ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)
Course Structure for Four Year Regular B.Tech Degree Program
(Effective for the batch admitted from 2020-21)
ELECTRCIAL & ELECTRONICS ENGINEERING (EEE)

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

Semester I (First Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science course	20ABS9901	Algebra and Calculus	3	0	0	3	30	70	100
2	Basic Science course	20ABS9902	Applied Physics	3	0	0	3	30	70	100
3	Humanities and Social Science	20AHS9901	Communicative English	3	0	0	3	30	70	100
4	Engineering Science Courses	20AES0304	Engineering Workshop Practice	1	0	4	3	30	70	100
5	Engineering Science Courses	20AES0501	Problem Solving and Programming	3	0	0	3	30	70	100
6	Humanities and Social Science LAB	20AHS9902	Communicative English Lab	0	0	3	1.5	30	70	100
7	Basic Science course(LAB)	20ABS9907	Applied Physics Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses (LAB)	20AES0503	Problem Solving and Programming Lab	0	0	3	1.5	30	70	100
			Total credits				**19.5**	**240**	**560**	**800**

Semester II (First Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science courses	20ABS9906	Differential Equations and Vector Calculus	3	0	0	3	30	70	100
2	Basic Science courses	20ABS9904	Chemistry	3	0	0	3	30	70	100
3	Engineering Science Courses	20AES0101	Basics of Civil and Mechanical Engineering	3	0	0	3	30	70	100
4	Engineering Science Courses	20AES0505	Internet of Things (IoT)	3	0	0	3	30	70	100
5	Engineering Science Courses	20AES0301	Engineering Graphics	1	0	4	3	30	70	100
6	Engineering Science Courses(LAB)	20AES0102	Basics of Civil and Mechanical Engineering Lab	0	0	3	1.5	30	70	100
7	Basic Science Course(LAB)	20ABS9909	Chemistry Lab	0	0	3	1.5	30	70	100
8	Engineering Science Courses(LAB)	20AES0506	Internet of Things (IoT)Lab	0	0	3	1.5	30	70	100
9	Mandatory course(AICTE suggested)	20AMC9902	Constitution of India	2	0	0	0	30	-	30
			Total Credits				**19.5**	**270**	**560**	**830**

Semester III (Second Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science Courses	20ABS9912	Transform Techniques and Complex Variables	3	0	0	3	30	70	100
2	Professional Core Courses	20APC0201	Electrical Circuits-I	3	0	0	3	30	70	100
3	Professional Core Courses	20APC0401	Electronic devices and circuits	3	0	0	3	30	70	100
4	Professional Core Courses	20APC0202	Power Systems-I	3	0	0	3	30	70	100
5	Professional Core Courses	20APC0203	Electrical Machines-I	3	0	0	3	30	70	100
6	Professional Core Courses(LAB)	20APC0204	Electrical Circuits-I Lab	0	0	3	1.5	30	70	100
7	Professional Core Courses(LAB)	20APC0404	Electronic Devices and Circuits Lab	0	0	3	1.5	30	70	100
8	Professional Core Courses (LAB)	20APC0205	Electrical Machines-I Lab	0	0	3	1.5	30	70	100
9	Skill Oriented Course	20AHE9902	Principles of Effective Public Speaking	1	0	2	2	100	-	100
10	Mandatory Course (AICTE suggested)	20AMC9903	Environmental Studies	3	0	0	0	30	-	30
			Total Credits				**21.5**	**370**	**560**	**930**

Semester IV (Second Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	Engineering Science Courses	20AES0509	Basics of Python Programming	3	0	0	3	30	70	100
2	Basic Science Course/Prof. Core Course	20APC0206	Electrical Circuits-II	3	0	0	3	30	70	100
3	Professional Core Courses	20APC0207	Electrical Machines-II	3	0	0	3	30	70	100
4	Professional Core Courses	20APC0208	Engineering Electromagnetics	3	0	0	3	30	70	100
5	Humanities and Social Sciences	20AHSMB01	Managerial Economics and financial analysis	3	0	0	3	30	70	100
6	Humanities and Social Sciences	20AHS9905	Universal Human Values	3	0	0	3	30	70	100
7	Engineering Science Courses/Prof. Core (Interdisciplinary)(LAB)	20AES0510	Basics of Python Programming Lab	0	0	3	1.5	30	70	100
8	Professional Core courses(LAB)	20APC0209	Electrical Circuits-II Lab	0	0	3	1.5	30	70	100
9	Professional Core courses(LAB)	20APC0210	Electrical Machines-II Lab	0	0	3	1.5	30	70	100
10	Skill Oriented Course	20ASC0201	Simulation of circuits using PSPICE	1	0	2	2	100	-	100
			Total Credits				**24.5**	**370**	**630**	**1000**
Community service project [To visit the selected Community to conduct survey (Socio-economic and Domain survey) and conduct sensitization/ awareness program / activities at the end of IV semester and before commencement of V semester and complete immersion program also during V semester and submit report in V semester. Assessment will be done at the end of V semester]										
Honors/Minor courses(The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**	**100**		**100**

Semester V (Third Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	Professional Core Courses	20APC0211	Electrical Machines-III	3	0	0	3	30	70	100
2	Professional Core Courses	20APC0212	Power Electronics	3	0	0	3	30	70	100
3	Professional Core Courses	20APC0213	Control Systems	3	0	0	3	30	70	100
4	Open Elective Course/Job Oriented Elective	20APC0425	Analog and Digital IC Applications	3	1	0	3	30	70	100
		20AOE0202	Programmable Logic Controllers	3	0	0	3	30	70	100
		20APC0515	Operating Systems	3	0	0	3	30	70	100
5	Professional Elective Courses	20APE0201	Power Systems-II	3	0	0	3	30	70	100
		20APC0403	Signals and Systems	3	0	0	3	30	70	100
		20APC0426	Linear System Analysis	3	0	0	3	30	70	100
6	Professional Core Courses Lab	20APC0214	Control Systems Lab	0	0	3	1.5	30	70	100
7	Professional Core Courses Lab	20APC0215	Power Electronics Lab	0	0	3	1.5	30	70	100
8	Skill advanced course/soft skill course	20ASC0202	Introduction to Programming with MATLAB	1	0	2	2	100	-	100
9	Mandatory Course (AICTE suggested)	20AMC9901	Biology for Engineers	3	0	0	0	30	-	30
10	Community Service Project	20CSP0201	Community service project	0	0	0	1.5	100	-	100
Total Credits							**21.5**	**440**	**490**	**930**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**	**100**		**100**

Sl. No	Course Code	Course Title	Sl. No	Course Code	Course Title
1	20AOE0201(a)	Joy Of Computing Using Python	11	20AOE0201(k)	Solar Energy Technology
2	20AOE0201(b)	Air pollution and control	12	20AOE0201(l)	Remote sensing essentials
3	20AOE0201(c)	Environment & Development	13	20AOE0201(m)	Ethical Hacking
4	20AOE0201(d)	Sustainable Power Generation Systems	14	20AOE0201(n)	Sustainable transportation systems
5	20AOE0201(e)	Solar Energy Engineering and Technology	15	20AOE0201(o)	An Introduction to Artificial Intelligence
6	20AOE0201(f)	Design of photovoltaic systems	16	20AOE0201(p)	Fundamentals of Electrical Engineering
7	20AOE0201(g)	Cyber security and Privacy	17	20AOE0201(q)	Smart Grid Basics to advanced Technologies
8	20AOE0201(h)	Physics of Renewable Energy Systems	18	20AOE0201(r)	Analog Electronic Circuit
9	20AOE0201(i)	Introduction To Semiconductors	19	20AOE0201(s)	Economic Operations and Control of Power Systems
10	20AOE0201(j)	Modern Digital Communication Techniques	20	20AOE0201(t)	Introduction To Photonics

