PO2 verb; Therefore, the correlation is high (3).

CO2: Analyze the BJT characteristics in three configurations, biasing methods and thermal stabilization techniques.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Identify (L3)

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

PO3 Verbs: Develop (L3)

CO2 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3).

PO4 Verbs: Analyze (L4)

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

CO3: Evaluate the transistor amplifier parameters by using small signal hybrid model for three configurations.

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).

PO3 Verb: Develop (L3)

CO3 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3).

CO4: Understand transistor biasing methods and thermal stabilization concepts. 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 Verb: Identify (L3)

CO4 Action Verb is less than PO2 verb by one level; Therefore, the correlation is moderate (2).

PO3 Verb: Develop (L3)

CO4 Action Verb is less than PO3 verb by level; Therefore, the correlation is moderate (2) PO4 Verb: Analyze (L4)

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

CO5: Analyze the transistor amplifier using h-parameter models for three configurations. Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

CO5 Action verb is greater to 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).

PO3 verb: Develop (L3)

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

PO4 verb: Analyze (L4)

CO5 Action verb is equal to PO4 verb; Therefore, the correlation is high (3).

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ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem	Digital Circuit Design	L	T/CLC	P	C
23APC0402	II-I		2	1	0	3

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

CO1	**Understand** the logic gates and minimization of Boolean functions using K maps
CO2	**Analyze** the design procedure of combinational logic circuits using logic gates.
CO3	**Apply** the Verilog constructs in HDL for various combinational circuits design.
CO4	**Analyze** the sequential logic circuits design using flip flops and Verilog constructs.
CO5	**Analyze** the Finite State Machines and realization of Programmable Logic Devices.

CO	Action Verb	Knowledge Statement	Condition	Criterion	Level
CO1	**Understand**	The Logic Gates minimisation of Boolean functions	Using K maps		L2
CO2	**Analyze**	the design procedure of combinational logic circuits	Using Logic gates		L4
CO3	**Apply**	The design procedure of combinational logic circuits			L3
CO4	**Analyze**	The design procedure of sequential logic circuits	Using Flipflops and verilog constructs		L4
CO5	**Analyze**	The Finite state machines and realisation of programmable logic devices			L4

UNIT I

Boolean algebra, logic operations, and minimization of Boolean functions
Review of Number Systems and Complements Representation of unsigned and signed integers, Floating Point representation of real numbers, Laws of Boolean Algebra, Theorems of Boolean Algebra, Realization of functions using logic gates, Canonical forms of Boolean Functions, Minimization of Functions using Karnaugh Maps.

UNIT II

Combinational Logic Circuits
Combinational circuits, Design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, Encoders, priority encoders, decoders, multiplexers, de-multiplexers.

UNIT III

Hardware Description Language

Introduction to Verilog - structural specification of logic circuits, behavioral specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, For loop using Combinational circuits with Verilog constructs in HDL

UNIT IV

Sequential Logic Circuits

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip- flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers,

universal shift register. Verilog constructs for sequential circuits, flip-flop with clear capability, using Verilog constructs for registers and counters.

UNIT V

Finite State Machines and Programmable Logic Devices

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa reduction of state tables using partition technique, Design of sequence detector. Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs.

Textbooks:

1. M. Morris Mano, "Digital Design", 3rdEdition,PHI.(Unit I to IV)
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill (Unit V)

Reference Books:

1. Charles H.Roth, Jr, "Fundamentals of Logic Design", 4thEdition, Jaico Publishers.
2. ZviKohavi and Niraj K.Jha, "Switching and Finite Automata Theory,3rdEdition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Prentice Hall PTR.
4. D.P.Leach, A.P.Malvino, "Digital Principles and Applications", TMH,7thEdition.

Mapping of COs to POs

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

Correlation Matrix:

CO	CO	Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)

	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1				Understand	L2	PO1, PO2,	PO1: Apply (L3) PO2: Review (L2)	2 3
2				Analyze	L4	PO1, PO2, PO3, PO4,	PO3: Develop (L3) PO4: Analyze (L4)	3 3
3				Apply	L3	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Develop (L3) PO4: Interpret(L2)	3 3 3 3
4				Analyze	L4	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
5				Analyze	L4	PO1, PO2, PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3

Justification statements

CO 1: Understand the logic gates and minimization of Boolean functions using K maps

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO2: Analyze the design procedure of combinational logic circuits using logic gates.

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: Identify (L3)

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

PO3 Verbs: Develop (L3)

CO2 Action Verb is greater than PO3 verb; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

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

CO3: Apply the Verilog constructs in HDL for various combinational circuits design.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Review (L2)

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

PO3 Verb: Develop (L3)

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

PO4 Verbs: Interpret (L2)

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

CO4: Analyze the sequential logic circuits design using flip flops and Verilog constructs.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO4 Action Verb greater to PO1 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO4 Action Verb greater to PO1 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb is equal to PO4 verb; Therefore correlation is high(3).

CO5: Analyze the Finite State Machines and realization of Programmable Logic Devices.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO5 Action verb is greater to 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).
PO3 verb: Develop (L3)
CO5 Action Verb is less than PO3 verb ; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb is equal to PO4 verb; Therefore correlation is high(3).

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ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem		L	T	P	C
23APC0403	II-I	Electronic Devices and Circuits Lab	0	0	3	1.5

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

CO1 **Analyze** the characteristics of UJT and various Clipping & Clamping circuits using PN junction diodes.

CO2 **Evaluate** the parameters of BJT from its input-output characteristics in three different configurations

CO3 **Evaluate** the parameters of JFET and MOSFETs from their characteristics in Common Source Configuration

CO4 **Analyze** the operation of various DC biasing circuits and switching circuits using BJT and MOSFETs

CO5 **Analyze** the frequency response of amplifier using BJT (Common Emitter) and MOSFET (Common Source).

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	the characteristics of UJT and various Clipping & Clamping circuits	using PN junction diodes		L4
CO2	Evaluate	the parameters of BJT from its input-output characteristics		in three different configurations	L5
CO3	Evaluate	the parameters of JFET and MOSFETs from their characteristics		in Common Source Configuration	L5
CO4	Analyze	the operation of various DC biasing circuits and switching circuits	using BJT and MOSFETs		L4
CO5	Analyze	the frequency response of amplifier	using BJT (Common Emitter) and MOSFET (Common Source)		L4

LIST OF EXPERIMENTS: (Implement/Execute any 10 experiments).

1. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs. (CO1)
2. Study and draw the Volt Ampere characteristics of UJT and determine η, IP, Iv, VP, & Vv from the experiment. (CO1)
3. Verification of the input and output characteristics of BJT in Common Emitter configuration experimentally and find required parameters from the graphs. (CO2)
4. Study and draw the input and output characteristics of BJT in Common Base configuration experimentally and determine required parameters from the graphs. (CO2)

5. Verification of the input and output characteristics of BJT in Common Collector configuration experimentally and find required parameters from the graphs. (CO2)
6. Study and draw the drain and transfer characteristics of JFET in Common Source configuration experimentally. Find IDSS, gm and Vp from the graph. (CO3)
7. Study and draw the output and transfer characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find Threshold voltage (V_T), gm, & K from the graphs. (CO3)
8. Study and draw the output and transfer characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find I_{DSS}, gm, & V_P from the graphs. (CO3)
9. Design and analysis of voltage-divider bias/self-bias circuit using BJT. (CO4)
10. Design and analysis of self-bias circuit using MOSFET. (CO4)
11. Design a suitable circuit for switch using MOSFET/BJT. (CO4)
12. Design a small signal amplifier using BJT (Common Emitter) for the given specifications. Draw the frequency response and find the bandwidth. (CO5)
13. Design a small signal amplifier using MOSFET (Common Source) for the given specifications. Draw the frequency response and find the bandwidth. (CO5)

Tools/Equipment Required: Software Tool like Multisim/Pspice or Equivalent, DC Power supplies, Multimeters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

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

Correlation matrix

Expt. No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs.)	%	Correlation	Co's Action verb	BTL			
1,2	6	15	2	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Review(L2)	3 3
3,4,5	9	23	3	Evaluate	L5	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
6,7,8	9	24	3	Evaluate	L5	PO1, PO 2, PO 3	PO1: Apply(L3) PO2: Review (L2) PO3: Design (L6)	3 3 2

9,10,11	**9**	**23**	**3**	Analyze	**L4**	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
12,13	**6**	**15**	**2**	Analyze	**L4**	PO 1, PO 2, PO 3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
	39	**100 %**						

Justification Statements:

CO1: Analyze the characteristics of UJT and various Clipping & Clamping circuits using PN junction diodes.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than 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).

CO2: Evaluate the parameters of BJT from its input-output characteristics in three different configurations.
Action Verb: Evaluate (L5)
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).
PO3 Verbs: Develop (L3)
CO2 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; Therefore, the correlation is high (3).

CO3: Evaluate the parameters of JFET and MOSFETs from their characteristics in Common Source Configuration.
Action Verb: Evaluate (L5)
PO1 Verbs: 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 is high (3).
PO3 Verb: Design (L6)
CO3 Action Verb is less than PO3 verb by one level; Therefore, the correlation is moderate (2).

CO4: Analyze the operation of various DC biasing circuits and switching circuits using BJT and MOSFETs. Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than 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 Verb: Design (L6)
CO4 Action Verb is less than PO3 verb by two levels; Therefore, the correlation is low (1) PO4 Verb: Analyze (L4)
CO4 Action Verb is same as PO4 verb; Therefore, the correlation is high (3).

CO5: Analyze the frequency response of amplifier using BJT (Common Emitter) and MOSFET (Common Source).

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)

CO5 Action verb is greater than 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 verb: Design (L6)

CO5 Action verb is less than PO3 verb by two levels; Therefore, the correlation is high (1).

PO4 verb: Analyze (L4)

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

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ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem	Digital Circuits and Signal Simulation Lab	L	T	P	C
23APC0404	II-I		0	0	3	1.5

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

CO1 **Analyze** the construction and operation of various combinational circuits using logic gates.

CO2 **Evaluate** th**e** Universal Shift Register in different modes and various counters using Flip flops**.**

CO3 **Analyze** the generation of standard signals, operations between them and sampling theorem

CO4 **Evaluate** the spectrum of a periodic and aperiodic signals using FS and FT respectively.

CO5 **Analyze** the system properties, filter responses, Gaussian noise, random data and pole-zero plots

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO 1	Analyze	the construction and operation of various combinational circuits	using logic gates		L4
CO 2	Evaluate	th**e** universal shift register in different modes and various counters	using Flip flops		L5
CO 3	Analyze	the generation of signals, operations between them and sampling theorem			L4
CO 4	Evaluate	the spectrum of a periodic and aperiodic signals	using FS and FT respectively		L5
CO 5	Analyze	the system properties, filter responses, Gaussian noise, random data and pole-zero plots			L4

List of Experiments:

PART A

1. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.(CO1)
2. Verification of functional table of 3 to 8-lineDecoder/De-multiplexer(CO1)
3. 4 variable logic function verification using 8 to1multiplexer.(CO1)
4. Design full adder circuit and verify its functional table.(CO1)
5. Design a four-bit ring counter using D Flip – Flops/JK Flip Flop and verify output.(CO2)
6. Design a four-bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output (CO2)

7. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.(CO2)
8. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.(CO2)
9. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms. (CO2)
10. (a)Draw the circuit diagram of a single bit comparator and test the output (b)Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.(CO1) Note: Design and verify combinational and sequential circuits using Hardware Description Language

References:

1.M. Morris Mano, "Digital Design", 3rdEdition,PHI

List of Experiments:

PART B

1. Write a program to generate various Signals and Sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc function. (CO3)
2. Perform operations on Signals and Sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power. (CO3)
3. Write a program to find the trigonometric &exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings- Plot the discrete spectrum of the signal. (CO4)
4. Write a program to find Fourier transform of a given signal. Plot its amplitude and phase spectrum. (CO4)
5. Write a program to convolve two discrete time sequences. Plot all the sequences. (CO3)
6. Write a program to find auto correlation and cross correlation of given sequences. (CO3)
7. Write a program to verify Linearity and Time Invariance properties of a given Continuous System. (CO5)
8. Write a program to generate discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal. (CO3)
9. Write a program to find magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.(CO5)
10. Write a program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (PDF) and Power Spectral Density (PSD).(CO5)
11. Generate a Random data (with bipolar) for a given data rate (say 10kbps). Plot the same for a time period of 0.2 sec. (CO5)
12. To plot pole-zero diagram in S-plane of given continuous system and verify its stability. (CO5) Note: Any 10 experiments. All the experiments are to be simulated using MATLAB or equivalent software.

References:

1.Stephen J. Chapman, "MATLAB Programming for Engineers",Cengage,November2012.

Mapping of Course Outcomes with Program Outcomes

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

Correlation matrix

Expt. 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			
DC: 1,2,3, 4,10	**15**	23	3	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
DC: 5,6,7, 8,9	**15**	23	2	Evaluate	**L5**	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
SS: 1,2,8	**9**	13	**2**	Analyze	**L4**	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Formulate(L6) PO4: Analyze(L4) PO5: Apply(L3)	3 1 3 3
SS:3, 4	**6**	9	**2**	Evaluate	**L5**	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Formulate(L6) PO4: Analyze(L4) PO5: Apply(L3)	3 2 3 3
SS: 5,6,7, 9,10, 11,12	**21**	32	**3**	Analyze	**L4**	PO 1, PO 3, PO 4, PO5	PO1: Apply (L3) PO3: Develop(L3) PO4: Design(L6) PO5: Apply(L3)	3 3 1 3
	66	**100 %**						

Justification Statements:

CO1: Analyze the construction and operation of various combinational circuits using logic gates.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb; Therefore, the correlation is high (3).

PO2 Verbs: Identify (L3)

CO1 Action Verb is greater than PO2 verb; Therefore, the correlation is high (3).

PO3 Verbs: Develop (L3)

CO1 Action Verb is greater than PO2 verb; Therefore, the correlation is high (3).

PO4 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO4 verb; Therefore, the correlation is high (3).

PO5 Verbs: Apply (L3)

CO1 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO2: Evaluate th**e** Universal Shift Register in different modes and various counters using Flip flops**. Action Verb: Evaluate (L5)**

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Identify (L3)

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

PO3 Verbs: Develop (L3)

CO2 Action Verb is greater than PO3 verb; Therefore, the correlation is high (3).

PO4 Verbs: Analyze (L4)

CO2 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

PO5 Verbs: Apply (L3)

CO2 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO3: Analyze the generation of standard signals, operations between them and sampling theorem.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Formulate (L6)

CO3 Action Verb is less than PO2 verb by two levels; Therefore, the correlation is low (1).

PO4 Verbs: Analyze (L4)

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

PO5 Verbs: Apply (L3)

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

CO4: Evaluate the spectrum of a periodic and aperiodic signals using FS and FT respectively.

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Formulate (L6)

CO5 Action Verb is less than PO2 verb one level; Therefore, the correlation is medium(2).

PO4 Verbs: Analyze (L4)

CO4 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

PO5 Verbs: Apply (L3)

CO4 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO5: Analyze the system properties, filter responses, Gaussian noise, random data and pole-zero plots

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO3 Verbs: PO3: Develop (L3)

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

PO4 Verbs: Design (L6)

CO5 Action Verb is less than PO4 verb by two levels; Therefore, the correlation is low(1).

PO5 Verbs: Apply (L3)

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

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AK23 Regulations
ELECTRONICS AND COMMUNICATION ENGINEERING

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

Course Outcomes:

After studying the course, student will be able to

CO1: Understand the Basic concepts of python programming to build scripts in IDLE.
CO2: Apply the modularity techniques to invoke user defined functions**.**
CO3: Apply the concept of Dictionaries, Tuples and sets to perform operations on data.
CO4: Analyze the file concepts and oops paradigms to manage data.
CO5: Apply the concepts of JSON and XML for data processing.

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

UNIT– I	9Hrs

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

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if…elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers with in an interval
3. Write a program to swap two numbers with out using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii)Relational Operators iii)Assignment Operators iv)Logical Operators v)Bitwise Operators vi)Ternary Operator vii)Membership Operators viii)Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT–II	9Hrs

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Writeaprogramtofindthelengthofthestringwithoutusinganylibraryfunctions.
10. Write a program to check if the substring is presenting invest ring or not.
11. Write a program to perform the given operations on a list: i.Addition ii.Insertion iii.slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT–III	9Hrs

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

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

UNIT–IV	9Hrs

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its are and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT–V	9Hrs

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.

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

Sample Experiments:

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

Reference Books:

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

Online Learning Resources/Virtual Labs

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

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	9	20	2	CO1 : Understand	L2	PO1 PO2 PO3 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)

CO4 Action verb is greater than PO1 verb. Therefore the correlation is high (3)

PO2 Verb : Review(L2)

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

PO3 Verb : Develop (L3)

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

PO4 Verb : Analyze(L4)

CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)

PO5 Verb : Apply(L3)

CO4 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)

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

PO2 Verb : Review(L2)

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

PO3 Verb : Develop (L3)

CO5 Action verb same as PO3 verb. Therefore the correlation 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 as PO5 verb. Therefore the correlation is high (3)

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AK23-REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– II Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	HM	23AHMMB01	Managerial Economics and Financial Analysis	2	0	0	2	30	70	100
2	ES	23AES0203	Linear Control Systems	3	0	0	3	30	70	100
3	PC	23APC0405	EM Waves and Transmission Lines	3	2	0	3	30	70	100
4	PC	23APC0406	Electronic Circuits Analysis	3	2	0	3	30	70	100
5	PC	23APC0407	Analog and Digital Communications	3	2	0	3	30	70	100
6	PC	23APC0408	Electronic Circuits Analysis Lab	0	0	3	1.5	30	70	100
7	PC	23APC0409	Analog and Digital Communications Lab	0	0	3	1.5	30	70	100
8	SC	23ASC9901	Soft Skills	0	1	2	2	30	70	100
9	ES	23AES0304	Design Thinking & Innovation	1	0	2	2	30	70	100
10	Audit Course	23AMC9901	Environmental Science	2	0	0	0	30	-	30
Total				17	7	10	21	300	630	930
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation										

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

Business Organizations and Markets

UNIT-III :

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.

Capital Budgeting

UNIT-IV :

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	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	PO	Apply	**1 1**

		%				1, PO10	Apply	
3	14	22.5 %	3	CO3: Analyze	L4	PO 1, 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)

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Year: II **Semester: II** **Branch of Study: ECE**

Subject Code	Subject Name	L	T	P	Credits
23AES0203	Linear Control Systems	2	1	0	3

Course Outcomes:

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

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. Controller components, DC Servomotor and AC Servo motor their transfer functions, Synchros.

UNIT-II

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, Study of effects and Design of P, PI, PD and PID Controllers on second order system.

UNIT-III

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

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 – Study of Effects and Design of Lag, Lead, Lag-Lead Compensator design in frequency Domain on a second order system.

UNIT-V

State space analysis of continuous systems

Concepts of state, state variables and state model - 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.

Textbooks:

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	

(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			
CO1				Understand	L2	PO1, PO2	Apply (L3), Analyze (L4)	2 1
CO2				Analyze	L4	PO1, PO2	Apply (L3), Analyze (L4)	3 3
CO3				Analyze	L4	PO1, PO 2, PO 3	Apply (L3), Analysis (L4), Design (L6)	3 3 1
CO4				Analyze	L4	PO1, PO2, PO3	Apply (L3), Analyze (L4), Design (L6)	3 3 1
CO5				Evaluate	L5	PO1, PO 2, PO 3	Apply (L3), Analyze (L4), Design (L6)	3 3 2

JUSTIFICATION STATEMENTS:

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 Hugh (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).

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ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem	EM Waves and Transmission lines	L	T/CLC	P	C
23APC0405	II-II		2	1	0	3

Course Outcomes: After studying the course, Student will be able to:
CO1: Understand the Vector Algebra and Electrostatic fields using Coulomb's law and Gauss law.
CO2: Understand the concepts of Magneto static fields and Time varying fields. **CO3:Analyze** the propagation of Electromagnetic waves in conductors and Dielectric media. **CO4:Understand** the concepts of transmission line types and its parameters.
CO5:Analyze different applications of transmission lines using Smith chart.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO 1	Understand	The Vector algebra and electromagnetic fields	Using coulombs law and gauss law		L2
CO 2	Understand	The concepts of magneto static fields and time varying fields	Using BIOT Savarts law and amperes circuit law		L2
CO 3	Analyze	The propagation of electromagnetic waves in conductors and dielectric media			L4
CO 4	Understand	The concepts of transmission line types and its parameters			L2
CO 5	Analyze	Different applications of transmission lines using smith chart			L4

UNIT I
Review of Co-ordinate Systems, Electrostatics: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

UNIT II
Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.
Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface, Illustrative Problems.

UNIT III
EM Wave Characteristics: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types, Illustrative Problems.
Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect

Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT IV

Transmission Lines-I:Types, Parameters, T & π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Illustrative Problems.

UNIT V

Transmission Lines – II: Input Impedance Relations, Reflection Coefficient, VSWR, Average Power, Shorted Lines, Open Circuited Lines, and Matched Lines, Low loss radio frequency and UHF Transmission lines, UHF Lines as Circuit Elements, Smith Chart – Construction and Applications, Quarter wave transformer, Single Stub Matching, Illustrative Problems.

Textbooks:

Elements of Electro magnetics, MatthewN. O.Sadiku, 4thEdition, Oxford University Press, 2008. Electromagnetic Waves and Radiating Systems,E.C.JordanandK.G.Balmain,2nd Edition, PHI, 2000.

References:

Electromagnetic Field Theory and Transmission Lines, G.S.N.Raju, 2ndEdition, Pearson Education, 2013. Engineering Electromagnetics, WilliamH. Hayt Jr. and John A. Buck, 7thEdition, Tata McGraw Hill, 2006. Electromagnetics, JohnD.Krauss,3rdEdition,McGrawHill, 1988.

Networks, Lines, and Fields, John D.Ryder,2ndEdition, PHI publications, 2012.

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	2
CO2	2	2										3	1
CO3	3	3										2	
CO4	2	2										2	
CO5	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	10	16	2	Understand	L2	PO1,PO2	PO1: Apply(L3) PO2:Identify (L3)	2 2
2	10	16	2	Understand	L2	PO1,PO2	PO1: Apply (L3) PO2: Identify (L3)	2 2
3	15	23	3	Analyze	L4	PO1,PO2	PO1:Apply(L3) PO2:Identify(L3)	3 3
4	14	22	3	Understand	L2	PO1, PO2	PO1:Apply(L3) PO2:Identify(L3)	2 2
5	14	22	3	Analyze	L4	PO1,PO2	PO1:Apply(L3) PO2: Identify(L3)	3 3
	63							

Justification Statements:

CO1: Understand the vector algebra and electrostatic fields using coulomb's law and Gauss law. Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO1 Action Verb is less than to PO1 verb; Therefore correlation is moderate (2). PO2 Verbs: Identify (L3) CO1 Action Verb is less than to PO2 verb; Therefore correlation is moderate (2). **CO2: Understand the concept of magnetostatic fields and time varying fields.**

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO2 Action Verb is less than to PO1 verb; Therefore correlation is moderate (2). PO2 Verbs: Identify (L3) CO2 Action Verb is less than to PO2 verb; Therefore correlation is moderate (2). **CO3:Analyze the propagation of electromagnetic waves in conductors and dielectric media.**

Action Verb: Analyze (L4)

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

CO4:Understand the concepts of transmission line types and its parameters. Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO4 Action Verb is less than to PO1 verb; Therefore correlation is moderate (2). PO2 Verbs: Identify (L3) CO4 Action Verb is less than to PO2 verb; Therefore correlation is moderate (2). **CO5:Analyze different applications of transmission lines using smith chart.**

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO5 Action Verb 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).

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ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year & Sem		L	T/CLC	P	C
23APC0406	II-II	Electronic Circuits Analysis	2	1	0	3

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

CO1 **Understand** the multi stage amplifiers and differential amplifiers using BJT and MOSFET. CO2**Apply** the hybrid π model for amplifiers using BJT and MOSFET at high frequencies

CO3 **Evaluate** the parameters of four feedback amplifiers and frequency of various oscillators. CO4 **Understand** the principle of operation of different power amplifiers using BJT and MOSFET.

CO5 **Analyze** the operation of three types of tuned amplifiers, multivibrators and Schmitt trigger.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the multi stage amplifiers and differential amplifiers	using BJT and MOSFET		L2
CO2	Apply	the hybrid π model for amplifiers	using BJT and MOSFET at high frequencies		L4
CO3	Evaluate	the parameters of four feedback amplifiers and frequency of various oscillators			L5
CO4	Understand	the principle of operation of different power amplifiers	using BJT and MOSFET		L2
CO5	Analyze	the operation of three types of tuned amplifiers, multivibrators and Schmitt trigger			L4

UNIT I

Multistage & Differential Amplifiers: Introduction, Classification of Amplifiers, Distortion in amplifiers, Coupling Schemes, RC Coupled Amplifier using BJT ,Cascaded RC Coupled BJT Amplifiers, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT Differential Pair, and other Non ideal Characteristics of the Differential Amplifier.

UNIT II

Frequency Response: Low-Frequency Response of the CE and CS Amplifiers, Internal Capacitive Effects and the High- Frequency Model of BJT & MOSFET, High- Frequency Response of the CE, Emitter follower, CS, CD, fβ,fT and gain bandwidth product.

UNIT III

Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies, Series—Shunt, Series—Series, Shunt—Shunt, Shunt—Series.

Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.

UNIT IV

Power Amplifiers: Introduction, Class A amplifiers (Series fed, Transformer coupled, Push pull), Second Harmonic distortion, Class B amplifiers (Push pull, Complementary symmetry),

Crossover distortion and Class AB operation, Class C amplifiers, Power BJTs, MOS power transistors.

UNIT V

Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response, Double Tuned Amplifiers – Q- factor, frequency response, Concept of stagger tuning and synchronous tuning.

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

Textbooks:

1. Adel. S.Sedra and Kenneth C.Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. J.Millman, H.Tauband Mothiki S.Prakash Rao - Pulse Digital and Switching Waveforms –2nd Ed., TMH, 2008.
3. Millman, C Chalkias, "Integrated Electronics", 4th Edition, McGraw Hill Education (India) Private Ltd., 2015.

References:

1. Behzad Razavi, "Fundamentals of Micro Electronics", Wiley, 2010.
2. Donald A Neamen, "Electronic Circuits –Analysis and Design," 3rdEdition, McGraw Hill (India), 2019.
3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson/Prentice Hall, 2006.

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO2
CO1	2	3		1	3								3
CO2	3	3		2	3								3
CO3	3	3		3	3								3
CO4	2	3		1	2								3
CO5	3	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	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	Apply	L3	PO 1, PO 2, PO4, PO5	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze-L4 PO5: Apply (L3)	3 3 2 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 multi stage amplifiers and differential amplifiers using BJT and MOSFET 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: Apply the hybrid π model for amplifiers using BJT and MOSFET at high frequencies Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

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

PO5 Verbs: Apply (L3)

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

CO3: Evaluate the parameters of four feedback amplifiers and frequency of various oscillators. 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 principle of operation of different power amplifiers using BJT and MOSFET. 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 three types of tuned amplifiers, multivibrators and Schmitt trigger.

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).

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Course Code	Year & Sem	Analog and Digital Communications	L	T/CLC	P	C
23APC0407	II-II		2	1	0	3

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

CO1: Understand the basic concepts of Communication systems and different Modulation techniques

CO2: Analyze various methods of Angle modulation and Demodulation techniques in Communication techniques.

CO3:Analyze Various types of AM, FM Transmitters and Radio receivers.

CO4: Understand the types of Noise and different Pulse Modulation methods in Communication systems

CO5: Apply Digital Modulation techniques for Pass band Data Transmission.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO 1	Understand	the basic concepts of communication systems and different modulation techniques			L2
CO 2	Analyze	Various methods of angle modulation and demodulation techniques in communication techniques			L4
CO 3	Analyze	Various types of AM, FM transmitters and radio receivers			L4
CO 4	Understand	The types of noise and different pulse modulation methods in communication systems			L2
CO 5	Apply	digital modulation techniques for pass band data transmission			L3

UNIT I

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

UNIT II

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de- emphasis

UNIT III

Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters

Receivers: Radio Receiver-Receiver Types-Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate

frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

UNIT IV

Introduction to Noise: Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers.

Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, Delta Modulation, DPCM, Noise in PCM and DM.

UNIT V

Digital Modulation Techniques: Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent

BFSK, DPSK. QASK, applications of Digital Modulation techniques. Base band Transmission and Optimal Reception of Digital Signal: A Base band Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

Text books:

1. Simon Haykin, "Communication Systems",JohnWiley&Sons,4thEdition, 2004.
2. Wayne Tomasi -Electronics Communication Systems -Fundamentals through Advanced, 5thEd., PHI, 2009 3.B.P.Lathi,ZhiDing "Modern Digital and Analog Communication Systems",Oxford press, 2011

References:

1. Sam Shanmugam,"Digital and Analog Communication Systems",John Wiley & Sons, 1999.
2. BernardSklar,F.J.harris "Digial Communications: Fundamentals and Applications", Pearson Publications, 2020.
3. Tauband Schilling, "Principles of Communication Systems", Tata McGraw Hill, 2007.
4. Dr.Sanjay Sharma, "Digital Communications", S.K Kataria &Sons, 2015.

ADC AK23

Unit No.	Topics to be deleted	Topics to be included	% of Topics to be deleted	% of Topics to be included
Unit 5	M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency	**QASK, applications of Digital Modulation techniques**	**2%**	**2%**
		Total	**2%**	**2%**

Mapping of COs to POs

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

Correlation matrix:

Unit No.	CO				BTL	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				
1	12	16	2	Understand	L2	PO1,PO2	PO1: Apply(L3) PO2:Identify (L3)	2 2
2	10	16	2	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Identify (L3)	3 3
3	15	23	3	Analyze	L4	PO1, PO2	PO1: Apply(L3) PO2: Identify(L3)	3 3
4	14	22	3	Understand	L2	PO1, PO2	PO1: Apply(L3) PO2: Identify(L3)	2 2
5	14	22	3	Apply	L3	PO1, PO2	PO1: Apply(L3) PO2: Identify (L3)	3 3
	65							

Justification Statements:

CO1: Understand the basic concepts of communication systems and different modulation techniques

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO1 Action Verb is less than to PO1 verb; Therefore, correlation is moderate (2). PO2 Verbs: Identify (L3) CO1 Action Verb is less than to PO2 verb; Therefore, correlation is moderate (2).

CO2: Analyze Various methods of angle modulation and demodulation techniques in communication techniques

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO2 Action Verb is greater to PO1 verb; Therefore, correlation is high (3). PO2 Verbs: Identify (L3) CO2 Action Verb is greater to PO2 verb; Therefore, correlation is high (3). **CO3:Analyze** Various types of AM, FM transmitters and radio receivers.

Action Verb: Analyze (L4)

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

CO4: Understand The types of noise and different pulse modulation methods in communication systems.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO4 Action Verb is less than to PO1 verb; Therefore, correlation is moderate (2). PO2 Verbs: Identify (L3) CO4 Action Verb is less than to PO2 verb; Therefore, correlation is moderate (2). **CO5: Apply** digital modulation techniques for pass band data transmission.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3) CO5 Action Verb is equal to PO1 verb; Therefore, correlation is high (3). PO2 Verb: Identify (L3) CO5 Action Verb is equal to PO2 verb; Therefore, correlation is high (3).

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Course Code	Year & Sem		L	T	P	C
23APC0408	II-II	Electronic Circuits Analysis Lab	0	0	3	1.5

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

CO1 **Analyze** the frequency response of Multistage Amplifier and Differential Amplifier.
CO2 **Evaluate** the parameters of Feedback Amplifiers with and without negative feedback.
CO3 **Analyze** the steps in the design of Oscillators using RC and LC as feedback elements.
CO4 **Evaluate** the % efficiency and frequency response of Class-A and Class-AB Power Amplifiers.
CO5 **Evaluate** the performance of Tuned amplifier, Multivibrators and Schmitt Trigger using BJT.

	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO 1	Analyze	the frequency response of Multistage Amplifier and Differential Amplifier			L4
CO 2	Evaluate	the parameters of Feedback Amplifiers	with and without negative feedback.		L5
CO 3	Analyze	the steps in the design of Oscillators	using RC and LC as feedback elements.		L5
CO 4	Evaluate	the % efficiency and frequency response of Class-A and Class-AB Power Amplifiers			L4
CO 5	Evaluate	performance of Tuned amplifier, Multivibrators and Schmitt Trigger	using BJT		L4

List of Experiments:

1. Design and Analysis of Darlington pair. (CO1)
2. Frequency response of CE– CC multistage Amplifier. (CO1)
3. Design and Analysis of Cascode Amplifier. (CO1)
4. Frequency Response of Differential Amplifier (CO1).
5. Design and Analysis of any two topologies of feedback amplifies and find the frequency response of it.(CO2)
6. Design and Analysis of RC phase shift oscillators. (CO3)
7. Design and Analysis of LC Oscillators. (CO3)
8. Design and Analysis of Class-A power amplifier. (CO4)
9. Design and Analysis of Class-AB amplifier. (CO4)
10. Frequency Response of Single Tuned amplifier. (CO5)
11. Design a Bistable Multivibrator and analyze the effect of commutating capacitors and draw the wave forms at base and collector of transistors. (CO5)
12. Design an Astable Multivibrator and draw the waveforms at base and collector of transistors. (CO5)
13. Design a Monostable Multivibrator and draw the input and output waveforms. (CO5)
14. Draw the response of Schmitt trigger for gain of greater than and less than one. (CO5) Note: At least 12 experiments shall be performed.

Faculty members who are handling the laboratory shall see that students are given design

specifications for a given circuit appropriately and monitor the design and analysis aspects of the circuit.

Mapping of Course Outcomes with Program Outcomes

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

Correlation matrix

Expt. No.	CO					Program Outcome (PO)	PO(s): Action Verb and BTL (for PO1 to PO11)	Level of Correlation (0-3)
	Lesson Plan (Hrs.)	%	Correlation	CO's Action verb	BTL			
1,2,3,4	12	29	2	Analyze	L4	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
5	3	7	3	Evaluate	L5	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 2 3
6,7	6	14	3	Analyze	L4	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
8,9	6	14	3	Evaluate	L5	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 2 3
10,11,12,13,14	15	36	2	Evaluate	L5	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design(L6) PO4: Analyze(L4)	3 3 2 3
	42	100%						

Justification Statements:

CO1: Analyze the frequency response of Multistage Amplifier and Differential Amplifier. Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than 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: Design (L6)

CO1 Action Verb is less than PO3 verb by two levels; Therefore, the correlation is low (1).

PO4 Verbs: Analyze (L4)

CO1 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO2: Evaluate the parameters of Feedback Amplifiers with and without negative feedback. Action Verb: Evaluate (L5)

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).

PO3 Verbs: Design (L6)

CO2 Action Verb is less than PO3 verb by one level; Therefore, the correlation is moderate (2).

PO4 Verbs: Analyze (L4)

CO2 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO3: Analyze the steps in the design of Oscillators using RC and LC as feedback elements. Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO3 Verbs: Design (L6)

CO3 Action Verb is less than PO3 verb by two levels; Therefore, the correlation is low (1).

PO4 Verbs: Analyze (L4)

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

CO4: Evaluate the % efficiency and frequency response of Class-A and Class-AB Power Amplifiers. Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO3 Verbs: Design (L6)

CO4 Action Verb is less than PO3 verb by one level; Therefore, the correlation is moderate (2).

PO4 Verbs: Analyze (L4)

CO4 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

CO5: Evaluate the performance of Tuned amplifier, Multivibrators and Schmitt Trigger using BJT. Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO3 Verbs: Design (L6)

CO5 Action Verb is less than PO3 verb by one level; Therefore, the correlation is moderate (2).