***Student shall register any number of MOOC courses listed by the department as approved by the BOS. But student is required to submit the pass certificate on NPTEL platform for at least one program within the Course duration (Before IV-II examination notification).**

Semester VI (Third Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	Professional Core Courses	20APC0216	Electrical Measurements and Instrumentation	3	0	0	3	30	70	100
2	Professional Core Courses	20APC0217	Power System Analysis	3	0	0	3	30	70	100
3	Professional Core Courses	20APC0218	Switch gear and Protection	3	0	0	3	30	70	100
4	Professional Elective Courses	20APE0202	Power Semi-Conductor Drives	3	0	0	3	30	70	100
		20APC0418	Microprocessors and Microcontrollers	3	0	0	3	30	70	100
		20APE0205	Power Quality	3	0	0	3	30	70	100
5	Professional Core Courses Lab	20APC0219	Electrical Measurements Lab	0	0	3	1.5	30	70	100
6	Professional Core Courses Lab	20APC0220	Power System Analysis Lab	0	0	3	1.5	30	70	100
7	Professional Core Courses Lab	20APC0221	Switch Gear and Protection Lab	0	0	3	1.5	30	70	100
8	Skill advanced course/soft skill course	20ASC0203	Numerical techniques using MATLAB	1	0	2	2	100	-	100
9	Mandatory Course(AICTE)	20AMC9904	Professional Ethics and Human Values	3	0	0	0	30	-	30
Total Credits							**18.5**	**340**	**490**	**830**
Honors/Minor Courses(The hours distribution can be3-0-2or3-1-0 also)				**4**	0	0	**4**	**100**		**100**
Industrial/Research Internship(Mandatory)2Months during summer vacation										

Semester VII (Fourth Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	Professional Elective courses	20APE0204	Flexible AC Transmission Systems	3	0	0	3	30	70	100
		20APE0207	Advanced Control Systems	3	0	0	3	30	70	100
		20APE0208	Power System Operation and Control	3	0	0	3	30	70	100
2	Professional Elective courses	20APE0203	Neural networks and fuzzy logic	3	0	0	3	30	70	100
		20APC0419	Digital Signal Processing	3	0	0	3	30	70	100
		20APE0306	Renewable energy technologies	3	0	0	3	30	70	100
3	Open Elective Course/Job Oriented Elective	20AHSMB02	Entrepreneurship Development	3	0	0	3	30	70	100
		20APE0411	Embedded systems	3	0	0	3	30	70	100
		20AOE0201(f)	Design of photovoltaic systems (MOOCS-NPTEL)	-	-	-	3	25	75	100
4	Open Elective Courses/Job oriented elective	20AHSMB03	Principles of Management	3	0	0	3	30	70	100
		20APC0502	Data Base Management System	3	0	0	3	30	70	100

		20APC0516	Computer Networks	3	0	0	3	30	70	100
5	Professional Elective Courses	20APE0206	Electrical Distribution System Automation	3	0	0	3	30	70	100
		20APE0209	High Voltage Engineering	3	0	0	3	30	70	100
		20APE0210	Electric Vehicle Technologies	3	0	0	3	30	70	100
6	Humanities and Social Science Elective	20AHE9903	Professional Communication	3	0	0	3	30	70	100
7	Skill advanced course/soft skill course	20ASC0204	Fundamentals of using AI tools	1	0	2	2	100	-	100
Industrial/Research Internship-(20APR0201) 2 Months (Mandatory) after third year (to be evaluated during VII semester)				0	0	0	3	100	-	100
				Total Credits			**23**	**380**	**420**	**800**
Honors/Minor courses(The hours distribution can be 3-0-2 or 3-1-0 also)				**4**		**0**	**4**	**100**		**100**

Semester VIII (Fourth Year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
1	Open Elective Course (MOOCS-NPTEL 12 Weeks)			-	-	-	3	**25**	**75**	**100**
2	INTERNSHIP(3 Months)	20APR0202					3	**100**	**-**	**100**
3	Major Project	20APR0203	Project Work	-	-	-	9	**60**	**140**	**200**
						Total Credits	**15**	**185**	**215**	**400**
						Grand Total	**163**	**2440**	**3780**	**6420**

AK20 Regulations

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

Subject Code: 20ABS9901	Subject Name: Algebra and Calculus	L T P 3 0 0	Credits 3	CLC 3

Course Outcomes (CO):

After studying of the course, Student will be able to:

CO1. Apply the matrix algebra techniques for solving various linear equations.

CO2. Analyze the linear transformations of quadratic forms and mean value theorems.

CO3. Apply the fundamental concepts of partial derivatives for multi variable functions.

CO4. Evaluate the multiple integrals in Cartesian, polar, cylindrical, and spherical co-ordinate systems.

CO5. Evaluate the improper integrals using special functions like Beta and Gamma.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	the matrix algebra techniques	for solving various linear equations		L3
2	Analyze	the linear transformations of quadratic forms and mean value theorems.			L4
3	Apply	the fundamental concepts of partial derivatives	for multi variable functions		L3
4	Evaluate	the multiple integrals	in cartesian, polar, cylindrical, and spherical co-ordinate systems		L5
5	Evaluate	the improper integrals	using special functions like Beta and Gamma		L5

Unit I : Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem.

Unit II : Quadratic Forms and Mean Value Theorems

Diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof).

Unit III: Multivariable calculus

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit IV: Multiple Integrals

Double integrals, change of order of integration, double integration in polar coordinates, change of Variables in double integration (Cartesian to polar), areas enclosed by plane curves. Evaluation of triple integrals.

Unit V: Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions, Bessel functions, Bessel's equation, Recurrence formulae or $J_n(x)$, Generating function- Orthoganality of Bessels functions.

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. Dr.T.K.VIyengar, B.Krishna Gandhi, S. Ranganathamamd M.V.S.S.N Prasad, Mathematics – 1, S.Chand publications.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. B.V.Ramana, Higher Engineering Mathematics, McGraw Hill Education.
4. N.Bali, M.Goyal, C.Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	14	21.21	3	Apply	L3	PO2	Apply (L3)	3
2	10	15.15	2	Analyze	L4	PO2	Analyze (L4)	3
3	14	21.21	3	Apply	L3	PO1	Apply (L3)	3
4	14	21.21	3	Evaluate	L5	PO1	Apply (L3)	3
5	14	21.21	3	Evaluate	L5	PO1	Apply (L3)	3

Justification:

CO1: Apply the matrix algebra techniques for solving various linear equations**.**

Action Verb: Analyze **(L4)**

PO2 Verbs: Analyze (L4)

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

CO2: Analyze the linear transformations of quadratic forms and mean value theorems**.**

Action Verb: Analyze **(L4)**

PO2 Verbs: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

CO3: Apply the fundamental concepts of partial derivatives for multi variable functions**.**

Action Verb: Apply **(L3)**

PO2 Verbs: Analyze (L4)

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

CO4: Evaluate the multiple integrals in cartesian, polar, cylindrical, and spherical co-ordinate systems.