PO4 Verbs: Analyze (L4)

CO5 Action Verb is greater than PO4 verb; Therefore, the correlation is high (3).

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AK23 Regulations
ELECTRONICS COMMUNICATION AND ENGINEERING (ECE)

Course Code	Year &Sem		L	T	P	C
23APC0409	II-II	Analog and Digital Communication systems Lab	0	0	3	1.5

Course Outcomes: After studying the course student will be able to

CO1: Analyze the Analog modulation and demodulation methods in time domain.
CO2: Evaluate the performance of various analog pulse modulation schemes.
CO3: Analyze the process of transmission and reception of signals using Time division multiplexing.
CO4: Analyze the Performance of Delta modulation and demodulation also PCM systems.
CO5: Analyze the Performance of Pass Band Data Transmission Systems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO 1	Analyze	The analog Modulation and demodulation methods in time domain			L4
CO 2	Evaluate	The performance of various analog pulse modulation schemes			L5
CO 3	Analyze	The process of transmission and reception of signals using time domain multiplexing			L4
CO 4	Analyze	The performance of delta modulation and demodulation also PCM systems			L4
CO 5	Analyze	The performance of pass band data transmission systems			L4

List of Experiments:

Design the circuits and verify the following experiments taking minimum of six from each section shown below. Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frequency Division Multiplexing
4. FM Modulation and Demodulation
5. Radio receiver measurements
6. PAM Modulation and Demodulation
7. PWM Modulation and Demodulation
8. PPM Modulation and

Demodulation Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BPSK Modulation and Demodulation
6. BFSK Modulation and Demodulation
7. QPSK Modulation and Demodulation
8. DPSK Modulation and Demodulation

Note: Faculty members (who are handling the laboratory) are requested to instruct the students not to use ready made kits for conducting the experiments. They are advised to make the students work in the laboratory by constructing the circuits and analyzing them during the lab sessions.

Mapping of COs to POs

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

Correlation matrix:

Exp. No	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1,2,3,4,5	15	32	3	Analyze	L4	PO1,PO2,PO3,PO4	PO1: Apply(L3) PO2:Identify (L3) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
6,7,8	9	18	3	Evaluate	L5	PO1,PO2,PO3,PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Design(L6) PO4: Analyze(L4)	3 3 2 3
B 1,2	6	12	3	Analyze	L4	PO1,PO2,PO3,PO4	PO1: Apply(L3) PO2:Identify (L3) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
3,4	6	12	3	Analyze	L4	PO1,PO2,PO3,PO4	PO1: Apply(L3) PO2:Identify (L3) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
5,6,7,8	12	26	3	Analyze	L4	PO1,PO2,PO3,PO4	PO1: Apply(L3) PO2:Identify (L3) PO3: Design(L6) PO4: Analyze(L4)	3 3 1 3
	48	**100 %**						

Justification Statements:

CO1: Analyze the Analog modulation and demodulation methods in time domain

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO1 Action Verb is greater than to PO1 verb; Therefore correlation is high (3). PO2 Verbs: Identify (L3) CO1 Action Verb is greater than to PO2 verb; Therefore correlation is high (3). PO3 Verbs: Design (L6) CO1 Action verb is two less than to PO3 verb; Therefore Correlation is low (1). PO4 verbs: Analyze(L4) CO1 Action verb is equal to PO4 verb; Therefore correlation is high(3)

CO2: Evaluate the performance of various analog pulse modulation schemes.

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3) CO2 Action Verb is greater than to PO1 verb; Therefore

correlation is high (3). PO2 Verbs: Identify (L3) CO2 Action Verb is greater than to PO2 verb; Therefore correlation is high (3).
PO3 Verbs: Design (L6) CO2 Action verb is one less than to PO3 verb; Therefore Correlation is moderate (2). PO4 verbs: Analyze(L4) CO2 Action verb is greater to PO4 verb; Therefore correlation is high(3)

CO3: Analyze the process of transmission and reception of signals using Time division multiplexing.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO3 Action Verb is greater than to PO1 verb; Therefore correlation is high (3). PO2 Verbs: Identify (L3) CO3 Action Verb is greater than to PO2 verb; Therefore correlation is high (3). PO3 Verbs: Design (L6) CO3 Action verb is two less than to PO3 verb; Therefore Correlation is low (1). PO4 verbs: Analyze(L4) CO3 Action verb is equal to PO4 verb; Therefore correlation is high(3)

CO4: Analyze the Performance of Delta modulation and demodulation also PCM systems.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO4 Action Verb is greater than to PO1 verb; Therefore correlation is high (3). PO2 Verbs: Identify (L3) CO4 Action Verb is greater than to PO2 verb; Therefore correlation is high (3). PO3 Verbs: Design (L6) CO4 Action verb is two less than to PO3 verb; Therefore Correlation is low (1). PO4 verbs: Analyze(L4) CO4 Action verb is equal to PO4 verb; Therefore correlation is high(3)

CO5: Analyze the Performance of Pass Band Data Transmission Systems.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO5 Action Verb is greater than to PO1 verb; Therefore correlation is high (3). PO2 Verbs: Identify (L3) CO5 Action Verb is greater than to PO2 verb; Therefore correlation is high (3). PO3 Verbs: Design (L6) CO5 Action verb is two less than to PO3 verb; Therefore Correlation is low (1). PO4 verbs: Analyze(L4) CO5 Action verb is equal to PO4 verb; Therefore correlation is high(3)

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

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

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 theoretical 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 behaviour in workplace environment.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom s 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. MitraBarun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr ShikhaKapoor, 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, RenuShorey) 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)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
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 PO11)	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).

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

Subject Code	Subject Name	L	T	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	Bloom s Level
CO1	Understand	the concepts and principles of design thinking process.			L1
CO2	Apply	the design thinking techniques for solving problems in various sectors.			L3
CO3	Analyze	the art of innovation & creativity in product development.			L4
CO4	Apply	the design guidelines for produced development.			L3
CO5	Analyze	the design thinking strategies for solving real time business issues.			L4

Unit I:

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit II

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit III

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit IV

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit V

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Text Books:

1. TimBrown, Change by design, Harper Bollins(2009)
2. IdrisMootee, Design Thinking for Strateg ic Innovation, 2013,JohnWiley&Sons.

Reference Books:

1. DavidLee, Design Thinking in the Classroom, Ulysses press
2. ShrutinN Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design-Kritinaholden,JillButter.
4. Chesbrough. H, The Era of OpenInnovation–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)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO 2
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. PO1Verb: **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)
PO1Verb: **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)
PO1Verb: **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 CO4co-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) PO1Verb: **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)

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Year: II B.Tech Semester: II AK 23 Regulations Branch: Common to All

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

Course Outcomes (CO): Student will be able to
1. Understand the multidisciplinary nature of environmental studies and various renewable and non renewable 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 waste land 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.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PS O 2
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)
AK23-REGULATIONS
B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING
B.Tech.– III Year I Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PC	23APC0410	Analog and Digital IC Applications	2	1	0	3	30	70	100
2	PC	23APC0411	Antennas & Wave Propagation	2	1	0	3	30	70	100
3	PC	23APC0412	Microprocessors and Microcontrollers	2	1	0	3	30	70	100
4	ES	23AES0504	Introduction to Quantum Technology and Applications	2	1	0	3	30	70	100
4	PE	23APE0401	**Professional Elective-I** Computer Architecture & Organization	2	1	0	3	30	70	100
		23APE0402	Information theory and coding							
		23APE0403	Detection and Estimation Theory							
	OE		***Open Elective-I**	2	1	0	3	30	70	100
6	PC	23APC0413	Analog & Digital IC Applications Lab	0	0	3	1.5	30	70	100
7	PC	23APC0414	Microprocessors and Microcontrollers Lab	0	0	3	1.5	30	70	100
8	SC	23ASC0401	**Skill oriented course -III** PCB Design and Prototype development.	0	1	2	2	30	70	100
9	ES	23AES0404	Tinkering Lab	0	0	2	1	30	70	100
10	PR	23APR0401	Community Service Project	-	-	-	2	100	-	100
			Total	12	7	10	26	400	700	1100

Open Elective – I

S. No.	Course Code	Course Name	Offered by the Dept.
1	23AOE0101	Green Buildings	CIVIL
2	23AOE0102	Construction Technology and Management	
3	23AOE0201	Electrical Safety Practices and Standards	EEE
4	23AOE0301	Sustainable Energy Technologies	ME
5	23AOE0501	Java Programming	CSE& Allied/IT
6	23AOE0502	Introduction to Artificial Intelligence	
7	23AOE0503	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	23AOEMB01	Entrepreneurship and New Venture Creation	MBA

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ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	ANALOG AND DIGITAL IC APPLICATIONS	L	T/CLC	P	C
23APC0410	III-I		2	1	0	3

Course Outcomes: Students should be able to
CO1: Understand the classification of ICs and characteristics of Op-Amp.
CO2: Analyze the linear and nonlinear applications of Op-Amp
CO3: Analyze the operation of Active filters, 555 Timer and PLL.
CO4: Analyze the operations of voltage regulators, A/D and D/A converters.
CO5: Understand the different types of Digital ICs and their applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the classification of ICs and characteristics of Op-Amp			L4
CO2	Analyze	the linear and nonlinear applications of Op-Amp			L3
CO3	Analyze	the operation of Active filters, 555 Timers, and PLL			L4
CO4	Analyze	operations of voltage regulators, A/D and D/A converters			L5
CO5	Understand	the different types of Digital ICs and their applications			L4

UNIT - I	**ICs and OP-AMPS**	21Hrs

Integrated Circuits and Operational Amplifier
Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Features of 741 Op-Amp.

UNIT - II	**Applications of OP-AMP**	12Hrs

Linear Applications of Op-Amp
Inverting, non-inverting, Differential amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.

Non-Linear Applications of Op-Amp

Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multi vibrators, Triangular and Square waveform generators, Oscillators.

UNIT - III	**Active Filters and other ICs**	19Hrs

Active Filters
Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.
Timer and Phase Locked Loops
Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - Introduction, basic principle, phase detector/comparator, voltage controlled oscillator(IC566), low pass filter, monolithic PLL and applications of PLL.

UNIT - IV	**Voltage Regulators and Converters**	12Hrs

Voltage Regulator

Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.
D to A and A to D Converters
Introduction, basic DAC techniques-weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC,
A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

UNIT - V	**Digital ICs**	11Hrs

CMOS Logic
CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.
Combinational Logic IC's
Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders,

Encoders, Priority Encoders, Multiplexers, Demultiplexers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

Sequential Logic IC's

Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Textbooks:

1. D.Roy Choudhury, Shail B.Jain,—LinearIntegratedCircuit‖,4th edition (2012), New Age International Pvt. Ltd., New Delhi, India
2. Floyd, Jain,—Digital Fundamentals, 8thedition(2009),Pearson Education, New Delhi.

Reference Books:

1. Ramakant A. Gayakwad- OP-AMP and Linear Integrated Circuits‖,4th edition(2012), Prentice Hall / Pearson Education, New Delhi.
2. Sergio Franco(1997),Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
3. Gray, Meyer(1995),Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

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	2									2	
CO2	3	3	3									3	
CO3	3	3	3	3								3	
CO4	3	3	3									3	
CO5	2	3	2									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	12	13%	2	Understand	L2	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3)	2 2 2
2	17	19%	2	Analyze	L4	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3)	3 3 3
3	18	20%	2	Analyze	L4	PO1 PO2 PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
4	19	21%	3	Analyze	L4	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
5	24	27%	3	Understand	L2	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3	2 3 2
	90	100 %						

Justification Statements:

CO1: Understand the classification of IC's and characteristics of Op-Amp

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: Analyze the Multivibrator circuits using IC555, A/D and D/A converters.
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: Identify (L3) CO2 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).
PO3 Verbs: Develop (L3) CO2 Action Verb is greater than PO3 verb by one level; Therefore correlation is high (3)

CO3: Analyze the operation of various filters, oscillators and waveform generators using Op-amp
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verb: Identify (L3) CO3 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).
PO3 Verb: Develop (L3) CO3 Action Verb is greater than PO3 verb by one level; Therefore correlation is high (3).
PO4 Verb: Analysis (L4) CO3 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

CO4: Analyze the operation of various filters, oscillators and waveform generators using Op-amp
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 Verb: Identify (L3) CO4 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).
PO3 Verb: Develop (L3) CO4 Action Verb is greater than PO3 verb by one level; Therefore correlation is high (3).
PO4 Verb: Analysis (L4) CO4 Action Verb is equal to PO4 verb; Therefore correlation is high (3).

CO5: Understand the logic families of integrated circuits using TTL and CMOS
Action Verb: Understand (L2)

PO1 Verb: Apply (L3) CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 verb: Review (L2) CO5 Action verb is equal to PO2 verb therefore the correlation is high (3).
PO3 verb: Develop (L3) CO5 Action verb is less than PO3 verb by one level: Therefore the correlation is moderate (2).

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AK 23 REGULATIONS

Course Code	Year & Sem	ANTENNAS & WAVE PROPAGATION	L	T/CLC	P	C
23APC0411	III-I		2	1	0	3

Course Outcomes: Students should be able to
CO1: Understand the fundamentals of Antenna Parameters & Dipole Antennas.
CO2: Analyze the working principles of HF, VHF and UHF antennas and their applications.
CO3: Analyze the working principles of Micro-strip antenna, Reflector, Lens antennas.
CO4: Analyze the Principles of Antenna Arrays and Measurements using pattern multiplication.
CO5: Understand the different modes of Wave propagation and their characteristics in Atmospheric Layers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamentals of Antenna Parameters & Dipole Antennas.			L2
CO2	Analyze	the working principles of HF, VHF and UHF antennas and their applications.			L4
CO3	Analyze	the working principles of Micro-strip antenna, Reflector, Lens antennas.			L4
CO4	Analyze	the Principles of Antenna Arrays and Measurements using pattern multiplication.			L4
CO5	Understand	the Different Modes of Wave propagation and their characteristics.	in Atmospheric Layers.		L2

UNIT - I		17Hrs
Antenna Basics & Dipole antennas: Definition of antenna, Radiation Mechanism –single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Antenna Theorems. Radiation – Basic Maxwell's equations, Retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.		
UNIT - II		16Hrs
HF, VHF and UHF Antennas: Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics. Log periodic Antenna, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat's Principle, Optimum Horns, Design considerations of Pyramidal Horns, Illustrative Problems.		
UNIT - III		15Hrs
Microwave Antennas: Microstrip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameters on characteristics, reflector antennas - Introduction, Flat sheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types-Related Features, Lens Antennas -Geometry of Non-metallic Dielectric Lenses, Zoning, Tolerances, Applications, Illustrative Problems.		
UNIT - IV		15Hrs
Antenna Arrays: Point sources - Definition, Patterns, arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, End fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSAa with Non-uniform Amplitude Distributions - General considerations and Bionomial Arrays, Illustrative problems. **Antenna Measurements:** Introduction, Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).		
UNIT - V		14Hrs
Wave Propagation: Introduction, Definitions, Characterizations and general classifications, different modes of wave propagation, Ray/Mode concepts, Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wave tilt, curved earth reflections, Space wave propagation - Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations, Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-		

HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges, Illustrative problems.
Textbooks:
ohn D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, "Antennas and wave propagation", TMH, New Delhi, 4th Ed., 2010. .A. Balanis, "Antenna Theory- Analysis and Design‖", John Wiley & Sons, 2nd Edn.,2001. 3. K.D. Prasad and Satya Prakashan, "Antennas and Wave Propagation"' New Delhi, Tech. India Publications, 2001
Reference Books:
1. E.C. Jordan and K. G. Balmain, "Electromagnetic Waves and Radiating Systems" 2nd Edition, PHI, 2000. .S.N Raju, "Antenna and Wave Propagation", Pearson Education India,3rdEdition 2009. K Shevgaonkar, "Electromagnetic Waves".Tata Mc Graw-Hill,2006
Online Learning Resources:
https://archive.nptel.ac.in/courses/108/101/108101092/ https://nptel.ac.in/courses/117107035

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	3							2	3	
CO3	3	3	3	3							2	3	
CO4	3	3	3	3							2	3	
CO5	2	2	2	1							2	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	17	22	3	Understand	L2	PO1, PO2, PO3, PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO11:Thumb rule	2 3 2 2
2	16	21	3	Analyze	L4	PO1,PO2,PO3,PO4,PO11	PO1:Apply(L3) PO2:Review(L2) PO3:Develop(L3) PO4:Interpret(L2). PO11:Thumb rule	3 3 3 3 2
3	15	19	2	Analyze	L4	PO1,PO2,PO3,PO4,PO11	PO1:Apply(L3) PO2:Identify(L3) PO3:Develop(L3) PO4:Analyze(L4) PO11:Thumb rule	3 3 3 3 2
4	15	19	2	Analyze	L4	PO1,PO2,PO3,PO4,PO11	PO1:Apply(L3) PO2:Identify(L3) PO3:Develop(L3) PO4:Analyze(L4) PO11:Thumb rule	3 3 3 3 2
5	14	19	2	Understand	L2	PO1,PO2,PO3,PO4,PO	PO1:Apply(L3) PO2:Identify(L3)	2 2
						11	PO3:Develop(L3) PO4:Analyze(L4) PO11:Thumb rule	2 1 2
	77							

Justification Statements:

CO1: Understand the fundamentals of Antenna Parameters & Dipole Antennas.

Action verb: Understand(L2)

PO1 Verbs: Apply(L3) CO1 Action Verb is less than PO1verb by one level; Therefore correlation is moderate (2).

PO2 Verbs: Review(L2) CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

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

PO11 Verbs: Based on the Thumb rule CO1correlates PO11 correlation is moderate(2).

CO2: Analyze the working principles of VHF and UHF antennas and their applications.

Action verb: Analyze(L4)

PO1 Verbs: Apply(L3) CO2 Action Verb is higher than PO1 verb by one level; Therefore correlation is (3).

PO2 Verbs: Review(L2) CO2 Action Verb is higher than PO2 verb by two level; Therefore correlation is High (3).

PO3 Verbs: Develop(L3) CO2 Action Verb is higher than PO3 verb by one level; Therefore correlation is High (3).

PO4 Verbs: Interpret(L2) CO2 Action Verb is higher than PO4 verb by two level; Therefore correlation is High (3).

PO11Verbs: Based on the Thumb rule CO2 correlates PO11 correlation is moderate(2).

CO3: Analyze the working principles of Micro-strip antenna, Reflector, Lens antennas.

Action verb: Analyze(L4)

PO1 Verbs: Apply(L3) CO3 Action Verb is higher than PO1 verb by one level; Therefore correlation is (3).

PO2 Verbs: Review(L2) CO3 Action Verb is higher than PO2 verb by two level; Therefore correlation is High (3).

PO3 Verbs: Develop(L3) CO3 Action Verb is higher than PO3 verb by one level; Therefore correlation is High (3).

PO4 Verbs: Analyze(L4) CO3 Action Verb is equal to PO4 verb; Therefore correlation is High (3).

PO11 Verbs: Based on the Thumb rule CO3 correlates PO11 correlation is moderate(2).

CO4: Analyze the Principles of Antenna Arrays and Measurements using pattern multiplication

Action verb: Analyze(L4)

PO1 Verbs: Apply(L3) CO4 Action Verb is higher than PO1 verb by one level; Therefore correlation is (3).

PO2 Verbs: Review(L2) CO4 Action Verb is higher than PO2 verb by two level; Therefore correlation is High (3).

PO3 Verbs: Develop(L3) CO4 Action Verb is higher than PO3 verb by one level; Therefore correlation is High (3).

PO4 Verbs: Analyze(L4) CO4 Action Verb is equal to PO4 verb; Therefore correlation is High (3).

PO11Verbs: Based on the Thumb rule CO4 correlates PO11 correlation is moderate(2).

CO5: Understand the Different Modes of Wave propagation and their characteristics in Atmospheric Layers.

Action verb: Understand(L2)

PO1 Verb: Apply(L3) CO5 Action verb is less than to PO1 verb by one level; therefore the correlation is moderate (2).

PO2 Verb: Identify(L3) CO5 Action Verb level is less than to PO2 verb by one level; therefore the correlation is moderate(2).

PO3 Verb: Develop(L3) CO5 Action verb is less than to PO3 verb by one level; therefore the correlation is moderate (2).

PO4 Verb: Analyze(L4) CO5 Action verb is less than to PO3 verb by two level; therefore the correlation is low (1).

PO11 Verbs: Based on the Thumb rule CO5 correlates PO11, correlation is moderate(2).

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(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS
COMMON TO ECE/ III-II EEE

Course Code	Year & Sem		L	T/CLC	P	C
23APC0412	III-I	MICROPROCESSORS AND MICROCONTROLLERS	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)
ELECTRONICS AND COMMUNICATION 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
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)
ELECTRONICS AND COMMUNNICATION ENGINEERING

Course Code	Year & Sem	COMPUTER ARCHITECTURE & ORGANIZATION	L	T/CLC	P	C
23APE0401	III-I		2	1	0	3

Course Outcomes:

After studying the course, student will be able to

CO1: **Analyze** digital computer structure, micro-operations, and basic computer organization.
CO2: **Understand** the microprogrammed control and CPU organization.
CO3: **Apply** data representation and arithmetic algorithms in computer systems.
CO4: **Analyze** the different types of memory and their interconnections.
CO5: **Understand** the basics of parallel computing and pipelining.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Analyze	digital computer structure, micro-operations, and basic computer organization.			L4
CO2	Understand	the microprogrammed control and CPU organization.			L2
CO3	Apply	data representation and arithmetic algorithms		in computer systems.	L3
CO4	Analyze	the different types of memory and their interconnections.			L4
CO5	Understand	the basics of parallel computing and pipelining.			L2

UNIT – I	**12 Hrs**
Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture**.** **Register Transfer Language and Micro operations:** Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit. **Basic Computer Organization and Design:** Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.	
UNIT – II	**9 Hrs**
Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit. **Central Processing Unit:** General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.	
UNIT – III	**9 Hrs**
Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation. **Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.	
UNIT – IV	**9 Hrs**
Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access. **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.	
UNIT – V	**13 Hrs**
Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor. Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.	
Textbooks:	
1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.	
Reference Books:	
1. Computer Organization – Car Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill. 2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI. 3. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.	

Mapping of course outcomes with program outcomes

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

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	12			CO1: Analyze	L4	PO1 PO2 PO3	PO1: Apply(L3) PO2: Analyze(L4) PO3: Design (L6)	3 3 1
2	9			CO2: Understand	L2	PO1 PO2 PO10 PO11	PO1: Apply (L3) PO2: Analyze (L4) PO10: Thumb Rule PO11: Thumb Rule	2 1 2 2
3	9			CO3: Apply	L3	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	3 2
4	9			CO4: Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Analyze(L4)	3 3
5	13			CO5: Understand	L2	PO1 PO2 PO10 PO11	PO1: Apply(L3) PO2: Analyze(L4) PO10: Thumb Rule PO11: Thumb Rule	2 1 2 2
		100 %						

Justification Statements:

CO1: Analyze digital computer structure, micro-operations, and basic computer organization.

Action Verb: Analyze(L4)

PO1 Verb: Apply(L3)

CO1 Action verb is Greater than PO1. Therefore, the correlation is high (3)

PO2 Verb: Analyze(L4)

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

PO3 Verb: Design(L6)

CO1 Action verb is less than PO3 verb by two level. Therefore, the correlation is low (1)

CO2: Understand the microprogrammed control and CPU organization.

Action Verb: Understand (L2)

PO1: Apply(L3)

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

PO2: Analyze(L4)

CO2 Action verb is less than PO2 verb by two level. Therefore, the correlation is low (1)

PO10: Thumb Rule

simulate CPU components such as microprogrammed control units and register operations, and explain their execution to demonstrate practical understanding. Therefore, the correlation is moderate (2)

PO11: Thumb Rule

Implement microprogrammed control logic and present execution flow.. Therefore, the correlation is moderate (2)

CO3: Apply data representation and arithmetic algorithms in computer systems.

Action Verb: Apply(L3)

PO1: Apply (L3)

CO3 Action verb is same level as PO1. Therefore, the correlation is high (3)

PO2: Analyze (L4)

CO3 Action verb is less than PO2 verb by one level. Therefore, the correlation is moderate (2)

CO4: **Analyze** the different types of memory and their interconnections.
PO1: Apply(L3)
CO4 Action verb is greater than PO1. Therefore, the correlation is high (3)
PO2: Analyze(L4)
CO4 Action verb is same level as PO2 verb. Therefore, the correlation is High (3)

CO5: Understand the basics of parallel computing and pipelining.
Action Verb: Create (L6)
PO1 Verb: Apply(L3)
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is moderate (2)
PO2 Verb: Analyze(L4)
CO5 Action verb is less than PO1 verb by two level. Therefore, the correlation is low (1)
PO10: Thumb Rule
Design or simulate pipelined and parallel processor components and explain their performance benefits
Therefore, the correlation is moderate (2)
PO11: Thumb Rule
Design and analyze RISC/CISC and multiprocessor systems. Therefore, the correlation is moderate (2)

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

Course Code	Year & Sem	INFORMATION THEORY AND CODING	L	T/CLC	P	C
23APE0402	III-I		2	1	0	3

Course Outcomes:

CO1: Understand the concepts of information theory and source codes in communication system.
CO2: Analyze the various source coding algorithms and their performances.
CO3: Apply various error control techniques for error detection and error correction.
CO4: Analyze the encoding and decoding process of linear block codes and cyclic codes.
CO5: Evaluate the error detection and correction using convolutional codes.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concepts of information theory and source codes in communication system.			L2
CO2	Analyze	the various source coding algorithms and their performances.			L4
CO3	Apply	various error control techniques for error detection and error correction.			L3
CO4	Analyze	the encoding and decoding process of		linear block codes and cyclic codes.	L4
CO5	Evaluate	The error detection and error correction		Using Convolutional code.	L5

UNIT - I		21Hrs
Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving. **Block to Variable length Coding:** Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Codelength, CodingaSingle Random Variable, Rooted Tree with Probabilities, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example. **Variable to Block Length Coding:** Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.		
UNIT - II		12Hrs
Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving. **Universal Source Coding:** Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding. Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.		
UNIT - III		19Hrs
Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.		
UNIT - IV		12Hrs
Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.		
UNIT - V		11Hrs
Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.		
Textbooks:		

Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons,2nd Edition,2006. Herbert Taub, Donald L Shilling, Goutam Saha, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.
Reference Books:
ShuLin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.
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	2		2								
CO2	3	3	3	3	3								
CO3	3	3	3	2	3								
CO4	3	3	3	3	3								
CO5	3	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, PO3,PO5	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO5: Apply (L3)	2 2 2 2
2	**12**	16%	2	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	**19**	**25%**	**2**	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	**12**	**16%**	**3**	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
5	**11**	**15%**	**2**	Evaluate	**L5**	PO1,PO2, PO3,PO4, PO5	PO1: Apply (L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
	75	**100 %**						

Justification Statements:

CO1: Understand the concepts of information theory and source codes in communication system.
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).

PO5 Verbs: Apply (L3)

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

CO2: Analyze the various source coding algorithms and their performances.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Identify (L3)
CO2 Action Verb is greater than PO2 verb ; Therefore correlation is high (3).
PO3 Verbs: Develop (L3)
CO2 Action Verb is greater than PO3 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; Therefore correlation is high (3).
PO5 Verbs: Apply (L3)
CO2 Action Verb is greater than PO5 verb; Therefore correlation is high (3).
CO3: Apply various error control techniques for error detection and error correction.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Review (L2)
CO3 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO3 Action Verb is equal to PO3 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO3 Action Verb is less than PO4 verb by one level; Therefore correlation is moderate (2).
PO5 Verbs: Apply (L3)
CO3 Action Verb is equal to PO5 verb; Therefore correlation is high (3).
CO4: Analyze the encoding and decoding process of linear block codes and cyclic codes.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO4 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO4 Action Verb is greater than PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb is equal to PO4 verb; Therefore correlation is high (3).
PO5 Verb: Apply (L3)
CO4 Action Verb is greater than PO5 verb; Therefore correlation is high (3).
CO5: Evaluate the error detection and correction using convolutional codes.
Action Verb: Evaluate (L5)
PO1 Verb: Apply (L3)
CO5 Action verb is greater to 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 verb: Develop (L3)
CO5 Action verb is greater than PO3 verb ; therefore the correlation is high (3).
PO4 verb: 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 correlation is high (3).

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

Course Code	Year & Sem	DETECTION AND ESTIMATION THEORY	L	T/CLC	P	C
23APF0403	III-I		2	1	0	3

Course Outcomes: Students will be able to

CO1: Understand the Impact of White Gaussian noise on the detection of signals.

CO2: Analyze the detection of deterministic signals and random signals

CO3: Understand the non-parametric detections of signals by using various detectors.

CO4: Apply suitable Estimation techniques for signal parameters.

CO5: Analyze the signal estimation in Discrete-time techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	e Impact of White Gaussian noise on the detection of signals.			L2
CO2	Analyze	e detection of deterministic signals and random signals			L4
CO3	Understand	the non-parametric detections of signals		by using various detectors.	L2
CO4	Apply	suitable Estimation techniques		signal parameters	L3
CO5	Analyze	e signal estimation	in Discrete-time techniques.		L4

UNIT - I		21Hrs
Statistical Decision Theory: Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete-time domain. Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.		
UNIT - II		12Hrs
Detection of Deterministic Signals: Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model. **Detection of Random Signals:** Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection		
UNIT - III		19Hrs
Nonparametric Detection: Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.		
UNIT - IV		12Hrs
Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.		
UNIT - V		11Hrs
Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.		
Textbooks:		
1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968. 2. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.		
Reference Books:		

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.

Online Learning Resources:

NPTEL Videos

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		2										
CO2	3	3	3										
CO3	2		2	3									
CO4	3	3	3										
CO5	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 PO3	PO1: Apply (L3) PO3: Develop(L3)	2 2
2	12	16 %	2	Analyze	L4	PO1 PO2 PO3	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop(L3)	3 3 3
3	19	25 %	2	Understand	L2	PO1 PO3 PO4	PO1: Apply(L3) PO3: Develop(L3) PO4: Interpret(L2)	2 2 3
4	12	16 %	3	Apply	L3	PO1 PO2 PO3	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop(L3)	3 3 3
5	11	15 %	2	Analyze	L4	PO1 PO2 PO4	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze (L4)	3 3 3
	75	100 %						

Justification Statements:

CO1: Understand the Impact of White Gaussian noise on the detection of signals

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO1 Action Verb is lessthan PO1 verb by one level. Therefore, the correlation is moderate (2)

PO3 Verbs: Develop (L3)CO1 Action Verb is lessthan PO1 verb by one level. Therefore, the correlation is moderate (2)

CO2: Analyze the detection of deterministic signals and random signals

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3), CO2 Action Verb is greater than PO1 verb by one level. Therefore, the correlation is high (3).

PO2 Verbs: Identify(L2), CO2 Action Verb is greater than PO1 verb by two level. Therefore, the correlation is high (3).

PO3 Verbs: Develop (L3), CO2 Action Verb is greater than PO1 verb by one level. Therefore, the correlation is high (3).

CO3: Understand the non parametric detections of signals by using various detectors.
Action Verb: Understand(L2)
PO1 Verbs: Apply (L3), CO3 Action Verb is less than the PO1 verb by one level. Therefore, the correlation is moderate(2).
PO3 Verb: Develop(L3) CO3 Action Verb is less than PO3 verb by one level. Therefore, the correlation is moderate(2).
PO4 Verb: Interpret(L2) CO3 Action Verb is equal to PO4 verb. Therefore, the correlation is High(3)

CO4: Apply suitable Estimation techniques for signal parameters.
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), CO4 Action Verb is equal to PO1 verb. Therefore, the correlation is high (3).
PO3 Verb: Develop (L3), CO4 Action Verb is equal to PO1 verb. Therefore, the correlation is high (3).

CO5: Analyze the signal estimation in Discrete-time techniques.
Action Verb: Analyze (L4)
PO1: Apply(L3),CO5 Action verb is greater than the PO1 verb by one level. Therefore, the correlation is high (3).
PO2: Identify(L3),CO5 Action verb is greater than the PO2 verb by one level . Therefore, the correlation is high (3).
PO4: Analyze(L4),CO5 Action verb is equal to PO2 verb. Therefore, the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)

AK23-REGULATIONS

B. Tech III Year I Semester

Course Code	Course Title	L	T	P	Credits
23APC0413	ANALOG AND DIGITAL IC APPLICATIONS LABORATORY	0	0	3	1.5

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

CO1: Design an Inverting and Non-Inverting Amplifier using an Op-amp.
CO2: Analyze the Linear and Non-linear applications using an Op-amp.
CO3: Design Astable and Monostable Multivibrators using Timer ICs.
CO4: Analyze the IC Voltage Regulators, DAC and ADC converters.
CO5: Design Counters and Registers using digital ICs.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
1.	Design	an Inverting and Non-Inverting Amplifier	using an Op-amp.		**L6**
2.	Analyze	the Linear and Non-linear applications	using an Op-amp.		**L4**
3.	Design	Astable and Monostable Multivibrators	Timer ICs		**L6**
4.	Analyze	the IC Voltage Regulators, DAC and ADC converters.			**L4**
5	Design	Counters and Registers using digital ICs	Using Digital ICs		**L6**

List of Experiments:(Atleast 8 linear and 4 Digital IC experiments shall be performed)

1. Design an Inverting and Non-inverting Amplifier using Op-Amp and calculate gain.(CO1)
2. Design Adder and Subtractor using Op-Amp and verify addition and subtraction process.(CO2)
3. Design a Comparator using Op-Amp and draw the comparison results of A=B,A>B,A<B (CO2)
4. Design a Integrator and Differentiator Circuits using IC741 and derive the required condition practically. (CO2)
5. Design a Active LPF, HPF cutoff frequency of 2 KHZ and find the rolloff of it. (CO2)
6. Design a Circuit using IC741 to generate sine/square/triangular wave with period of 1KHZand draw the output waveform. (CO2)
7. Construct Mono-stable Multivibrator using IC555 and draw its output waveform. (CO3)
8. Construct Astable Multivibrator using IC555 and draw its output waveform and also find its duty cycle. (CO3)
9. Design a Schmitt Trigger Circuit and find its LTP and UTP. (CO2)
10. Design Voltage Regulator using IC723, IC7805/7809/7912 and find its load regulation factor. (CO4)
11. Design R-2R ladder DAC and find its resolution and write a truth table with respective voltages. (CO4)
12. Design Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency. . (CO4)
13. Design a 8x1multiplexer using digital ICs. (CO5)
14. Design a 4-bit Adder/Subtractor using digital ICs (CO5)
15. Design a Decade counter and verify its truth table and draw respective waveforms. (CO5)
16. Design a Up/down counter using IC74163 and draw read/write waveforms. (CO5)
17. Design a Universal shift register using IC 74194/195 and verify its shifting operation (CO5)
18. Design a 8x3 encoder/3x8 decoder and verify its truth table. (CO5)

Mapping of Course Outcomes with Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3									3
CO2	3	3	3	3									3
CO3	3	3	3	3									3
CO4	3	3		3									3
CO5	3		3	3									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	3	6%		Design	L6	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
2,3,4,5,6,9	18	33%	3	Analyze	L4	PO1, PO2, PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
7,8	6	11 %	1	Design	L6	PO1, PO2, PO3 PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
10,11,12	9	17 %	2	Analyze	L4	PO1, PO2, PO4	PO1: Apply(L3) PO2: Identify (L3) PO4: Analyze(L4))	3 3 3
13,14,15,16,17,18	18	33 %	3	Design	L6	PO1, PO3, PO4	PO1: Apply(L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3
	54	100 %						

Justification Statements:

CO1: Design an Inverting and Non Inverting Amplifier using an Op-amp.
Action Verb: Design(L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Identify (L3)
CO1 Action Verb is higher than the PO2 verb. Therefore, the correlation is high (3).