Action Verb: Evaluate (L5)

PO1 Verb: **Apply** (L3)

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

CO5: Evaluate the improper integrals using special functions like Beta and Gamma**.**

Action Verb: Evaluate (L5)

PO1 Verb: **Apply** (L3)

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

Annamacharya Institute of Technology & Sciences (Autonomous), Tirupati

AK20 Regulations

Course Code	APPLIED PHYSICS	L	T	P	C
20ABS9902		**3**	**0**	**0**	**3**
Regulation: **AK20**	Common to I B.Tech ECE, EEE, AI&DS, AI&ML, and CSD(Sem-1), CSE & CIC (Sem-2)				

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Understand the properties of light and electromagnetic waves.
2. Analyze the fundamentals of Lasers and optical fibers.
3. Analyze the properties of dielectric and magnetic materials.
4. Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.
5. Apply the basic concepts of superconductors and nanomaterials for engineering problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	The properties of light and electromagnetic waves.			L2
2	Analyze	The fundamentals of Lasers and optical fibers.			L4
3	Analyze	The properties of dielectric and magnetic materials.			L4
4	Analyze	The charge carrier dynamics in semiconductors.	By implementing the equations of state.		L4
5	Apply	The basic concepts of superconductors and nanomaterials		for engineering problems.	L3

Unit I: Optics and EM Theory

Interference of light -principle of superposition-Conditions for sustained
Interference-Interference in thin films (reflected light) - Newton's Rings -Determination of Wavelength.
Diffraction-Fraunhofer diffraction- Single slit and double slit- Diffraction Grating.
Divergence and Curl of Electric and Magnetic Fields - Gauss' theorem for divergence and Stokes' theorem for curl - Maxwell's Equations (Quantitative) – Electromagnetic wave - propagation in non-conducting medium - Poynting's Theorem.

Unit II: Lasers and Fiber Optics

Lasers – Introduction – Characteristics – Spontaneous and Stimulated Emission – Einstein Coefficients – Population Inversion – Excitation Mechanism and Optical Resonator - He-Ne Laser -Nd:YAG Laser – Semiconductor Diode Laser – Applications of Lasers.

Introduction to Optical Fibers – Total Internal Reflection – Critical angle of propagation –Acceptance angle – Numerical Aperture – Classification of fibers based on Refractive index profile – Propagation of electromagnetic wave through optical fiber – modes – importance of V-number-Attenuation, Block Diagram of Fiber optic Communication – Industrial Applications –Fiber optic Sensors.

Unit III: Dielectric and Magnetic Materials

Introduction—Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant-Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Frequency dependence of polarization-Lorentz (internal) field-Claussius-Mosotti equation-Applications of Dielectrics: Ferroelectricity.
Introduction-Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability-Origin of permanent magnetic moment – Classification of Magnetic materials - Weiss theory of ferromagnetism (qualitative) – Hysteresis– soft and hard magnetic materials – Magnetic memory device applications.

Unit IV: Semiconductors

Origin of Energy bands (Qualitative)-Intrinsic and Extrinsic semiconductors –Direct and indirect band gap semiconductors- Density of charge carriers – Fermi energy–-Dependence of Fermi energy on carrier concentration and temperature – Electrical conductivity – Drift and Diffusion currents – Continuity equation - Hall effect -Applications of Hall effect and Semiconductors.

Unit V: Superconductors and Nanomaterials

Superconductors-Properties-Meissner's effect-BCS Theory (Qualitative) - Josephson effect (AC&DC)-Types of Superconductors-Applications of superconductors.
Nanomaterials–Significance of nanoscale–: Physical, Mechanical, Magnetic, Optical properties of nanomaterials –Synthesis of nanomaterials: Top-down-Ball Milling, Bottom-up-Chemical vapour deposition–Characterization of nanomaterials : X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM)-Applications of Nanomaterials.

Textbooks:

1. M. N. Avadhanulu, P. G. Kshirsagar &TVS Arun Murthy" A Text book of Engineering Physics"-S. Chand Publications,11th Edition2019.
2. B.K.Pandey and S.Chaturvedi, Engineering Physics, Cengage Learning,2012.

References:

1. K Thyagarajan "Engineering Physics",-Mc Graw Hill Publishing Company Ltd, 2016
2. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
3. David J.Griffiths,"Introduction to Electrodynamics"-4/e, Pearson Education, 2014
4. T Pradeep, "A Text book of NanoScience and NanoTechnology"-Tata Mc Graw Hill 2013.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													
2	3			3										
3	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)	**%**	**correlation**	**Verb**	**BTL**			
1	**16**	**23.8**	**3**	**Understand**	**L2**	PO1	PO1: Apply (L3)	2
2	**11**	**16.4**	**2**	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
3	**12**	**17.9**	**2**	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	**13**	**19.4**	**2**	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	**15**	**22.3**	**3**	**Apply**	**L3**	PO1, PO4	PO1: Apply (L3)	3
	67							

CO1: 1. Understand the properties of light and electromagnetic waves.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

CO2: Analyze the fundamentals of Lasers and optical fibers.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3);

PO4 Verbs: Analyze (L4);

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

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

CO3: Analyze the properties of dielectric and magnetic materials.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3);

PO4 Verbs: Analyze (L4);

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

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

CO4: Analyze the charge carrier dynamics in semiconductors by implementing the equations of state.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3); PO4 Verbs: Analyze (L4);

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

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

CO5: 5. Apply the basic concepts of superconductors and nanomaterials for engineering problems.

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore, the correlation is high (3).

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

Subject Code 20AHS9901	Subject Name **COMMUNICATIVE ENGLISH**	L T P 3 0 0	Credit: 3

Course Outcomes (CO): After studying of the course, Student will be able to:

CO1. Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (Listening and Writing)

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

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions (Speaking)

CO4: Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.(Reading and Writing)

CO5: Create a coherent paragraph interpreting a figure/graph/chart/table (Writing)

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the context, topic, and pieces of specific information from social or transactional dialogues	Spoken by native speakers of English.		L2
2	**Apply**	Grammatical structures to formulate sentences and correct word forms.			L3
3	**Analyze**	Discourse markers to speak clearly on a specific topic in informal discussions.			L4
4	**Evaluate**	reading/listening texts and to write summaries		Based on global comprehension of these texts.	L5
5	**Create**	a coherent paragraph		Interpreting a figure/graph/chart/table.	L6

UNIT -1

Lesson: On the Conduct of Life: William Hazlitt

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: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary- I: Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form – wh questions; word order in sentences.

Vocabulary -2: Formal/academic words and phrases.

UNIT -2

Lesson: The Brook: Alfred Tennyson

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

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

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; Mechanics of writing - punctuation, capital letters.

Grammar & Vocabulary building-1: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Vocabulary building: 2 Idioms and Phrases, Homonyms, Homophones and Homographs.

UNIT -3
Lesson: The Death Trap: Saki
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 – identifying main idea/s and rephrasing what is read.
Grammar and Vocabulary building-II: Direct and indirect speech, reporting verbs for academic purposes.
Technical Writing-1: personal experiences, unforgettable incidents, travelogues. (Imaginative, Narrative and Descriptive)

UNIT-4
Lesson: Innovation: Muhammad Yunus
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/Report writing***, e-mail writing***
Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice.
Vocabulary: 2: Jigsaw Puzzles, Vocabulary Activities through Web tools
UNIT -5
Lesson: Politics and the English Language: George Orwell
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.
Reading: Reading for comprehension.
Writing: Writing structured essays on specific topics using suitable claims and evidences.
Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage.
Technical Writing-2: Narrative short story, Newspaper articles on science fiction.