PO3 Verbs: Develop(L3)
CO1 Action Verb is more than the PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze(L4)
CO1 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

CO2: Analyze the Linear and Non-linear applications using an Op-amp.
Action Verb: Analyze(L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Identify (L3)
CO2 Action Verb is higher than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop(L3)
CO2 Action Verb is more than the PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze(L4)

CO2 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

CO3: Design Astable and Monostable Multivibrators using Timer ICs.

Action Verb: Design(L6)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Identify (L3)

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

PO3 Verbs: Develop(L3)

CO3 Action Verb is more than the PO3 verb. Therefore, the correlation is high (3).

PO4 Verbs: Analyze(L4)

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

CO4: Analyze the IC Voltage Regulators, DAC and ADC converters.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO2 Verb: Identify (L3)

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

PO4 Verbs: Analyze(L4)

CO4 Action Verb is more than the PO4 verb. Therefore, correlation is high (3).

CO5: Design Counters and Registers using digital ICs.

Action Verb: Design(L4)

PO1 Verbs: Apply (L3)

CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO3 Verb: Develop(L3)

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

PO4 Verbs: Analyze(L4)

CO4 Action Verb is more than the PO4 verb. Therefore, correlation is high (3).

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

Course Code	Year & Sem	MICROPROCESSORS AND MICROCONTROLLERS LAB	L	T	P	C
23APC0414	III-I		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/Stepsignal.

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) PO4: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)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	PCB DESIGN AND PROTOTYPE DEVELOPMENT	L	T	P	C
23ASC0401	III-I		0	1	2	2

Course Outcomes:
CO1: Understand the electronic components, schematic diagrams, PCB layers, and design rules
CO2: Understand the concepts of PCB design and Electronic Design Automation (EDA)Tools.
CO3: Analyze the steps involved in different stages of PCB design for Circuits using CAD Tools.
CO4: Analyze the steps involved in Schematic and Layout designs for fabrication of PCB circuits.
CO5: Evaluate various analog and digital PCB circuits for prototype development using different ICs.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the electronic components, schematic diagrams, PCB layers, and design rules			L2
CO2	Understand	Understand the concepts of PCB design and Electronic Design Automation (EDA)Tools.	EDA Tools		L2
CO3	Analyze	Analyze the steps involved in different stages of PCB design for Circuits using CAD Tools.	CAD Tools	for the given PCB Layout specifications	L4
CO4	Analyze	the steps involved in Schematic and Layout designs for fabrication of PCB circuits			L4
CO5	Evaluate	various analog and digital PCB circuits for prototype development using different ICs.		ICs	L5

UNIT - I

Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, Creating new PCB, Browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT - II

Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA)tools and comparison.

UNIT - III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards.

UNIT -IV

ctice following PCB Design steps

- Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Netlist generation.
- Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic.
- Create new schematic components.
- Create new component footprints.

T-V

ctice Exercises: Any twelve experiments are to be done

1. Regulator circuit using 7805

2. Inverting Amplifier or Summing Amplifier using op-amp
3. Full-wave Rectifier
4. Astable multivibrator using IC555
5. Monostable multivibrator using IC555
6. RC Phase-shifter oscillator using transistor.
7. Wein-bridge Oscillator using op- amp
8. Full-Adder using half-adders.
9. 4-bit binary /MOD N counter using D-Flip flops.
10. One open-ended (analog/ digital/mixed circuit) experiments of similar nature and magnitude to the above are to be assigned by the teacher
(Student is expected to solve and execute/simulate independently).
11. Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor, headers, LED.
12. Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector,Jumper, LEDs
13. Design an 8051 Development board having Reset & Input/output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors
14. Fabricate a single-sided PCB, mount the components and assemble them in a cabinet for any on of the circuits mentioned in the above exercises.

Reference Books:

1. Jon Varteresian, Fabricating Printed Circuit Boards, *z*, 2002.
2. R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001.
3. C. Robertson. PCB Designer´s Reference. Prentice Hall, 2003

Online Learning Resources:

1. Open-source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/ 13.
PCB Fabrication user guide page:
2. http://www.wikihow.com/Create-Printed-Circuit-Boards
3. http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/
4. http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself
5. PCB Fabrication at home(video):
https://www.youtube.com/watch?v=mv7Y0A9YeUc ,
https://www.youtube.com/watch?v=imQTCW1yWkg

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

Correlation Matrix

CO	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	Understand	L2	PO1 PO2 PO3	PO1: Apply[L3] PO2: Review[L2] PO3: Develop[L3]	2 3 2
2	Understand	L2	PO1 PO2 PO5	PO1: Apply[L3] PO2: Review[L2] PO5: Apply[L3]	2 3 2

3	Analyze	L4	PO1 PO3 PO4 PO5	PO1: Apply[L3] PO3: Develop[L3] PO4: Analyze [L4] PO5: Apply[L3]	3 3 3 3
4	Analyze	L4	PO1 PO2 PO4	PO1: Apply[L3] PO2: Identify[L3] PO4: Design[L6]	3 3 1
5	Evaluate	L5	PO1 PO2 PO3 PO5	PO1: Apply[L3] PO2: Formulate[L6] PO3: Develop[L3] PO5: Apply [L3]	3 2 3 3

Justification statements:

CO1: Understand the electronic components, schematic diagrams, PCB layers, and design rules
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 in the same level of less than PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3)
CO1 Action Verb is less than PO1 verb by one level. Therefore, correlation is moderate (2).

CO2: Understand the concepts of PCB design and Electronic Design Automation (EDA)Tools.
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 in the same level of less than PO2 verb. Therefore, the correlation is high (3).
PO5 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level. Therefore, correlation is moderate (2).

CO3: Analyze the steps involved in different stages of PCB design for Circuits using CAD Tools.
Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb. Therefore, correlation is high (3).
PO2 Verbs: Develop (L3)
CO3 Action Verb is greater than PO2 verb. Therefore, correlation is high (3).
PO4 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO2 verb. Therefore, correlation is high (3)
PO5 Verb: Apply (L3)
CO3 Action Verb is greater than PO3 verb. Therefore, correlation is moderate (2).

CO4: Analyze the steps involved in Schematic and Layout designs for fabrication of PCB circuits.
Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb. Therefore, correlation is high (3).
PO2 Verbs: Identify (L3)
CO3 Action Verb is greater than PO2 verb. Therefore, correlation is high (3).
PO3 Verb: Design (L6)
CO3 Action Verb is less than PO3 verb. Therefore, correlation is low (1).

CO5: Evaluate various analog and digital PCB circuits for prototype development using different ICs.
Action Verb: Evaluate (L6)

PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb. Therefore, correlation is high (3).
PO2 Verbs: Formulate(L6)
CO5 Action Verb is less than PO2 verb. Therefore, correlation is moderate (2).
PO3 Verb: Develop (L3)
CO5 Action Verb is greater than PO3 verb. Therefore, correlation is high (3).
PO5 Verb: Apply (L3)
CO5 Action Verb is greater than thePO5 verb. Therefore, correlation is high (3).

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	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)

AK23-REGULATIONS

B.TECH.–ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.– III Year II Semester

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T/CLC	P	C			
1	PC	23APC0415	Digital Signal Processing	2	1	0	3	30	70	100
2	PC	23APC0416	Microwave and Optical Communications	2	1	0	3	30	70	100
3	PC	23APC0417	VLSI Design	2	1	0	3	30	70	100
4	PE		**Professional Elective-II**	2	1	0	3	30	70	100
		23APE0405	Electronic Measurements and Instrumentation							
		23APE0406	Embedded systems & IOT							
		23APE0407	Speech Processing							
5	PE		**Professional Elective-III**	2	1	0	3	30	70	100
		23APE0408	Digital Image Processing							
		23APE0409	Artificial Intelligence & Machine learning							
		23APE0410	Satellite Communications							
6	OE		***Open Elective-II**	2	1	0	3	30	70	100
7	PC	23APC0418	Microwave and Optical Communications Lab	0	0	3	1.5	30	70	100
8	PC	23APC0419	VLSI Design Lab	0	0	3	1.5	30	70	100
9	SC	23ASC0402	**Skill oriented course -IV** Machine Learning and DSP	0	1	2	2	30	70	100
10	AMC	23AMC9902	Technical Paper Writing & IPR	2	0	0	0	-	30	-
11	SC	23ASC0403	Workshop	-	-	-	-	-	-	-
Total				14	7	8	23	270	660	900
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	23AOE0202	Renewable Energy Sources	EEE
4	23AOE0302	Automation and Robotics	ME
5	23AOE0504	Operating Systems	CSE& Allied/IT
6	23AOE0505	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

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AK 23 REGULATIONS

Course Code	Year & Sem	DIGITAL SIGNAL PROCESSING	L	T/CLC	P	C
23APC0415	III-II		2	1	0	3

Course Outcomes: Students should be able to
CO1: Analyze the discrete time signals and systems in time, frequency and Z-domains.
CO2: Apply the Fast Fourier Transform algorithms for efficient computation of DFT.
CO3: Analyze the steps in the design and realization of digital IIR Filters.
CO4: Analyze the steps in the design and realization of digital FIR Filters.
CO5: Understand the basic architectures for programmable digital signal processing devices.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the discrete time signals and systems	in time and frequency and Z-domains		L4
CO2	Apply	the Fast Fourier Transform algorithms	for efficient computation of DFT		L3
CO3	Analyze	the steps in the design realization of digital IIR Filters.			L4
CO4	Analyze	the realizations of digital FIR filters			L4
CO5	Analyze	the interpolation and decimation			L4

UNIT - I		21Hrs
Introduction to discrete time signals and systems: Introduction to digital signal processing, Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems **Z–Transform:** Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z- Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.		
UNIT - II		12Hrs
Discrete Fourier Transform: Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects. **Fast Fourier Transform:** Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).		
UNIT - III		19Hrs
IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form- I, Direct form-II, Cascade form and Parallel form realizations.		
UNIT - IV		12Hrs
FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.		
UNIT - V		11Hrs
Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.		

Textbooks:
ohn G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007. .V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.
Reference Books:
.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004. IH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.
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	3	3		2		2							
CO2	3	3	3								2		
CO3	3		3	1		2							
CO4	3	2	3			2							
CO5	3	3			1	2					2		

Correlation matrix

Unit No.	CO				BTL	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				
1	21	28 %	2	Analyze	L4	PO1 PO2 PO4 PO6	PO1: Apply (L3) PO2: Review(L2) PO4: Identity (L5) PO6: Thumb rule	3 3 2 2
2	12	16 %	2	Apply	L3	PO1 PO2 PO3 PO11	PO1: Apply (L3) PO2: Identify(L3) PO3: Develop(L3) PO11: Thumb rule	3 3 3 2
3	19	25 %	2	Analyze	L4	PO1 PO3 PO4 PO6	PO1: Apply(L3) PO3: Develop(L3) PO4: Design(L6) PO6: Thumb rule	3 3 1 2
4	12	16 %	3	Analyze	L4	PO1 PO2 PO3 PO6	PO1: Apply(L3) PO2: Formulate(L6) PO3: Develop(L3) PO6: Thumb rule	3 2 3 2
5	11	15 %	2	Analyze	L4	PO1 PO2 PO5 PO6 PO11	PO1: Apply(L3) PO2: Identify(L3) PO5: Create (L6) PO6: Thumb rule PO11: Thumb rule	3 3 1 2 2
	75	100 %						

Justification Statements:

CO1: Analyze the discrete time signals and systems in time, frequency and Z-domains.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO1 Action Verb is greater than PO1 verb. Therefore, the correlation is high (3).

PO2 Verbs: Review (L2) CO1 Action Verb is in the same level of less than PO2 verb. Therefore, the correlation is high (3).

PO4 Verbs: Identify(L5) CO1 Action Verb is less than PO4 verb by one levels. Therefore, the correlation is moderate (2).
PO6: CO1 using Thumb rule, correlates PO6 as medium (2).

CO2: Apply the Fast Fourier Transform algorithms for efficient computation of DFT.
Action Verb: Apply (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 PO3 verb. Therefore, the correlation is high (3).
PO11: CO2 using Thumb rule, correlates PO11 as medium (2).

CO3: Analyze the steps in the design and realization of digital IIR Filters.
PO1 Verbs: Apply (L3) CO3 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO3 Verb: Develop(L3) CO3 Action Verb level is in the same level of PO3 verb. Therefore, the correlation is high (3).
PO4 Verb: Design(L6) CO3 Action Verb is less than PO4 verb by two levels. Therefore, the correlation is high (1).
PO6: CO3 using Thumb rule, correlates PO6 as medium (2).

CO4: Analyze the steps in the design and realization of digital FIR Filters.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3) CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Formulate (L6) CO4 Action Verb level is less than the PO2 verb by one level. Therefore, the correlation is moderate (2).
PO3 Verb: Develop (L3) CO4 Action Verb is greater than the PO3 verb. Therefore, correlation is high (3).
PO6: CO4 using Thumb rule, correlates PO6 as medium (2).

CO5: Understand the basic architectures for programmable digital signal processing devices.
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3) CO5 Action verb is less than the PO1 verb by one level. Therefore, the correlation is medium (3).
PO4 verb: Identify (L3) CO5 Action verb is greater than the PO4 verb . Therefore, the correlation is high (3).
PO5 verb: create (L6) CO5 Action verb is less than PO5 verb by one level. Therefore, the correlation is low (1)
PO6: CO5 using Thumb rule, L3 correlates PO6 as medium (2).
PO11: CO5 using Thumb rule, correlates PO11 as medium (2).

(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	MICROWAVE AND OPTICAL COMMUNICATIONS	L	T/CLC	P	C
23APC0416	III-II		2	1	0	3

Course Outcomes: Students should be able to
CO1: Understand the different modes of operations in waveguides and resonators.
CO2: Analyze the different microwave devices and microwave sources.
CO3: Understand the various microwave semiconductor devices and microwave measurement procedures.
CO4: Understand the concepts of optical fiber and its transmission characteristics.
CO5: Analyze the working principles of optical sources, optical detectors and optical links.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the different modes of operations in waveguides and resonators			L2
CO2	Analyze	the different microwave devices and microwave sources			L4
CO3	Understand	the various microwave semiconductor devices and microwave measurement procedures			L2
CO4	Understand	the concepts of optical fiber and its transmission characteristics			L2
CO5	Analyze	the working principles of optical sources, optical detectors and optical links			L4

UNIT - I		18Hrs
Waveguides: Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Waveguide current and mode excitation, Circular waveguide – TE and TM modes(**Qualitative treatment only**), Wave propagation, Cavity resonators (**Qualitative treatment only**).		
UNIT - II		23Hrs
Passive Microwave Devices: Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator, Circulator. **Microwave Amplifiers and Oscillators:** Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (**Qualitative treatment only**).Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.		
UNIT - III		18Hrs
Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes. **Microwave Measurements:** Description of Microwave bench-different blocks and their features, errors and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of _Q' of a cavity, Impedance measurements.		
UNIT - IV		15Hrs
Introduction to Optical Fibers and Transmission Characteristics - The propagation of lighting optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD		
UNIT - V		12Hrs
Optical Transmitters and Receivers: Optical Sources: - Light source materials – LED homo and hetero structures–surface and edge emitters–Quantum efficiency– Injection Laser Diode – Modes and threshold condition – Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes – Photo detector noise		

Optical Link Design: Point-to-point links–System considerations –Link Power budget –Rise time budget.
Textbooks:
1.Microwave devices and circuits-Samuel Y. Liao, Pearson,3rdEdition,2003. 2.Microwave principles-Herbert J.Reich, J.G.Skalnik, P. F.Ordung and H.L.Krauss, CBS publishers and distributors, New Delhi,2004. 3.Gerd Keiser,"Optical Fiber Communication" McGraw– Hill International, Singapore,3rded.,2000
Reference Books:
1. Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint. 2. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012. lectronic Communication System – George Kennedy, 6th Ed., McGrawHill.
Online Learning Resources:
Nptel videos, https://youtube.com/playlist?list=PL9zyqBvEBmDb60i543TBEdoh4Rvvjp7ik&si=342xAWznFdDVQXAF https://youtube.com/playlist?list=PL9zyqBvEBmDYG5lgzFLn1eaYGMTDQiB-y&si=jnkuZy-rjdlcYFjS, https://youtube.com/playlist?list=PLrjkTql3jnm8WeHfJEQRtxWaxY-olK3eg&si=E4pdLeVqup0VDXwf

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**2**	**3**		**1**								**2**	**2**
CO2	**3**	**3**	**3**									**3**	**3**
CO3	**2**	**3**		**1**								**3**	**3**
CO4	**2**	**3**		**1**								**2**	**2**
CO5	**3**	**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	**18**	21%	3	Understand	**L2**	PO1 PO2 PO4	PO1: Apply (L3) PO2: Review(L2) PO4: Analyze(L4)	**2** **3** **1**
2	**23**	27%	3	Analyze	**L4**	PO1 PO2 PO3	PO1: Apply (L3) PO2: Review(L2) PO3: Develop(L3)	**3** **3** **3**
3	**18**	21%	3	Understand	**L2**	PO1 PO2 PO4	PO1: Apply (L3) PO2: Review(L2) PO4: Analyze(L4)	**2** **3** **1**
4	**15**	17%	2	Understand	**L2**	PO1 PO2 PO4	PO1: Apply (L3) PO2: Review(L2) PO4: Analyze(L4)	**2** **3** **1**
5	**12**	14%	2	Analyze	**L4**	PO1 PO2 PO3	PO1: Apply (L3) PO2: Review(L2) PO3: Develop(L3)	**3** **3** **3**
	86	**100 %**						

Justification Statements:

CO1: Understand the different modes of operations in waveguides and resonators.

Action Verb: Understand(L2)

PO1 Verbs: Apply (L3) CO1 Action Verb is lesser than PO1 verb. Therefore, the correlation is high (2).

PO2 Verbs: Review (L2) CO1 Action Verb is in the same level of less than 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 moderate (1).

CO2: Analyze the different microwave devices and microwave sources.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO2 Action Verb is equal to the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2) 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 more than PO3 verb. Therefore, the correlation is high (3).

CO3: Understand the various microwave semiconductor devices and microwave measurement procedures.
Action Verb: Understand(L2)
PO1 Verbs: Apply (L3) CO3 Action Verb is lesser than PO1 verb. Therefore, the correlation is high (2).
PO2 Verbs: Review (L2) CO3 Action Verb is in the same level of less than PO2 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze(L4) CO3 Action Verb is less than PO4 verb by two levels. Therefore, the correlation is moderate (1).

CO4: Understand the concepts of optical fiber and its transmission characteristics.
Action Verb: Understand(L2)
PO1 Verbs: Apply (L3) CO4 Action Verb is lesser than PO1 verb. Therefore, the correlation is high (2).
PO2 Verbs: Review (L2) CO4 Action Verb is in the same level of less than PO2 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze(L4) CO4 Action Verb is less than PO4 verb by two levels. Therefore, the correlation is moderate (1).

CO5: Analyze the working principles of optical sources, optical detectors and optical links.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3) CO5 Action Verb is equal to the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2) CO5 Action Verb is in the same level of PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3) CO5 Action Verb is more than PO3 verb. Therefore, the correlation is high (3).

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Course Code	Year & Sem	VLSI DESIGN	L	T/CLC	P	C
23APC0417	III-II		2	1	0	3

Course Outcomes: Students should be able to
CO1: Understand the steps involved in the fabrication of ICs using MOS transistor technology.
CO2: Analyze the VLSI design processes, stick diagrams, and layouts with design rules.
CO3: Analyze knowledge of gate-level design concepts like Logic gates, complex gates and Switch logic.
CO4: Analyze various subsystems using different VLSI design styles and methods.
CO5: Evaluate CMOS testing and testability techniques for integrated circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the steps involved in the fabrication	of ICs using MOS transistor technology		L2
CO2	**Analyze**	the VLSI design processes,	stick diagrams and layouts		L4
CO3	**Analyze**	knowledge of gate-level design concepts	Logic gates, complex gates and Switch logic.		L4
CO4	**Analyze**	Various subsystems using	different VLSI design styles.		L4
CO5	**Evaluate**	CMOS testing and testability techniques	for integrated circuits		L5

UNIT - I		20Hrs
Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS &BiCMOS Technologies. Basic Electrical Properties of MOS and BiCMOS Circuits: IDS - VDS relationships, MOS transistor Threshold Voltage, figure of merit, Transconductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters		
UNIT - II		21Hrs
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.		
UNIT - III		10Hrs
Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out		
UNIT - IV		10Hrs
Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design		
UNIT - V		11Hrs
CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques		
Textbooks:		
1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, Eshraghian Dougles, A. Pucknell, 2005, PHI. 2. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education		
Reference Books:		
1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009. 2. Behzad Razavi , —Design of Analog CMOS Integrated Circuits‖, McGraw Hill, 2003.		

3. Jan M. Rabaey, ―Digital Integrated Circuits‖, Anantha Chandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO				BTL	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				
1	**20**	**27.78**	3	Understand	L2	PO1, PO2,PO 11	PO1: Apply (L3) PO2: Review (L2) PO11: Thumb rule	2 3 1
2	**21**	**29.16**	**3**	Analyze	L4	PO2,PO 4, PO11	PO2: Analyze (L4) PO4: Interpret(L2) PO11: Thumb rule	3 3 1
3	**10**	**13.88**	2	Analyze	L4	PO3,PO 4, PO11	PO3: Design (L6) PO4: Interpret (L5) PO11: Thumb rule	1 2 1
4	**10**	**13.88**	**2**	Analyze	L4	PO3, PO4,PO 11	PO3: Design (L6) PO4: Interpret (L5) PO11: Thumb rule	1 2 1
5	**11**	**15.3**	**2**	**Evaluate**	L5	PO4, PO5,PO 11	PO4: Interpret (L5) PO5: Create (L6) PO11: Thumb rule	3 2 1
	72	**100**						

Justification Statements:

CO1: Understand the steps involved in the fabrication of ICs using MOS transistor technology**.**

Action Verb- Understand (L2)

PO1: Action Verb- Apply (L3), CO1 action verb is less than PO1 action verb by one level, therefore correlation is moderate (2)

PO2: Action verb- Review (L2), CO1 action verb is equal to PO2 action verb, therefore correlation is high (3)

PO11: CO1 correlates PO11 as per thumb rule with correlation is Low (1)

CO2: Analyze the VLSI design processes, stick diagrams, and layouts with design rules**.**

Action Verb- Analyze(L4)

PO2: Action verb- Analyze (L4), CO2 action verb is equal to PO2 action verb; therefore correlation is high (3)

PO4: Action verb- Interpret(L2), CO2 action verb is greater than PO4 action verb; therefore correlation is high (3)

PO11: CO2 correlates PO11 as per thumb rule with correlation is Low (1)

CO3: Analyze knowledge of gate-level design concepts like Logic gates, complex gates and Switch logic**.**

Action Verb- Analyze(L4)

PO3: Action verb- Design (L6), CO3 action verb is less than to PO3 action verb by two levels; therefore correlation is Low (1)

PO4: Action verb- Interpret(L5), CO3 action verb is less than PO4 action verb by one level; therefore correlation is moderate (2)

PO11: CO3 correlates PO11 as per thumb rule with correlation is Low (1)

CO4:Analyze various subsystems using different VLSI design styles and methods**.**
Action Verb- Analyze(L4)
PO3: Action verb- CO4 action verb is less than to PO3 action verb by two levels; therefore correlation is Low (1)
PO4: Action verb- Interpret(L5), CO4 action verb is less than to PO3 action verb by two levels; therefore correlation is Low (1)
PO11: CO4 correlates PO11 as per thumb rule with correlation is Low (1)

CO5: Evaluate CMOS testing and testability techniques for integrated circuits.
Action Verb- Evaluate (L5)
PO4: Action verb- Interpret(L5), CO5 action verb is equal to PO4 action verb; therefore correlation is high (3)
PO5: Action verb- Create(L6), CO5 action verb is less than PO5 action verb by one; therefore correlation is moderate (2)
PO11: CO5 correlates PO11 as per thumb rule with correlation is Low (1)

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Course Code	Year & Sem	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	L	T/CLC	P	C
23APE0405	III-II		2	1	0	3

Course Outcomes: After studying the course, Student will be able to:
CO1: Understand the basic principles involved in the meters for measuring voltage, current, resistance, frequency a
on
CO2: Understand the working of CRO for measuring voltage, current, resistance, frequency and so on
CO3: Apply the Principles of measurements associated with different bridges
CO4: Analyze the working of advanced instruments such as wave analyzer and spectrum analyzers.
CO5: Analyze Electrical Parameters using advanced Electrical and Mechanical Transducer

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basic principles involved in the meters for measuring voltage, current, resistance, frequency and so on.			L2
CO2	Understand	the working of CRO for measuring voltage, current, resistance, frequency and so on			L2
CO3	Apply	The Principles of measurements associated with different bridges		.	L3
CO4	Analyze	the working of advanced instruments such as wave analyzer and spectrum analyzers			L4
CO5	Analyze	Electrical Parameters using advanced Electrical and Mechanical Transducers			L4

UNIT - I	10Hrs
Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.	
UNIT - II	10Hrs
Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.	
UNIT - III	15Hrs
Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin‘s Bridge, AC Bridges for Measurement of inductance- Maxwell‘s bridge, Hay‘s Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.	
UNIT - IV	14Hrs
Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.	
UNIT - V	14Hrs
Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.	
Textbooks:	

D.Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 5th Edition, 2002.
I.S.Kalsi, "Electronic instrumentation", second edition, Tata McGrawHill,2004.
. LalKishore, "Electronic Measurements & Instrumentations", Pearson Education, 2009

Reference Books:

1. H.S.Kalsi, "Electronic instrumentation", second edition, TataMcGrawHill,2004.
rnest O Doebelin and Dhanesh N Manik, "Measurement Systems Application and Design", TMH,5th Edition, 2009
)liver and Cage, "Electronic Measurement and Instrumentation", TMH
Robert A.Witte, "Electronic Test Instruments, Analog and Digital Measurements", Pearson Education, 2nd Ed., 2004.
)avid A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2003

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	2	2										2	
CO3	3	3		2								3	
CO4	3	3		3								3	
CO5	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	10	16	2	Understand	L2	PO1, PO2,	PO1: Apply(L3) PO2: Review (L2)	2 3
2	10	16	2	Understand	L2	PO1,PO2	PO1: Apply (L3) PO2: Identify (L3)	2 2
3	14	22	3	Apply	L3	PO1, PO2 PO4	PO1:Apply(L3) PO2:Review(L2) PO4:Analyze(L4)	3 3 2
4	15	23	3	Analyze	L4	PO1,PO2	PO1:Apply(L3) PO2:Identify(L3) PO4:Analyze(L4)	3 3 3
5	14	22	3	Analyze	L4	PO1,PO2	PO1:Apply(L3) PO2: Identify(L3)	3 3
	63	100						

Justification Statements:

CO1: Understand basic principles involved in the meters for measuring voltage, current, resistance, frequency and so on

Action Verb: Understand (L2)

PO1 Verbs: Identify (L2)

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

PO2 Verbs: Review (L2)

CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO2: Understand & analyze the CRO for measuring voltage, current, resistance, frequency and so on..

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

CO2 Action Verb is less than by one level PO1 verb; Therefore correlation is moderate (2).

PO2 Verbs: Review (L2)

CO2 Action Verb is less than by one level PO2 verb; Therefore correlation is moderate (2).

CO3: Analyze the propagation of electromagnetic waves in conductors and dielectric media.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Review?(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 by one level to PO4 verb; Therefore correlation is moderate (2).
CO4: Analyze the working of advanced instruments such as wave analyzer and spectrum analyzers.
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).
PO4 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

CO5: understand the concepts of transmission line parameters and its applications.
Action Verb: Analyze(L4)
PO1 Verb: Apply (L3)
CO5 Action verb is greater to PO1 verb; therefore the correlation is high (3).
PO2 Verb: Identify (L3)
CO5 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).

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Course Code	Year & Sem	EMBEDDED SYSTEMS & IOT	L	T/CLC	P	C
23APE0406	III-II		2	1	0	3

Course Outcomes: Students should be able to
CO1: Understand the architecture, development & design of Embedded Systems and IoT.
CO2: Analyze knowledge of ARM architecture to program microcontrollers for embedded applications.
CO3: Apply the Python programs on Raspberry Pi for IoT-based applications.
CO4: Analyze various IoT standards, communication protocols, and technologies using in IoT ecosystems.
CO5: Design real-time IoT applications using suitable tools and platforms.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the architecture, development & design of		Embedded Systems and IoT	L2
CO2	Analyze	knowledge of ARM architecture to program microcontrollers	for embedded applications		L4
CO3	Apply	the Python programs on Raspberry Pi for	IoT-based applications		L3
CO4	Analyze	various IoT standards, communication protocols, and technologies	using in IoT ecosystems		L4
CO5	Design	real-time IoT applications	using suitable tools and platforms		L6

UNIT - I		12Hrs
Introduction to Embedded Systems and Internet of Things (IoT): Introduction, Hardware & Software Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Physical Design & Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Tools, Applications of Embedded Systems and IoT, Design Methodology for IOT Products		
UNIT - II		14Hrs
ARM Microcontrollers Architecture and Programming: Architecture, Pin Diagram, Register Set & Modes, Memory Organization, Instruction set, Programming ports, Timer/Counter, Serial communication, I/O System, Development Tools, interrupts in C, Introduction ARM mBedplatform		
UNIT - III		19Hrs
Fundamentals of Python Programming & Raspberry Pi: Introduction to python programming, Data Types &Data Structures, working with functions, Modules & Packages, File Handling, classes, REST full Web Services, Client Libraries, Introduction & programming Raspberry Pi3, Interfaces, Integrating Input Output devices with Raspberry Pi3		
UNIT - IV		17Hrs
IoT Technologies, Standards, Tools & M2M Network: Fundamental characteristics and high- level requirements of IoT, IoT Reference models; Introduction to Communication Technologies & Protocols of IoT: BLE, Wi-Fi, LoRA, 3G/4G Technologies and HTTP, MQTT, CoAP protocols; Relevant Practicals on above technologies, M2M Network, SDN (Software Defined Networking) & NFV (Network Function Virtualization) for IoT		
UNIT - V		12Hrs
IoT Platform, Cloud Computing Platforms & Data Analytics for IoT Development: IOT Platform Architecture (IBM Internet of Things & Watson Platforms); API Endpoints for Platform Services; Devices Creation and Data Transmission; Introduction to NODE-RED and Application deployment, Introduction to Data Analytics, Apache Hadoop, Apache Oozie, Spark & Storm		
Textbooks:		
1. Arsheep Bahga, Vijay Madisetti, —Internet of Things: A Hands-On Approach‖,1st Edition, VPT, 2014. K.V.K.K.Prasad, —Embedded Real Time Systems: Concepts, Design and Programming‖, 1st Edition, Dreamtech Publication, 2014.		

Adrian McEwen, Hakim Cassimally, —Designing the Internet of Things‖, Wiley Publications, 2013.

Reference Books:

Jonathan WValvano, —Embedded Microcomputer Systems: Real-Time Interfacing‖, 3rdEdition, Thomson Engineering, 2012.

Olivier Hersent,David Boswarthick,Omar Elloumi,—The Internet of Things: Key applications and Protocols‖, 2nd Edition, Wiley Publications, 2012.

Rene Beuchat, Andrea Guerrieri & Sahand Kashani —Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers ‖Paperback, 2 August 2021.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3			3							2	
CO2	3	3			3							1	
CO3	3	3			3						1		2
CO4	3	3		3	3						1		2
CO5		3	3	3	3						1		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	12	16	2	Understand	L2	PO1,PO2,PO5	PO1: Apply (L3) PO2:Review(L2) PO5:Select(L1)	2 3 3
2	14	18	2	Analyze	L4	PO1,PO2,PO5	PO1: Apply (L3) PO2: Identify (L3) PO5:Select(L1)	3 3 3
3	19	30	3	Apply	L3	PO1,PO2,PO5	PO1: Apply (L3) PO2:Review(L2) PO5:Select(L1) PO11:ThumbRule	3 3 3 1
4	17	22	3	Analyze	L4	PO1,PO2,PO4, PO5,PO11	PO1: Apply (L3) PO2: Review (L2) PO4: Analyze (L4) PO5:Apply(L3) PO11:ThumbRule	3 3 3 3 1
5	12	16	2	Design	L6	PO2, PO3,PO4,PO5	PO2: Review (L2) PO3: Design (L6) PO4:Analyze(L4) PO5:Apply(L3) PO11:Thumb Rule	3 3 3 3 1
	74	**100**						

Justification Statements :

CO 1: Understand the architecture, development & design of Embedded Systems and IoT.. Action Verb: Understand (L2)

PO1Verbs: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).

PO5 Verbs: Select(L1)

CO1 Action Verb is greater than PO5 verb by one level; Therefore correlation is high(3)

CO2: Analyze knowledge of ARM architecture to program microcontrollers for embedded applications. Action Verb: Analyze(L4)

PO1Verbs:Apply(L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high(3)PO2 Verbs: Identify (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high(3)PO5 Verbs: Select (L1)
CO2ActionVerbisgreaterthanPO5verbbyonelevel;Thereforecorrelationishigh(3)

CO3: Apply the Python programs on Raspberry Pi for IoT-based applications. Action Verb: Apply (L3)

PO1 Verbs: Apply(L3)
CO3 Action Verb is equal to PO1verb,Therefore correlation is high(3).
PO2 Verbs: Review(L2)
CO3 Action Verb is greater than PO2 verb by one level; Therefore correlation is high(3).
PO5Verbs: PO5:Select(L1)
CO3 Action Verb is greater than PO5 verb by two level Therefore correlation is high(3).
PO11 CO3 using thumb rule; Therefore correlation is low(1)

CO4: Analyze various IoT standards, communication protocols, and technologies using in IoT ecosystems (L4)

PO1Verbs:Apply(L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high(3)PO2 Verbs: Review (L2)
CO4 Action Verb is greater than PO2 verb by two level; Therefore correlation is high(3).
PO4: Analyze(L4)
CO4 Action Verb is equal to PO4 verb, Therefore correlation is high(3).
PO5 Verbs:PO5: Select(L1)
CO4 Action Verb is greater than PO5 verb, Therefore correlation is high(3).
PO11 CO4 using thumb rule; Therefore correlation is low(1)

CO5: Design real-time IoT applications using suitable tools and platforms. Action Verb: Design(L6)

PO2 Verbs: Review(L2)
CO5 Action Verb is greater than PO2 verb; Therefore correlation is high(3).
PO3 Verbs: Design(L6)
CO5 Action Verb is greater than PO3 verb; Therefore correlation is high(3).
PO4 Verbs: Analyze(L4)
CO5 Action Verb is greater than PO4 verb, Therefore correlation is high(3).
PO5 Verbs: Apply(L3)
CO5 Action Verb is greater than PO5 verb; Therefore correlation is high(3)
PO11 CO5 using thumb rule; Therefore correlation is low(1)

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Course Code	Year & Sem	SPEECH PROCESSING	L	T/CLC	P	C
23APE0407	III-II		2	1	0	3

Course Outcomes: After studying the course, Student will be able to:
CO1: **Understand** the anatomy& physiology of speech organs and speech production process.
CO2: **Apply** the time domain methods for speech processing for parameters extraction.
CO3: **APPLY** the frequency domain methods for speech processing for parameters extraction.
CO4: **Evaluate** linear predictive coding (LPC) for speech processing in time domain.
CO5: **Understand** the concepts of homomorphic speech processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	Anatomy & physiology of speech organs and speech production process			L2
CO2	**Apply**	time domain methods for speech processing for parameters extraction			L3
CO3	**APPLY**	quency domain methods for speech processing for parameters extraction			L3
CO4	**Evaluate**	linear predictive coding (LPC) for speech processing	in time domain.		L5
CO5	**Understand**	concepts of homomorphic speech processing			L2

UNIT - I		15 Hours
Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract and radiation at lips, Digital models for speech signals.		
UNIT - II		14 Hours
Time Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation		
UNIT - III		14 Hours
Frequency Domain Methods for Speech Processing: Short time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.		
UNIT - IV		12 Hours
Linear predictive Coding (LPC) for Speech: Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.		
UNIT - V		14 Hours
Homomorphic Speech Processing: Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.		