Text Book:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

Web links

www.englishclub.com
www.easyworldofenglish.com
www.languageguide.org/english/
www.bbc.co.uk/learningenglish
www.eslpod.com/index.html
www.myenglishpages.com

Correlation of COs with the POs & PSOs

Course Title	Course Outcomes COs	Programme Outcomes(POs)											
		PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Communicative English	CO1										3		
	CO2									2	3		
	CO3										3		
	CO4										3		
	CO5										3		

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

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	10	20	2	**Understand**	**L2**	PO10	Thumb Rule	2
2	10	20	2,2	**Apply**	**L3**	PO9, PO10	Thumb Rule Thumb Rule	2, 2
3	10	20	**3**	**Analyze**	**L4**	PO10	Thumb Rule	3
4	10	20	**3**	**Evaluate**	**L5**	PO10	Thumb Rule	3
5	10	20	**3**	**Create**	**L6**	PO10	Thumb Rule	3

CO1: Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English

Action Verb: Understand (L2)

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 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 PO12 as moderate (2)

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions

Action Verb: Analyze (L4)

CO3 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

CO4: Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.

Action Verb: Evaluate (L5)

CO4 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

CO5: Create a coherent paragraph interpreting a figure/graph/chart/table

Action Verb: Create (L6)

CO5 Action Verb Create is of BTL 6. Using Thumb rule, L6 correlates PO6 to PO12 as high (3).

I.B.Tech **Semester: I&II** **AK20 Regulations**

Subject Code	Subject Name	L T P	Credits: 3
20AES0304	ENGINEERING WORKSHOP PRACTICE	1 0 4	

Course Outcomes: At the end of the laboratory, the student will be able to

CO1. Understand workshop tools and operational capabilities.
CO2. Apply wood working skills to prepare different joints.
CO3. Apply sheet metal operations to prepare different components in real world applications.
CO4. Apply fitting operations for various applications.
CO5. Apply basic electrical engineering knowledge for house wiring practice.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	workshop tools and operational capabilities			L2
2	Apply	wood working skills to prepare different joints			L3
3	Apply	Sheet metal operations to prepare different components in real world applications.			L3
4	Apply	fitting operations in various applications			L3
5	Apply	basic electrical engineering knowledge for house wiring practice			L3

WOOD WORKING: (CO1 & CO2)
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

SHEET METAL WORKING: (CO1 & CO3)
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

FITTING: (CO1 & CO4)
Study the difference types of fits and tolerances, surface finishing materials. 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 tyre puncture and change of two wheeler tyre

ELECTRICAL WIRING: (CO1 & CO5)

Study the different types of circuits and connections, Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series
b) Two-way switch
c) Godown lighting
d) Tube light
e) Three phase motor
f) Soldering of wires

Mapping of COs to POs and PSOs

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ENGINEERING WORKSHOP PRACTICE	CO1	2												2	2
	CO2	3	3	3			2			2				2	2
	CO3	3	3	3			2			2				2	2
	CO4	3	3	3			2			2				2	2
	CO5	3	3	3			2			2				2	2

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

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Understand	**L2**	PO1	Apply (L3)	2
2	Apply	**L3**	PO1 PO2 PO3 PO6 PO9	Apply (L3) Identify (L3) Develop (L3) TR TR	3 3 3 2 2
3	Apply	**L3**	PO1 PO2 PO3 PO6 PO9	Apply (L3) Identify (L3) Develop (L3) TR TR	3 3 3 2 2
4	Apply	**L3**	PO1 PO2 PO3 PO6 PO9	Apply (L3) Identify (L3) Develop (L3) TR TR	3 3 3 2 2
5	Apply	**L3**	PO1 PO2 PO3 PO6 PO9	Apply (L3) Identify (L3) Develop (L3) TR TR	3 3 3 2 2

CO-PO mapping justification:

CO1: Understand workshop tools and operational capabilities.
Action Verb: Understand **(L2)**
PO1 Verb: Apply (L3)
CO1 Action Verb is less than one to PO1; Therefore correlation is medium (2)

CO2: Apply wood working skills to prepare different joints.

Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore, correlation is high (3)
PO2 verb: Identify (L3)
CO2 Action Verb is equal to PO2 verb; Therefore, correlation is high (3)
PO3 Verb: Develop (L3)
CO2 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)
PO6: TR,
CO2 co-relates with PO6 moderately. Therefore correlation is chosen as medium (2)
PO7: TR
CO2 co-relates with PO7 moderately. Therefore correlation is chosen as medium (2)

CO3: Apply sheet metal operations to prepare different components in real world applications.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO2 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, correlation is high (3)
PO3 Verb: Develop (L3)
CO3 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)
PO6: TR,
CO3 co-relates with PO6 moderately. Therefore correlation is chosen as medium (2)
PO7: TR
CO3 co-relates with PO7 moderately. Therefore correlation is chosen as medium (2)

CO4: Apply fitting operations for various applications.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO4 Action Verb is equal to PO1 verb; Therefore, correlation is high (3)
PO2 verb: Identify (L3)
CO4 Action Verb is equal to PO2 verb; Therefore, correlation is high (3)
PO3 Verb: Develop (L3)
CO4 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)
PO6: TR,
CO4 co-relates with PO6 moderately. Therefore correlation is chosen as medium (2)
PO7: TR
CO4 co-relates with PO7 moderately. Therefore correlation is chosen as medium (2)

CO5: Apply basic electrical engineering knowledge for house wiring practice**.**
Action Verb: Apply (L3)
PO1 Verb: 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)
PO3 Verb: Develop (L3)
CO5 Action Verb is equal to PO3 verb; Therefore, correlation is high (3)
PO6: TR,
CO5 co-relates with PO6 moderately. Therefore correlation is chosen as medium (2)
PO7: TR
CO5 co-relates with PO7 moderately. Therefore correlation is chosen as medium (2)

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

Course Code	Year & Sem	Problem Solving And Programming	L	T	P	C
20AES0501	I-I		3	0	0	3

Course Outcomes:

After studying of the course, Student will be able to:

CO 1: Understand the Programming and Algorithms concepts to Perform Basic operations.
CO 2: Apply the problem solving approaches to generate different algorithms.
CO 3: Understand the various operators to perform mathematical operations.
CO 4: Apply the Pointers and Array Techniques to manipulate the data.
CO 5: Analyze the Sorting and Searching Techniques to arrange the data in sorted order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the Programming and Algorithms concepts		to Perform Basic operations.	L2
CO2	Apply	the problem solving approaches		to generate different algorithms	L3
CO3	Understand	the various operators		to perform mathematical operations	L2
CO4	Apply	the Pointers and Array Techniques		to manipulate the data	L3
CO5	Analyze	the Sorting and Searching Techniques		to arrange the data in sorted order.	L4

UNIT - I		
Computer Fundamentals: What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU. Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.		
UNIT - II		
Introduction to computer problem solving: Introduction, the problem-solving aspect, top-down design, implementation of algorithms, the efficiency of algorithms, and the analysis of algorithms. **Fundamental algorithms**: Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.		
UNIT - III		
Types, Operators, and Expressions: Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation. **Input and output**: standard input and output, formatted output-Printf, formatted input-Scanf. Control Flow: Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Do- while, break and continue, Goto and labels. **Functions and Program Structure**: Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.		
UNIT - IV		
Factoring methods: Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.		

Pointers and arrays: Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

Array Techniques: Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the kth smallest element

UNIT - V

Sorting and Searching: Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

Structures: Basics of structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedef, unions, bit-fields.

Some other Features: Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

Textbooks:

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. R.G. Dromey, "How to Solve it by Computer". 2014, Pearson.
3. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.

Reference Books:

1. RS Bichkar "Programming with C", 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, "Information Technology in Theory", 2017, Cengage Learning.
3. Byron Gottfried and Jitender Kumar Chhabra, "Programming with C", 4th Edition, 2019, McGraw Hill Education.

Online Learning Resources:

www.nptel.ac.in

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	19	25%	3	CO1: Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	10	14%	2	CO2: Apply	L3	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Analyze (L4) PO3: Develop (L3) PO12: Thumb rule	3 2 3 2
3	19	25%	3	CO3: Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review (L2) PO12: Thumb rule	2 3 2
4	15	20%	2	CO4: Apply	L3	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO12: Thumb rule	3 3 3 2
5	12	16%	2	CO5: Analyze	L4	PO1 PO2 PO3 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop(L3) PO12: Thumb rule	3 3 3 2
	75	100 %						

Justification Statements:

CO1: Analyze the Programming and Algorithms concepts to Perform Basic operations.

Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2 Verb: Review (L2)
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

CO2: Apply the problem solving approaches to generate different algorithms.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Analyze (L4)
CO2 Action verb is less than PO2 verb by one level. Therefore, the correlation is medium (2)
PO3: Develop (L3)
CO2 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
Some of the Algorithm knowledge are used to solve various problems. Therefore, the correlation is medium (2)

CO3: Understand the various operators to perform mathematical operations.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2: Review (L2)
CO3 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some mathematical operations to perform operators are used to create programs. Therefore, the correlation is medium (2)

CO4: Apply the Pointers and Array Techniques to manipulate the data.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)
PO12: Thumb rule
For some mathematical operations to perform Pointers and Array Techniques are used to create programs. Therefore, the correlation is medium (2)

CO5: Analyze the Sorting and Searching Techniques to arrange the data in sorted order.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action verb is less than PO1 verb by two levels. Therefore, the correlation is low (1)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb by one level. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb by one level. Therefore, the correlation is high (3)
PO12: Thumb rule
For some Data Structures operations to perform Sorting and Searching Techniques are used to create programs. Therefore, the correlation is medium (2)

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

Subject Code	Subject Name	L T P	Credit:	CLC
20AHS9902	**COMMUNICATIVE ENGLISH LAB**	0 0 3	1.5	1

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

Course Outcomes (CO): After studying of the course, Student will be able to:

CO1. Evaluate the awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

CO2. Understand the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions.

CO3. Apply the knowledge of vocabulary and skills in various language learning activities.

CO4. Analyze the speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO5. Evaluate the acceptable etiquette essentials in social and professional presentations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Evaluate**	the awareness on mother tongue influence and neutralize it	in order to improve fluency in spoken English		**L5**
2	**Understand**	the different aspects of the language with emphasis on LSRW skills and		make use of different strategies in discussions	**L2**
3	**Apply**	the knowledge of vocabulary and skills		in various language learning activities	**L3**
4	**Analyze**	the speech sounds, stress, rhythm, intonation and syllable division	for better listening and speaking comprehension		**L4**
5	**Evaluate**	the acceptable etiquette essentials in social and professional presentations			**L5**

Unit 1

1. Phonetics (CO1)
2. Non - verbal communication (CO2)
3. Vocabulary (word formation, one word substitutes, words often misused & confused, collocations idioms & phrases) (CO3)

Unit 2

1. Reading Comprehension (CO2, CO4)
2. JAM (CO2, CO3)
3. Distinction between Native and Indian English accent (Speeches by TED and Kalam). (CO4)

Unit 3
1. Situational dialogues/Giving Directions (CO1)
2. Describing objects/places/persons (CO2, CO3)

Unit 4
1. Fun – Buzz (Tongue twisters, riddles, puzzles etc) (CO3)
2 Formal Presentations (CO5)

Unit 5
1. Debate (Contemporary / Complex topics) (CO2)
2. Group Discussion (CO2)

Software Source:
K-Van Solutions Software

Reference:
Teaching English - British Council

***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	PO12
Communicative English Lab	CO1										3		
	CO2									2			
	CO3										2		
	CO4										3		
	CO5										3		

CO-PO mapping justification:

CO	**Percentage of contact hours over the total planned contact hours (Approx. Hrs)**			**CO**		**Program Outcome (PO)**	**PO(s): Action verb and BTL (for PO1 to PO5)**	**Level of Correlation (0-3)**
		%	**corr**	**Verb**	**BTL**			
1	9	25	3	**Evaluate**	**L5**	PO10	Thumb Rule	3
2	6	16	2	**Understand**	**L2**	PO9	Thumb Rule	2
3	6	16	**2**	**Apply**	**L3**	PO10	Thumb Rule	2
4	6	16	**3**	**Analyze**	**L4**	PO10	Thumb Rule	3
5	9	25	**3**	**Evaluate**	**L5**	PO10	Thumb Rule	3

CO1: Evaluate awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Action Verb: Evaluate (L5)

CO1 Action Verb **Evaluate** is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

CO2: Understanding the different aspects of the language with emphasis on LSRW skills and make use of different strategies in discussions

Action Verb: Understand (L2)
CO2 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2)

CO3: Apply knowledge of vocabulary and skills in various language learning activities
Action Verb: Apply (L3)
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

CO4: Analyze speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension
Action Verb: Analyze (L4)
CO4 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).

CO5: : Evaluate the acceptable etiquette essentials in social and professional presentations.
Action Verb: Evaluate (L5)

CO5 Action Verb Evaluate is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY SCIENCES: TIRUPATI

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I B.Tech **AK20 Regulations**

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

Subject Code:20ABS9907	Subject Name: **Applied Physics Lab**	L T P 0 0 2	Credits:1.5

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

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

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Analyze**	**The properties of light for solving engineering problems.**			**L4**
2	**Understand**	**The basic concepts of electromagnetic induction.**			**L2**
3	**Evaluate**	**The crystallite size**	**Using X-ray diffraction.**		**L5**
4	**Analyze**	**The basic properties of dielectric and magnetic behavior of the given material.**			**L4**
5	**Evaluate**	**The basic parameters of a given semiconductor material.**			**L5**

List of Experiments:

1. Determination of the thickness of the wire using wedge shape method. **(CO1)**
2. Determination of the radius of curvature of the lens by Newton's ring method. **(CO1)**
3. Determination of wavelength by plane diffraction grating method. **(CO1)**
4. Dispersive power of a diffraction grating. **(CO1)**
5. Study of the Magnetic field along the axis of a circular coil carrying current. **(CO2)**
6. Study the variation of B versus H of the magnetic material (B-H curve) **(CO4)**
7. Determination of the numerical aperture of a given optical fiber and angle of acceptance. **(CO1)**
8. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect. **(CO5)**
9. Determination of the energy gap of a semiconductor. **(CO5)**
10. Determination of crystallite size using X-Ray diffraction spectra. **(CO3)**
11. Determination of Wavelength of LASER using diffraction grating. **(CO1)**
12. Determination of particle size using LASER. **(CO1)**
13. Determination of the resistivity of semiconductor by four probe method. **(CO5)**
14. Determination of dielectric constant by charging and discharging method. **(CO4)**
15. Study the temperature dependence of resistance of a thermister. **(CO5)**