Textbooks:

1. L.R.Rabiner and S.W.Schafer, Digital Processing of Speech Signals, Pearson Education.
2. DouglasO' Shaughnessy, Speech Communications: Human &Machine,2nd Ed., Wiley-IEEE Press.

Reference Books:

1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1stEd., Pearson Education.
2. BenGold&NelsonMorgan,SpeechandAudioSignalProcessing:Processingand Perception of Speech and Music ,1st Ed., Wiley.

Mapping of course outcomes with program outcomes

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

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	15	22	3	Understand	L2	PO1,PO2, PO3,	PO1: Apply (L3) PO2:Review (L2) PO3:Develop(L3)	2 3 2
2	14	20	2	Apply	L3	PO1,PO2, PO3,	PO1: Apply (L3) PO2:Review (L2) PO3: Develop(L3)	3 3 3
3	14	20	2	Apply	L3	PO1,PO2, PO4,	PO1: Apply (L3) PO2:Identify(L3) PO4: Analyze-(L4)	3 3 2
4	12	18	2	Evaluate	L5	PO1,PO2, PO4,	PO1: Apply (L3) PO2:Review (L2) PO4: Analyze-(L4)	3 3 3
5	14	20	2	Understand	L2	PO1,PO2, PO4,	PO1: Apply (L3) PO2:Identify(L3) PO4: Analyze-L4	2 2 1
	69	**100%**						

Justification Statements :

CO1: Understand the anatomy& physiology of speech organs and speech production process.
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 by same levels; therefore, correlation is High (3).
PO3 Verbs: Develop(L3),CO1 Action Verb is less than PO3 verb by one level; Therefore, correlation is moderate (2).

CO2: Apply the time domain methods for speech processing for parameters extraction.
Action Verb: Apply (L3)

PO1 Verbs: Apply (L3),CO2 Action Verb is equal to PO1 verb by same level; Therefore, correlation is high (3).
PO2 Verbs: Review (L2),CO2 Action Verb is high than PO2 verb by one level ; Therefore, correlation is high (3).
PO3 Verbs: Develop(L3),CO2 Action Verb is equal to PO3 verb by same level; Therefore, correlation is high (3).

CO3: APPLY the frequency domain methods for speech processing for parameters extraction.
Action Verb: Apply (L3)

PO1 Verbs: Apply (L3),CO3 Action Verb is equal to PO1 verb by same level; Therefore, correlation is high (3).
PO2 Verb: Identify (L3),CO3 Action Verb is equal to PO2 verb by same level; Therefore, correlation is high (3).
PO4 Verbs: Analyze(L4),CO3 Action Verb is less than PO4 verb by one levels; therefore, correlation is moderate(2).

CO4: Evaluate linear predictive coding (LPC) for speech processing in time domain.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3),CO4 Action Verb is greater than PO1 verb by two level; Therefore, correlation is High (3).
PO2 Verbs: Review (L2),CO4 Action Verb is greater than PO2 verb by three levels; Therefore, correlation is High (3).
PO4 Verb: Analysis (L4),CO4 Action Verb level is greater than PO4 verb by two levels; Therefore, correlation is High (3).

CO5: Understand the concepts of homomorphic speech processing.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3),CO5 Action verb is lessthan PO1 verb by one level; Therefore, the correlation is moderate (2).
PO2 Verb: Identify (L3),CO5 Action verb is lessthan PO2 verb by one levels; Therefore, the correlation is moderate (2).
PO4 Verb: Analyze (L4),CO5 Action verb is lessthan PO4 verb by two levels; Therefore the correlation is low (1).

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ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK 23 REGULATIONS

Course Code	Year & Sem	DIGITAL IMAGE PROCESSING	L	T/CLC	P	C
23APE0408	III-II		2	1	0	3

Course Outcomes:
CO1: **Understand** the fundamental concepts of image processing and different transforms.
CO2: **Apply** the intensity transformation techniques for image enhancement in spatial and frequency domain.
CO3: **Analyze** the various methods of image restoration and reconstruction from projections.
CO4: **Evaluate** different coding methods, wavelets and multiresolution processes for image compression.
CO5: **Analyze** the various methods of image segmentation and color image processing.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamental concepts of image processing and different transforms			L2
CO2	Apply	the intensity transformation techniques for image enhancement	in spatial and frequency domain.		L3
CO3	Analyze	the various methods of image restoration and reconstruction	from projections		L4
CO4	Evaluate	different coding methods, wavelets and multiresolution processes	for image compression.		L5
CO5	Analyze	the various methods of image segmentation and color image processing			L4

UNIT - I		21Hrs
Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.		
UNIT - II		12Hrs
Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering		
UNIT - III		19Hrs
Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter ,image reconstruction from projections.		
UNIT - IV		12Hrs
Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids,		

subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT - V		11Hrs

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.
Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar,‖ Digital Image Processing‖, Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, ―Fundamentals of Digital Image Processing‖, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
3.Chanda, D.DuttaMajumder, ―Digital Image Processing and Analysis‖, PHI, 2009

Online Learning Resources:

https://nptel.ac.in/courses/117105079
https://nptel.ac.in/courses/117105135

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	
CO2	3		3		3						2	3	
CO3	3			3	3						3	3	
CO4	3	2	3								3	3	
CO5	3			3	1						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 PO11	PO1: Apply (L3) PO2: Review(L2) PO11: Thumb rule	2 3 2
2	12	16 %	2	Apply	L3	PO1 PO3 PO5 PO11	PO1: Apply (L3) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb rule	3 3 3 2
3	19	25 %	2	Analyze	L4	PO1 PO4 PO5 PO11	PO1: Apply(L3) PO4: Analyze(L4) PO5: Apply(L3) PO11: Thumb rule	3 3 3 3
4	12	16 %	3	Evaluate	L5	PO1 PO2 PO3 PO11	PO1: Apply(L3) PO2: Formulate(L6) PO3: Develop(L3) PO11: Thumb rule	3 2 3 3
5	11	15	2	Analyze	L4	PO1	PO1: Apply(L3)	3

		%				PO4 PO5 PO11	PO4: Identify (L3) PO5: create (L6) PO11: Thumb rule	**3** **1** **3**
	75	**100 %**						

Justification Statements:

CO1: Understand the fundamental concepts of image processing and different transforms.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3) CO1 Action Verb is less than PO1 verb by one level. Therefore, the correlation is low (1).
PO2 Verbs: Review (L2) CO1 Action Verb is same level of PO2 verb. Therefore, the correlation is high (3).
PO11: CO1 using Thumb rule, correlates PO11 as medium (2).

CO2: Apply the intensity transformation techniques for image enhancement in spatial and frequency domain.

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3) CO2 Action Verb is equal to the PO1 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop (L3) CO2 Action Verb is equal to the PO3 verb. Therefore, the correlation is high (3).
PO5 verb: Apply (L3) CO2 Action verb is equal to the PO1 verb. Therefore, the correlation is high (3).
PO11: CO2 using Thumb rule, correlates PO11 as medium (2).

CO3: Analyze the various methods of image restoration and reconstruction from projections.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3) CO3 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO4 Verb: Analyze (L4) CO3 Action Verb is equal to the 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: CO3 using Thumb rule, correlates PO11 as high (3).

CO4: Evaluate different coding methods for image compression, wavelets and multiresolution processes.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3) CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verb: Formulate (L6) CO4 Action Verb level is less than the PO2 verb by one level. Therefore, the correlation is moderate (2).
PO3 Verb: Develop (L3) CO4 Action Verb is greater than the PO3 verb. Therefore, correlation is high (3).
PO11: CO4 using Thumb rule, correlates PO11 as high (3).

CO5: Analyze the various methods of image segmentation and color image processing.

Action Verb: Analyze (L4)

PO1 Verb: Apply (L3) CO5 Action verb is more than the PO1 verb by one level. Therefore, the correlation is medium (3).
PO4 verb: Identify (L3) CO5 Action verb is greater than the PO4 verb . Therefore, the correlation is high (3).
PO5 verb: create (L6) CO5 Action verb is less than PO5 verb by two levels. Therefore, the correlation is low (1)
PO11: CO5 using Thumb rule, correlates PO11 as high (3).

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AK 23 REGULATIONS

Course Code	Year & Sem	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T/CLC	P	C
23APE0409	III-II		2	1	0	3

Course Outcomes

CO1: Understand the basics and problems of Artificial Intelligence with rationality and structure of agents.
CO2: Analyze the search for solutions using various search strategies & algorithms for optimization.
CO3: Apply the representation of Agents with Propositional Logic in Shopping World.
CO4: Understand the concepts of Machine Learning with different Perspectives.
CO5: Analyze the Decision Tree Representation with different problems& issues.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the basics and problems of Artificial Intelligence with rationality and structure of agents.			L2
CO2	**Analyze**	the search for solutions using various search strategies & algorithms		for optimization	L4
CO3	**Apply**	the representation of Agents with Propositional Logic in Shopping World.			L3
CO4	**Understand**	the concepts of Machine Learning with different Perspectives.			L2
CO5	**Apply**	the Decision Tree Representation with different problems& issues.			L3

UNIT I

Introduction:

What is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II

Problem Solving: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT III

Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

UNIT IV

Introduction to Machine Learning: Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning. **Concept Learning and The General-to-Specific Ordering:** Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate Elimination, Inductive Bias

UNIT V

Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning. **Text Books:**

1) Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach‖ , 3rd Edition, Pearson

2) Tom M. Mitchell, *Machine Learning,* McGraw Hill Edition, 2013

Reference Books:

1) Saroj Kaushik, ―Artificial Intelligence‖, Cengage Learning India, 2011

2) Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Tata McGraw Hill
3) David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press 2010.
4) Trivedi, M.C., ―A Classical Approach to Artifical Intelligence‖, Khanna Publishing House, Delhi.
5) Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.
6) ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

Mapping of course outcomes with program outcomes

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

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				Understand	L2	PO1 PO5	PO1: Apply(L3) PO5: Apply (L3)	2 2
2				Analyze	L4	PO1 PO2 PO3	PO1: Apply(L3) PO2: Analysis(L4) PO3: Develop(L3)	2 3 2
3				Apply	L3	PO1 PO2 PO3 PO5 PO11	PO1: Apply(L3) PO2: Analysis(L4) PO3: Develop(L3) PO5: Apply (L3) PO11: Thumb Rule	3 2 3 3 2
4				Understand	L2	PO1 PO2 PO3 PO5 PO6	PO1: Apply(L3) PO2: Analysis(L4) PO3: Develop(L3) PO5: Apply (L3) PO6: Thumb Rule	2 2 1 2 2
5				Apply	L3	PO1 PO3 PO5 PO11	PO1: Apply(L3) PO3: Develop(L3) PO5: Apply (L3) PO11:Thumb Rule	3 3 3 2

Justification Statements:
CO1:Understand the basics and problems of Artificial Intelligence with rationality and structure of agents.
Action Verb: Understand (L2)
PO1: Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is moderate (2)
PO5: Apply (L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is moderate (2)

CO2: Analyze the search for solutions using various search strategies & algorithms for optimization.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is Greater than PO1 verb by one level. Therefore the correlation is moderate (2)
PO2: Analysis(L4)
CO2 Action verb is same level as PO2verb. Therefore the correlation is high (3)
PO3: Develop (L3)

CO2 Action verb is Greater than PO1 verb by one level PO3 verb. Therefore the correlation is moderate (2)

CO3: Apply the representation of Agents with Propositional Logic in Shopping World.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO3 Action verb is more than PO1 verb. Therefore the correlation is high (3)
PO2: Analysis(L4)
CO3 Action verb is Greater than PO2 verb. Therefore the correlation is moderate (2)
PO3: Develop(L3)
CO3 Action verb more than PO2 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb less than PO2 verb by one levels. Therefore the correlation is moderate (2)
PO5: Apply (L3)
CO3 Action verb same as PO5 verb. Therefore the correlation is high (3)
PO11: Thumb rule
The NLP models are Code generation and completion tools are lifelong learning. Therefore the correlation is Moderate (2)

CO4: Understand the concepts of Machine Learning with different Perspectives.
Action Verb: Understand (L2)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is Moderate (2)
PO2: Analysis(L4)
CO4 Action verb is less than PO2 verb by two level. Therefore the correlation is Low(1)
PO3: Develop(L3)
CO4 Action verb is less than PO3 verb by one levels. Therefore the correlation is Moderate (2)
PO5: Apply (L3)
CO4 Action verb is less than PO5 verb by two levels. Therefore the correlation is Moderate (2)
PO6: Thumb rule
Since we are developing the machine Learning Models and applications. Therefore the correlation is Moderate (2)

CO5: Analyze the Decision Tree Representation with different problems& issues.
Action Verb: Appy (L3)
PO1: Apply(L3)
CO5 Action verb is same as PO1 verb. Therefore the correlation is High (3)
PO3: Develop(L3)
CO5 Action verb is same as PO3 verb. Therefore the correlation is High (3).
PO5: Apply (L3)
CO5 Action verb is same as PO3 verb. Therefore the correlation is High (3).
PO11: Thumb Rule
We are using the Decision Tree in lifelong Learning. Therefore the correlation is moderate (2)

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AK 23 REGULATIONS

Course Code	Year & Sem		L	T/CLC	P	C
23APE0410	III-II	SATELLITE COMMUNICATIONS	2	1	0	3

Course Outcomes:
CO1: Understand the fundamentals of orbital mechanics and satellite launch system.
CO2: Analyze the design aspects of communication satellites and their subsystems.
CO3: Apply multiple access and random-access techniques in satellite communication.
CO4: Analyze the design of satellite communication links based on performance requirements.
CO5: Analyze the working of earth station design with emphasis on satellite broadcasting.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the fundamentals of orbital mechanics and satellite launch system.			L2
CO2	Analyze	the design aspects of communication satellites and their subsystems.			L4
CO3	Apply	multiple access and random-access techniques in satellite communication.			L3
CO4	Analyze	the design of satellite communication links based on performance requirements.			L4
CO5	Analyze	the working of earth station design with emphasis on satellite broadcasting.			L4

UNIT - I		12Hrs
Elements of orbital mechanics. Equations of motion. Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Multistage rocket launchers and their performance.		
UNIT - II		12Hrs
Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.		
UNIT - III		12Hrs
Multiple access techniques. FDMA, TDMA,CDMA. Random access techniques. Satellite onboard processing.		
UNIT - IV		15Hrs
Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication. links.		
UNIT - V		15Hrs
Earth station design. Configurations. Antenna and tracking systems. Satellite broadcasting.		
Textbooks:		
Roddy, Satellite Communication (4/e), McGraw- Hill, 2009. Pratt & C.W. Bostain, Satellite Communication, Wiley 2000.		

Reference Books:
N. Agrawal, Design of Geo synchrons Spacecraft, Prentice- Hall,1986.
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		1							1	2	
CO2	3	3	3	3							2	2	
CO3	3	3		2							2		2
CO4	3	3	1	2							2		2
CO5	3	3	1	1							2		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	12	18%	2	Understand	L2	PO1,PO2, PO4,PO11	PO1: Apply(L3) PO2: Identify(L3) PO4: Analyze(L4) PO11: Thumb rule	2 2 1 1
2	12	18%	2	Analyze	L4	PO1,PO2, PO3,PO4,PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Develop (L3) PO4: Analyze(L4) PO11: Thumb rule	3 3 3 3 2
3	12	18%	2	Apply	L3	PO1,PO2, PO4, PO11	PO1: Apply (L3) PO2: Identify(L3) PO4: Analyze(L4) PO11:Thumb Rule	3 3 2 2
4	15	23%	3	Analyze	L4	PO1,PO2,PO3 PO4, PO11	PO1: Apply(L3) PO2: Identify(L3) PO3: Design (L6) PO4: Analyze(L4) PO11: Thumb rule	3 3 1 2 2
5	15	23%	3	Analyze	L4	PO1,PO2, PO3,PO4, PO11	PO1: Apply(L3) PO2: Review(L2) PO3: Design (L6) PO4: Design (L6) PO11: Thumb rule	3 3 1 1 2
	66	100 %						

Justification Statements:

CO1: Understand the fundamentals of orbital mechanics and satellite launch system.

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)

PO4 Verb : Analyze(L4)

CO1 Action verb is less than PO4 verb by two level. Therefore the correlation is low (1)

PO11 Verb : Thumb rule

CO1 Action verb is correlates PO11 verb as per Thumb Rule.

CO2: Analyze the design aspects of communication satellites and their subsystems.
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).

PO3 Verb: Develop (L3)
CO2 Action Verb is greater than PO3 verb. Therefore the correlation is high (3).

PO4 Verb : Analyze(L4)
CO2 Action verb is equal to PO4 verb. Therefore the correlation is high (3).

PO11 Verb : Thumb rule
CO2 Action verb is correlates PO11 verb as per Thumb Rule.

CO3: Apply multiple access and random-access techniques in satellite communication.
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 is equal to PO2 verb. Therefore the correlation is high (3).

PO4 Verbs: Analyze (L4)
CO3 Action Verb is less than PO4 verb by one level; Therefore correlation is moderate (2).

PO11 Verb : Thumb rule
CO3 Action verb is correlates PO11 verb as per Thumb Rule.

CO4: Analyze the design of satellite communication links based on performance requirements.
Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb; Therefore correlation is high (3).

PO2 Verb : Identify(L3)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3).

PO3 Verbs: Design (L6)
CO4 Action Verb is less than PO3 verb by two levels. Therefore correlation is low (1).

PO4 Verbs: Analyze (L4)
CO4 Action Verb is equal to PO4 verb by one level; Therefore correlation is moderate (2).

PO11 Verb : Thumb rule
CO4 Action verb is correlates PO11 verb as per Thumb Rule.