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

References:

1. S. Balasubramanian, M.N.Srinivasan, “A Text book of Practical Physics”-S Chand Publishers, 2017.

2. http://vlab.amrita.edu/index.php-VirtualLabs, Amrita University.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3			3										
2	2			1										
3	3			3										
4	3			3										
5	3			3										

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

CO-PO mapping justification:

CO	**Percentage of contact hours over the total planned contact hours**			**CO**		**Program Outcome (PO)**	**PO(s): Action verb and BTL (for PO1 to PO5)**	**Level of Correlation (0-3)**
	Lesson Plan (Hrs)	**%**	**correlation**	**Verb**	**BTL**			
1	**9**	**25**	**3**	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
2	**6**	**16**	**2**	**Understand**	**L2**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	2 1
3	**6**	**16**	**2**	**Evaluate**	**L5**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
4	**9**	**25**	**3**	**Analyze**	**L4**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
5	**6**	**16**	**2**	**Evaluate**	**L5**	PO1, PO4	PO1: Apply (L3), PO4: Analyze (L4)	3 3
	36							

CO1: Analyze the properties of light for solving engineering problems.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

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

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

CO2: Understand the basic concepts of electromagnetic induction.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

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

CO2 Action Verb is greater than PO1 verb by two levels; Therefore correlation is low (1).

CO3: Evaluate the crystallite size using X-ray diffraction.

Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

PO4 Verb: Analyze (L4)

CO3 Action Verb level is greater than PO1 action verb by two levels; Therefore correlation is high (3).

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

CO4: 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)

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

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

CO5: Evaluate the basic parameters of a given semiconductor material.

Action Verb: Evaluate (L5)

PO1 and PO4 Verb: Apply (L3)

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

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

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

Course Code	Year & Sem	Problem Solving And Programming Lab	L	T	P	C
20AES0503	I-I		0	0	3	1.5

Course Outcomes:

After studying of the course, Student will be able to:

CO 1: Analyze the basics of computer and concepts of C for writing simple programs.

CO 2: Analyze the control statements for solving the problems using C

CO 3: Design the algorithm for implementing complex problems using C.

CO 4: Analyze the arrays to store and retrieve the elements.

CO 5: Apply the different sorting techniques for solving real world problems.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the basics of computer and concepts of C		for writing simple programs	L4
CO2	Analyze	the control statements	using C	for solving the problems	L4
CO3	Design	the algorithm	using C	for implementing complex problems	L6
CO4	Analyze	the arrays		to store and retrieve the elements.	L4
CO5	Apply	the different sorting techniques		for solving real world problems	L3

List of Experiments

1. Assemble and disassemble parts of a Computer **(CO1)**
2. Design a C program which reverses the number**(CO1)**
3. Design a C program which finds the second maximum number among the given list of numbers. **(CO2)**
4. Construct a program which finds the kth smallest number among the given list of numbers. **(CO2)**
5. Design an algorithm and implement using C language the following exchanges a ← b ← c ← d ← a**(CO2)**
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them. **(CO2)**
7. Implement the C program which computes the sum of the first n terms of the series Sum = 1 – 3 + 5 -7 + 9**(CO2)**
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565. **(CO2)**
9. Design an algorithm and implement using a C program which finds the sum of the infinite series 1 – x2/2! + x4/4! – x6/6! + …. **(CO3)**
10. Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1. **(CO3)**
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa. **(CO3)**
12. Develop an algorithm which computes the all the factors between 1and100 for a given number and implement it using C. **(CO3)**
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n. **(CO3)**
14. Design a C program which reverses the elements of the array. **(CO4)**
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The starts for each number should be printed horizontally. **(CO4)**
16. Implement the sorting algorithms a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort. **(CO5)**
17. Illustrate the use of auto, static, register and external variables. **(CO5)**
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list. **(CO5)**
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers. **(CO5)**
20. Design a C program which sorts the strings using array of pointers. **(CO5)**

Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) : Action Verb and BTL (for PO1 to PO12)	Level of Correlation (0-3)
1	CO1: Analyze	L4	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	3 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: Design	L6	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Formulate (L6) PO3: Design(L6) PO4: Analyze (L4) PO5: Create (L6) PO12: Thumb rule	3 3 3 3 3 3
4	CO4: Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO12	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3) PO12: Thumb rule	3 3 3 3 3 3
5	CO5: Apply	L3	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze (L4) PO5: Apply (L3)	3 3 3 2 3

Justification Statements :

CO1: Analyze the basic concepts of C for writing simple programs.

Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO1 Action verb is Greater than PO1 verb. Therefore, the correlation is high(3)
PO2 Verb: Review(L2)
CO1 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)

CO2: Analyze the control statements for solving the problems.

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)

CO3: Design the algorithm for implementing complex problems using C.
Action Verb: Design (L6)
PO1: Apply (L3)
CO3 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: Formulate(L6)
CO3 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is greater than as PO4 verb. Therefore, the correlation is high (3)
PO5: create (L6)
CO3 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

PO12: Thumb rule
Algorithms analysis is learning process to find the solution better manner the correlation is high (3)

CO4: Analyze the arrays to store and retrieve the elements.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action verb is greater than as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO4 Action verb is greater than as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore, the correlation is high (3)
PO5: Apply (L3)
CO4 Action verb is greater than as PO5 verb. Therefore, the correlation is high (3)

PO12: Thumb rule
Data analysis is the trending approach in the current days Therefore, the correlation is high (3)

CO5: Apply the different sorting techniques for solving real world problems.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action verb is same as PO1 verb. Therefore, the correlation is high (3)
PO2: idetify(L3)
CO5 Action verb is same as PO2 verb. Therefore, the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is same as PO3 verb. Therefore, the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is less than PO4 verb by one level. Therefore, the correlation is medium (2)
PO5: Apply (L3)
CO5 Action verb is same as PO5 verb. Therefore, the correlation is high (3)

AK20 Regulations

Year: I **Semester**: II **Branch of Study: ECE, EEE, ME, CE**

Subject Code:20ABS9906	Subject Name: Differential Equations and Vector Calculus	L T P 3 0 0	Credits 3

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Analyze the mathematical concepts of ordinary differential equations of higher order.
2. Apply the methods of linear differential equations related to various engineering problems.
3. Analyze the partial differential equations of first and higher order.
4. Understand the vector differential operators such as gradient, curl, divergent.
5. Evaluate the vector integral theorems by using line, surface, and volume integrals.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Analyze**	the mathematical concepts of ordinary differential equations	of higher order		**L4**
2	**Apply**	the methods of linear differential equations	related to various engineering problems		**L3**
3	**Analyze**	the partial differential equations	of first and higher order		**L4**
4	**Understand**	The vector differential operators such as gradient, curl, divergent.			**L2**
5	**Evaluate**	the vector integral theorems	by using line, surface, and volume integrals		**L5**

UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral (e^{ax}, sinax (or) cosax, X^k, $e^{ax}v$, x v(x)), method of variation of parameters.

UNIT II: Equations Reducible to Linear Differential Equations and Applications

simultaneous linear equations with constant coefficients ,Cauchy's and Legendre's linear equations, Applications to oscillations of a spring, L-C-R Circuit problems and Mass spring system.

UNIT III: Partial Differential Equations of First order and Higher Order

Linear Equations of First order P.D.E: Method of Grouping, Method of Multipliers.
Non-linear Equations of First Order PDE: f (p , q) = 0, f (z, p ,q) = 0, f (x , p) = F (y , q) and z = px +qy + f (p , q) OR Clairaut's Equation.
Homogenous Linear P.D.E with constant coefficients of Higher order: Finding complementary function, Particular Integrals of e^{ax+by}, Sin (ax+by) Or Cos (ax +by), X^mY^n and for any function of F (x, y). Non-Homogenous Linear P.D.E of constant coefficient.

UNIT IV:Vector differentiation

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

UNIT V: Vector integration

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	PO12
1		3										
2	3											
3		3										
4	2											
5		3										

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

CO-PO mapping:

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	**Analyze**	**L4**	PO2	**Analyze (L4)**	3
2	**15**	22.3	3	**Apply**	**L3**	PO1	**Apply (L3)**	3
3	**14**	20.8	**3**	**Analyze**	**L4**	PO2	**Analyze (L4)**	3
4	**9**	13.4	**2**	**Understand**	**L2**	PO1	**Apply (L3)**	2
5	**15**	22.3	**3**	**Evaluate**	**L5**	PO2	**Analyze (L4)**	3

Justification:

CO1: Analyze the mathematical concepts of ordinary differential equations of higher order.
Action Verb: Analyze (L4)
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO2 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 partial differential equations of first and higher order.
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 vector differential operators such as gradient, curl, divergent.
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 vector integral theorms by using line, surface, and volume integrals**.**
Action Verb: Evaluate (L5)

AK20 Regulations

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

(Autonomous)

(Effective for the batches admitted from 2022-23)

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

Subject Code: 20ABS9904	**Subject Name:** Chemistry	L 3	T 0	P 0	Credits: 3	CLC 3

Course Code	**CHEMISTRY**		L	T	P	C
20ABS9904			**3**	**0**	**0**	**3**
Pre-Requisites		Semester	**I**			

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 electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors**
3. **Analyze the preparation and mechanism of polymers**
4. **Analyze the separation of gaseous and liquid mixtures using instrumental methods**
5. **Apply the purification technique to remove hardness of water and to check the quality of water**

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	**The interaction of energy levels between atoms and molecules**			**L2**
2	**Apply**	**The electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors**			**L3**
3	**Analyze**	**The preparation and mechanism of polymers**			**L4**
4	**Analyze**	**The separation of gaseous and liquid mixtures**		**Using instrumental methods**	**L4**
5	**Apply**	**The purification technique to remove hardness of water**		**to check the quality of water**	**L3**

Unit 1: Structure and Bonding Models

Planck's quantum theory, Schrodinger wave equation, significance of Ψ^1 and Ψ^2 , applications to hydrogen, particle in a box and their applications for conjugated molecules, crystal field theory – salient features – energy level diagrams for transition metal ions – splitting of orbital's in tetrahedral and octahedral complexes, magnetic properties, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 , N_2 and CO, calculation of bond order.

Unit 2: Electrochemistry and Applications

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode) electrochemical cell, Nern'st equation, cell potential calculations, numerical problems, concept of pH, pH meter and applications of pH metry (acid-base titrations), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications, photogalvanic cells with specific examples. Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, alkali metal sulphide batteries, Fuel cells, hydrogen-oxygen, and methanol fuel cells – working of the cells.

Secondary cells – lead acid, nickel-metal hydride and lithium ion batteries- working of the batteries including cell reactions, button cells,

Unit 3: Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.
Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, carbon fibres, Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

Unit 4: Instrumental Methods and Applications

Principle and applications of Colorimetry, AAS, AES, UV-Viscible spectrophotometry (Beer-Lambert's law, Instrumentation ,Principles and applications of Chromatographic techniques(GC & HPLC), separation of gaseous mixtures and liquid mixtures(GC & HPLC methods).

Unit 5: Water Technology

Introduction –Soft Water and hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Text books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference books:

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.
4. Willard Merritt Dean Settle, 7 th Edition Instrumental methods for analysis

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	Analyze	L4	PO2	PO2: Analyze (L4)	3
4	10	13	20.3	3	Analyze	L4	PO2	PO2: Analyze (L4)	3
5	10	12	18.7	3	Apply	L3	PO1	PO1: Apply (L3)	3
	50	64							

CO1: Understand the interaction of energy levels between 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 the electrochemical principles to the construction of batteries, fuel cells and electrochemical sensors

Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO3: Analyze the preparation and mechanism of polymers

Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

CO3 Action Verb level isequal to PO2 verb; Therefore correlation is high (3).

CO4: Analyze the separation of gaseous and liquid mixtures using instrumental methods

Action Verb: Analyze (L4)

PO2 Verb: Analyze (L4)

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

CO5: Apply the purification technique to remove hardness of water and to check the quality of water

Action Verb: Apply (L3)

PO1 Verb: Apply (L3)

CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)

B.Tech - Civil Engineering **AK20 REGULATIONS**

I Year II Semester

Subject code	Subject Name	L	T	P	Credits
20AES0101	**Basics of Civil & Mechanical Engineering**	3	0	0	3

Course Outcomes:

After studying of the course, Student will be able to:

CO1 Understand the principles of Stress, Strain, Shear force, Bending Moment and Torsion.
CO2 Understand the basic principles and concepts of Strain Rosettes for strain measurement.
CO3 Understand the characteristics of common building materials used in construction
CO4 Understand the working principles of various power plants
CO5 Understand the concepts of power transmission process
CO6 Understand the principles of CAD, CAM, CIM and functioning of robots in manufacturing.

Course Outcomes	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The principles of Stress ,Strain, Shear force, Bending Moment and Torsion			L2
CO2	Understand	The basic principles and concept of strain rosettes		for Strain Measurement	L2
CO3	Understand	Characteristics of common building materials		used in construction	L2
CO4	Understand	The working principles		of various power plants	L2
CO5	Understand	The concepts of power transmission process			L2
CO6	Understand	The principles of CAD, CAM, CIM and functioning		Of robots in manufacturing	L2

PART – A

UNIT – I: 11 Hrs

Basic Definitions of Force – Types of Stress and Strain, Thermal stress and thermal strain – Elasticity, Types of supports, Types of loads - Shear force – Bending Moment – Torsion.

UNIT – II: 11 Hrs

Measurement of Strain - Electrical Capacitance and Resistance Strain gauges – multi channel strain indicators. Rosette analysis – Rectangular and Triangular strain rosettes – Wheatstone bridge, Linear Variable Differential Transformer (LVDT).

UNIT – III: 11 Hrs

Characteristics of common building materials – Brick, Steel, Concrete and their applications in Construction Industry, Structural components of building.

PART – B

UNIT – IV: 11 Hrs

Power Plants Classification of Power plants – Steam Power Plants – Nuclear Power Plants – Gas turbines – Hydro Power Plants – Solar energy – wind energy – Tidal Power – Geo Thermal Power.