CO5: Analyze the working of earth station design with emphasis on satellite broadcasting.
Action Verb: Analyze (L4)

PO1 Verb: Apply (L3)
CO5 Action verb is greater to 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 Verbs: Design (L6)
CO5 Action Verb is less than PO3 verb by two levels. Therefore correlation is low (1).

PO4 Verbs: Design (L6)
CO5 Action Verb is less than PO4 verb by two levels. Therefore correlation is low (1).

PO11 Verb : Thumb rule
CO5 Action verb is correlates PO11 verb as per Thumb Rule.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)
AK23-REGULATIONS

B. Tech III Year II Semester

Course Code	Course Title	L	T	P	Credits
23APC0418	**MICROWAVE AND OPTICAL COMMUNICATIONS LABORATORY**	**0**	**0**	**3**	**1.5**

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

CO1: Analyze the characteristics of the microwave source.

CO2: Analyze the performance of Reflex klystron using different microwave components and measurements.

CO3: Analyze the radiation pattern of Antennas and gain measurements.

CO4: Evaluate the parameters of LED and LASER from its V-I characteristics.

CO5: Evaluate the parameters of Analog and Digital Optical Fiber Communication link

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
1.	Analyze	the characteristics of the microwave source			**L4**
2.	Analyze	the performance of Reflex klystron using different microwave components and measurements			**L4**
3.	Analyze	the radiation pattern of Antennas and gain measurements			**L4**
4.	Evaluate	the parameters of LED and LASER from its V-I characteristics			**L5**
5	Evaluate	the parameters of Analog and Digital Optical Fiber Communication link			**L5**

PART-A: Microwave Lab -Any Seven (7) Experiments

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Attenuation Measurement
4. Directional Coupler Characteristics
5. VSWR Measurement
6. Impedance Measurements
7. Frequency and Wavelength measurement
8. Scattering Parameters of Directional coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of a Antenna
11. Antenna gain measurement

PartB: Optical Fiber Lab-Any five(5)Experiments

1. Characterization of LED
2. Characterization of Laser Diode
3. Intensity Modulation of Laser output through Optical fiber
4. Measurement of data rate for digital Optical link
5. Measurement of Numerical Aperture.
6. Measurement of Losses for Analog optical link.

Mapping of Course Outcomes with Program Outcomes:

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

Correlation Matrix

Justification Statements:

CO1: Analyze the characteristics of the microwave source.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2)
CO1 Action Verb is more than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Design(L6)
CO1 Action Verb is two levels less than the PO3 verb. Therefore, the correlation is low (1).
PO4 Verbs: Analyze(L4)
CO1 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

	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			
A1,A2	6	11.7 %	1	Analyze	L4	PO1,PO2, PO3,PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L6) PO4: Analyze (L4)	3 3 1 3
A3,A4, A5,A6, A7,A8, A9	21	41%	3	Analyze	L4	PO1,PO2, PO3,PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L6) PO4: Analyze (L4)	3 3 1 3
A10,A11	6	11.7 %	1	Analyze	L4	PO1,PO2, PO3,PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L6) PO4: Analyze (L4)	3 3 1 3
B1,B2, B3	9	17.6 %	2	Evaluate	L5	PO1,PO2, PO3,PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L6) PO4: Analyze (L4)	3 3 2 3
B4,B5, B6	9	17.6 %	2	Evaluate	L5	PO1,PO2, PO3,PO4	PO1: Apply (L3) PO2: Review (L2) PO3: Design (L6) PO4: Analyze (L4)	3 3 2 3
	51	100%						

CO2: Analyze the performance of Reflex klystron using different microwave components and measurements
Action Verb: Analyze(L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2)
CO2 Action Verb is more than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Design(L6)

CO2 Action Verb is two levels less than the PO3 verb. Therefore, the correlation is low (1).
PO4 Verbs: Analyze(L4)
CO2 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

CO3: Analyze the radiation pattern of Antennas and gain measurements.
Action Verb: Design(L6)
PO1 Verbs: Apply (L3)
CO3 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2)
CO3 Action Verb is more than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Design(L6)
CO3 Action Verb is two levels less than the PO3 verb. Therefore, the correlation is low (1).
PO4 Verbs: Analyze(L4)
CO3 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

CO4: Evaluate the parameters of LED and LASER from its V-I characteristics.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2)
CO4 Action Verb is more than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Design(L6)
CO4 Action Verb is one level less than the PO3 verb. Therefore, the correlation is low (2).
PO4 Verbs: Analyze(L4)
CO4 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

CO5: Evaluate the parameters of Analog and Digital Optical Fiber Communication link
Action Verb: Design(L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Review(L2)
CO5 Action Verb is more than the PO2 verb. Therefore, the correlation is high (3).
PO3 Verbs: Design(L6)
CO5 Action Verb is one level less than the PO3 verb. Therefore, the correlation is low (2).
PO4 Verbs: Analyze(L4)
CO5 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

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ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)

AK 23-REGULATIONS

B. Tech III Year II Semester

Course Code	Course Title	L	T	P	Credits
23APC0419	**VLSI DESIGN LABORATORY**	**0**	**0**	**3**	**1.5**

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

CO1: Design logic gates using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, AC and DC analysis.

CO2: Evaluate different schematics & output responses for AOI logic by using different software tools.

CO3: Design CMOS logic circuits using Full & Semi custom IC designs.

CO4: Design amplifier circuits using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, AC and DC analysis

CO5: Design different layouts using different software tools for analog circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
1.	Design	A logic circuit using CMOS transistor using 180 nm technology analysis.	schematic, symbol, test bench, DC analysis		L6
2.	Evaluate	different schematics &output responses for AOI logic	using different software's		L5
3.	Design	CMOS circuits using Full & Semi custom IC designs.			L6
4.	Design	amplifier circuits using CMOS transistor using 180 nm technology	schematic, symbol, test bench, DC analysis		L6
5	Design	Different layouts.	using different software tools	for analog circuits	L6

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

1. Design and analysis of CMOS Inverter

a) Implement CMOS inverter schematic using 180 nm technology and design its symbol.

b) Implement test bench for CMOS Inverter and check its output response.

c) Perform DC and AC analysis for CMOS inverter.

d) Check the performance of CMOS inverter using parametric sweep.

2. Design and analysis of NAND and NOR Logic gates

a) Implement NAND/NOR schematic using 180 nm technology and design its symbol.

b) Implement test bench for NAND/NOR and check its output response.

c) Perform DC and AC analysis for NAND/NOR.

d) Check the performance of NAND/NOR using parametric sweep.

3. Design and analysis of XOR and XNOR Logic gates

a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol.

b) Implement test bench for XOR/XNOR and check its output response.

c) Perform DC and AC analysis for XOR/XNOR.

d) Check the performance of XOR/XNOR using parametric sweep.

4. **Design of AOI logic**
   a) Design Schematic for AB+C_D and check its output response.
   b) Design Schematic for AB_+C_D and check its output response.
   c) Design Schematic for (A+B_)(C+D) and check its output response.
   d) Design Schematic for (A+B_)(C_+D) and check its output response.
5. **Design and analysis of Full adder**
   a) Design full adder using Full custom IC design.
   b) Design full adder using Semi custom IC design.
6. **Analysis of NMOS and PMOS characteristics**
   a) Implement test bench for NMOS/PMOS transistor.
   b) Perform DC and AC analysis for NMOS/PMOS transistor
   c) Check the performance of NMOS/PMOS transistor using parametric sweep.
7. **Design and analysis of Common source amplifier**
   a) Implement CS amplifier schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CS amplifier and check its output response.
   c) Perform DC and AC analysis for CS amplifier.
   d) Check the performance of CS amplifier using parametric sweep.
8. **Design and analysis of Common drain amplifier**
   a) Implement CD amplifier schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CD amplifier and check its output response.
   c) Perform DC and AC analysis for CD amplifier.
   d) Check the performance of CD amplifier using parametric sweep.
9. **Design of MOS differential amplifier**
   a) Design differential amplifier schematic using 180 nm technology and its symbol.
   b) Implement test bench for differential amplifier and check its output response.
   c) Perform DC and AC analysis for differential amplifier.
   d) Check the performance of differential amplifier using parametric sweep.
10. **Design of differential amplifier using FET/BJT**
    a) Design differential amplifier using FET/BJT schematic using 180 nm technology and its symbol.
    b) Implement test bench for two stage differential amplifier and check its output response.
    c) Perform DC and AC analysis for differential amplifier.
    d) Check the performance of differential amplifier using parametric sweep.
11. **Design of Inverter Layout**
    a) Design and implement inverter schematic.
    b) Design the layout for inverter using 180 nm tech file.
    c) Perform LVS for schematic and layout
    d) Check and remove all DRC violations.
    e) Extract parasitic R and C in layout.
12. **Design of NAND/NOR Layout**
    a) Design and implement NAND/NOR schematic.
    b) Design the layout for inverter using 180 nm tech file.
    c) Perform LVS for schematic and layout
    d) Check and remove all DRC violations.
    e) Extract parasitic R and C in layout

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the experiments with the Industry standard EDA Tools.

Software Required i. Mentor Graphics/ Synopsis/ Cadence / Equivalent Industry Standard Software. ii. Personal computer system with necessary software to run the programs and to

implement.

Mapping of Course Outcomes with Program Outcomes:

Course Title	Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
VLSI Design Laboratory	CO1	3	3		3	3								3
	CO2	3	2		3	3								3
	CO3	3		3	3	3								3
	CO4	3		3	3	3								3
	CO5	3		3	3	3								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			
E1,E2	**6**	16.6%		Design	**L6**	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Formulate (L6) PO4: Analyze(L4) PO5: Apply (L3)	3 3 3 3
E3,E4	**6**	16.6%		Evaluate	**L5**	PO1, PO2, PO4, PO5	PO1: Apply (L3) PO2: Formulate (L6) PO4: Analyze(L4) PO5: Apply (L3)	3 2 3 3
E5,E6 E7,E8	**12**	33.3%		Design	**L6**	PO1, PO3, PO4, PO5	PO1: Apply (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
E9,E10	**6**	16.6%		Design	**L6**	PO1, PO3, PO4, PO5	PO1: Apply(L3) PO2: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
E11,E12	**6**	16.6%		Design	**L6**	PO1, PO3, PO4, PO5	PO1: Apply(L3) PO2: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 3
	36	100%						

Justification Statements:

CO1: Design a logic circuit using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, AC & DC analysis

Action Verb: Design (L6)

PO1 Verbs: Apply (L3)

CO1 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).

PO2 Verbs: Formulate(L6)

CO1 Action Verb is more than the PO2 verb by two levels. Therefore, the correlation is high (3).

PO4 Verbs: Analyze(L4)

CO1 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).

PO5 Verbs: Apply(L3)

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

CO2: Evaluate different schematics &output responses for AOI logic by using different software tools.

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)
CO2 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO2 Verbs: Formulate(L6)
CO2 Action Verb is more than the PO2 verb by one level. Therefore, the correlation is medium (2).
PO4 Verbs: Analyze(L4)
CO2 Action Verb is more than the PO4 verb. Therefore, the correlation is high (3).
PO5 Verbs: Apply(L3)
CO2 Action Verb is more than PO5 verb. Therefore, the correlation is high (3).

CO3: Design CMOS logic circuits using Full & Semi custom IC designs for analyzation.
Action Verb: Design (L6)
PO1 Verbs: Apply (L3)
CO3 Action Verb is same as the PO1 verb. Therefore, the correlation is high (3).
PO3 Verbs: Develop(L3)
CO3 Action Verb is in the same level of the PO2 verb by one level. Therefore, the correlation is high (3).
PO4 Verbs: Analyze(L4)
CO3 Action Verb is more than the PO3 verb. Therefore, the correlation is high (3).
PO5 Verbs: Apply(L3)
CO3 Action Verb is more than PO5 verb. Therefore, the correlation is high (3).

CO4: Design amplifier circuits using CMOS transistor using 180 nm technology in terms of schematic, symbol, test bench, AC and DC analysis
Action Verb: Design (L6)
PO1 Verbs: Apply (L3)
CO4 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO3 Verb: Develop (L3)
CO4 Action Verb level is more than the PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4)
CO4 Action Verb is same as the PO4 verb. Therefore, correlation is high (3).
PO5 Verbs: Apply(L3)
CO4 Action Verb is more than PO5 verb. Therefore, the correlation is high (3).

CO5: Design different layouts using different software tools for analog circuits.
Action Verb: Design (L6)
PO1 Verbs: Apply (L3)
CO5 Action Verb is more than the PO1 verb. Therefore, the correlation is high (3).
PO3 Verb: Develop (L3)
CO5 Action Verb level is more than the PO3 verb. Therefore, the correlation is high (3).
PO4 Verbs: Analyze (L4)
CO5 Action Verb is same as the PO4 verb. Therefore, correlation is high (3).
PO5 Verbs: Apply(L3)
CO5 Action Verb is more than PO5 verb. Therefore, the correlation is high (3).

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AK 23 REGULATIONS

Course Code	Year & Sem	MACHINE LEARNING AND DSP	L	T/CLC	P	C
23ASC0402	III-II		0	1	2	2

Course Outcomes: Students should be able to

CO1: Understand the modules and dependencies for machine learning corresponding to different applications.
CO2: Understand a range of machine learning regression techniques & clustering along with their datasets.
CO3: Analyze the KNN & CNN algorithms using iris dataset and images.
CO4: Evaluate the basic signal processing operations like convolution and correlation.
CO5: Analyze the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

MACHINE LEARNING (Implement any six concepts)

Implement the following concepts using python with supporting applications.

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python
2. **Linear regression**: Predict the profit of a company/House price from a dataset using the concept of linear regression. Implement the speech recognition model (NLP) from a speech/audio dataset using the concept of linear regression
3. ***Logistic regression:***
   a) Identify whether the patient has diabetes or not from diabetes dataset using Logistic regression
   b) Implement the speech to text model (NLP- Speech recognitions system) from a speech dataset using the concept of linear regression
4. ***Polynomial regression :***
   a. Determine the quality of wine using wine dataset with the help of polynomial regression
   b. Implement the speech recognition model (NLP) from a speech / audio data set using the concept of polynomial regression.
5. **K-means clustering**: Apply the concept of K-means clustering for image segmentation problem (Brain tumor and Lung images)/Color quantization
6. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set to demonstrate the working of the decision tree based ID3 algorithm.
7. Write a program to implement the k-Nearest Neighbor algorithm for image classification and distance metric learning for large margin with image classification applications using k- nearest neighbor.
8. **PCA/LDA:** Reduce the dimensionality of a dataset for Face recognition system
9. Design an Artificial neural network for Digit classification using Back Propagation Algorithm for MNIST Data set. Train MLP using Gradient descent algorithm by applying Linear, Sigmoid, tanh, and ReLu activation functions
10. **Digit recognition using CNN:** Identify the digit s 0-9 from MNIST data and CIFR 10 set using CNN
11. Image Classification using CNN: Classify cats and dogs using CNN from the given dataset
12. LSTM (Long Short-Term Memory Networks)/ARIMA--- Implementation biomedical signals (like EEG, ECG, EMG) classifications and disease prediction.

DIGITAL SIGNAL PROCESSING (Implement any six concepts)

1. Generate the following standard discrete time signals.
i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
i. Using rectangular window, ii. Using hamming window, iii. Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.

Reference books:

1. S.N. Sivanandam and S.N. Deepa, Introduction to neural networks using Matlab, 2006.
2. Simon Haykin, Neural Networks and Learning Machines, PHI, 2008.
3. Digital Signal Processing: Alon V. Oppenhelm, PHI
4. Digital Signal processing (II-Edition): S.K. Mitra, TMH

Mapping of Course Outcomes with Program Outcomes

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

Correlation Matrix

Unit No.	Lesson plan (Hrs)	% Correlation	CO	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO11)	Level of Correlation (0-3)
1	6	20	CO1	PO1, PO2	PO1: Apply(L3), PO2: Analyze(L4)	2, 1
2	6	20	CO2	PO1, PO2	PO1: Apply(L3), PO2: Analyze(L4)	2, 1
3	6	20	CO3	PO1, PO2, PO3	PO1: Apply(L3), PO2: Analyze(L4), PO3: Design(L3)	3, 3, 3
4	6	20	CO4	PO1, PO2	PO1:	3, 3

					Apply(L3), PO2: Analyze(L4)	
5	6	20	CO5	PO1, PO2	PO1: Apply(L3), PO2: Analyze(L4)	3, 3

Justification Statements

CO1: **Understand** the modules and dependencies for machine learning corresponding to different applications. 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 CO1 Action Verb is less than PO2 verb by two level; Therefore correlation is low (1).

CO2: **Understand** a range of machine learning regression techniques & clustering along with their datasets.
Action verb: Undertand (L2)
PO1: Apply(L3), CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2: Analyze CO2 Action Verb is less than PO2 verb by two level; Therefore correlation is low (1).

CO3: **Analyze** the KNN & CNN algorithms using iris dataset and images.
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 CO3 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).
PO3: Design CO3 Action Verb is greater than PO3 verb by two level; Therefore correlation is high (3).

CO4: **Evaluate** the basic signal processing operations like convolution and correlation.
Action verb: Evaluate (L5)
PO1: Apply(L3), CO4 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2: Analyze CO4 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

CO5: **Analyze** the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.
Action verb: Analyze (L4)
PO1: Apply(L3), CO5 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2: Analyze CO5 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

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Course Code	Year & Sem	Technical Paper Writing & IPR	L	T/CLC	P	C
23AMC9902	III-II		2	0	0	0

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.

CO2 Apply the fundamentals of technical research paper writing by organizing abstract, objectives, limitations, literature review to frame effective research questions.

CO3 Apply the research process and publication mechanisms and follow citation rules and proofreading techniques for paper writing.

CO4 Evaluate the rights and responsibilities of the holder of Intellectual Property.

CO5 Apply various forms of copy rights and patents at national and international levels.

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 I

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**

Mapping of Course Outcomes with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1									2				
CO2		3											
CO3									2		2		
CO4											3		
CO5											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)	%	corr	Verb	BTL			
1							Thumb Rule	2
2							Analyze	3
3							Thumb Rule	2
4							Thumb Rule	3
5							Thumb Rule	2

Justification Statements :

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).