UNIT – V: 11 Hrs

Transmission of Power Transmission of Power – Belt and Rope Drives – Types of Belts – Materials – Velocity ratio – Speed Ratio – Rope Drives – V-Belt – Flat Belt.

UNIT – VI: 11 Hrs

Computer Aided Design & Manufacturing Introduction to engineering applications of computer aided design – Computer Aided Drawing – Advantages of CAD – Computer Aided Manufacturing – Functions of Robots in manufacturing Applications – advantages of Robots – Computer integrated Manufacturing (CIM).

Text Books:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd.

References:

1. S.Trymbaka Murthy., "Computer Aided Engineering Drawing" , Universities Press
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies.
3. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam.
4. Er. R. Vaishnavi, Basic Civil and Mechanical Engineering, 2/e, S. Chand Publications.

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

Unit No	Course Outcomes					Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson Plan Hrs	%	Correlation	CO's Action Verb	BTL			
1	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
2	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
3	11/33	33	2	Understand	L2	PO1 PO2 PO7	Apply (L3) Analyze (L4) Thumb Rule	2 2 2
4	11/33	33	3	Understand	L2	PO1 PO3 PO6	Apply-L3 Review-L2 TR	2 3 2
5	11/33	33	3	Understand	L2	PO1 PO3 PO6	Apply-L3 Review-L2 TR	2 3 2
6	11/33	33	3	Understand	L2	PO1 PO3 PO6	Apply-L3 Review-L2 TR	2 3 2

Justification Statements:

CO1: Understand the principles of Stress, Strain, Shear force, Bending Moment and Torsion.

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Analyze(L4)**

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

PO7 Verb: **Thumb Rule**

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

CO2: Understand the basic principles and concepts of Strain Rosettes for strain measurement

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

CO2 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze(L4)**

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

PO7 Verb: **Thumb Rule**

CO2 correlates medium with PO7. Therefore, the correlation is medium (2)

CO3: Understand the characteristics of common building materials used in construction

Action Verb: Understand (L2)

PO1 Verb: **Apply (L3)**

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

PO2 Verb: **Analyze(L4)**

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

PO7 Verb: **Thumb Rule**

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

CO4: Understand the working principles of various power plants

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

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

PO3 Verb: **Review-L2**

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

PO7 Verb: **TR**

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

CO5: Understand the concepts of power transmission process

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

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

PO3 Verb: **Review-L2**

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

PO7 Verb: **TR**

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

CO6: Understand the principles of CAD, CAM, CIM and functioning of robots in manufacturing.

Action Verb: **Understand (L2)**

PO1 Verb: **Apply (L3)**

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

PO3 Verb: **Review-L2**

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

PO7 Verb: **TR**

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

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

Course Code	Year & Sem	Internet of Things	L	T	P	C
20AES0505	III-I		3	0	0	3

Course Outcomes:

After studying of the course, Student will be able to:

1. Understand the vision of IoT from the Global Context.

2. Understand the concept of Market perspective in M2M and IoT

3. Understand the M2M and IoT Technology Fundamentals using Devices, Networks & Gateways.

4. Analyze the Architecture of IoT in ETSI, IETF, ITU-T

5. Apply the Real world design Constraints and Industrial Automation

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1.	Understand	The Vision of IoT from the Global Context			L2
2.	Understand	the concept of Market Perspective in		M2M & IoT	L2
3.	Understand	The M2M and IoT Technology Fundamentals using	Devices, Networks & Gateways.		L2
4.	Analyze	The Architecture of IoT		in ETSI, IETF, ITU-T	L4
5	Apply	The Real world design Constraints and Industrial Automation			L3

UNIT - I	M2M to IoT	
M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics		
UNIT - II	M2M to IoT - A Market Perspective-	10Hrs
M2M to IoT - A Market Perspective- Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview- Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.		
UNIT - III	M2M and IoT Technology Fundamentals	
M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management		
UNIT - IV		
IoT Architecture-State of the Art - Introduction, State of the art.		
UNIT - V	IoT Reference Architecture-	
IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things		
Textbooks:		
1.Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. (ISBN-13:978-0124076846)		
Online Learning Resources:		
NPTEL videos		

CourseTitle	COS	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Internet of Things	CO1		3												
	CO2		3												
	CO3	3	3												
	CO4	2			3										
	CO5	3	2												

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	10	16	2	Understand	L2	PO2	PO2: Review (L2)	3
2	10	16	2	Understand	L2	PO1	PO2: Identify (L2)	3
3	15	23	2	Understand	L2	PO1,PO2	PO1:Apply PO2:Identify	3 3
4	14	22	3	Analyze	L4	PO1,PO4	PO1:Apply PO4: Analyze	2 3
5	14	22	3	Apply	L3	PO1,PO2	PO1:Apply PO2: Identify	3 2
	63							

CO1: . Understand the vision of IoT from the Global Context**.**
Action Verb: Understand (L2)
PO2 Verbs: Review (L2)
CO1 Action Verb is equal to PO2 verb; Therefore, correlation is high (3).
CO2: Understand the concept of Market perspective in M2M and IoT**.**
Action Verb: Understand (L2)
PO1 Verbs: Identify (L2)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
CO3: Understand M2M and IoT Technology Fundamentals**.**
Action Verb: Understand (L2)
PO1 Verbs: Apply (L2)
CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L2)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO4: Analyze the Architecture of IoT in ETSI, IETF, and ITU-T**.**
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO4 Verbs: Analyze (L3)
CO4 action verb is equal to PO4 verb. Therefore correlation is high (3)
CO5: Apply Real world design Constraints and Industrial Automation**.**
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO5 Action verb is equal to PO1 verb; therefore the correlation is high (3).
PO2 Verb: Identify (L2)
CO5 Action Verb is greater than PO2 verb; Therefore correlation is high (3).

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

Subject Code	Subject Name	L	T	P	Credits
20AES0301	Engineering Graphics	1	0	4	3

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

CO1. Apply the concepts of engineering curves for technical drawing
CO2. Understand the quadrant system to locate the position of points and projection of lines
CO3. Analyze the projection of planes as well as solids located in quadrant system
CO4. Analyze the sectional views and development of surfaces of regular solids
CO5. 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		for technical drawing	L3
CO2	Understand	the quadrant system to locate the position of points and projection of lines			L2
CO3	Analyze	draw the projection of planes as well as 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 to Engineering graphics***: Principles of Engineering Graphics and their significance Conventions in drawing - lettering - BIS conventions.
a) Conic sections including the rectangular hyperbola- general method only,
b) Cycloid, epicycloids and hypocycloid

Unit II: ***Projection of points, lines***: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line, traces.

Unit III: ***Projections of Planes***: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.
Projections of Solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

Unit IV: ***Sections of solids***: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.
Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.
Unit V: ***Orthographic Projections***: Systems of projections, conventions and application to orthographic projections.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views - lines, planes, figures, simple and compound solids.

Text Books:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers
3. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill
4. Shah and Rana, Engineering Drawing, 2/e, Pearson Education
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill

Articulation Matrix

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

Co-relation 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 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
2	15	20	2	Understand	L2	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	2 2 1 2 2
3	15	20	2	Analyze	L4	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
4	15	20	2	Analyze	L4	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2
5	12	16	2	Apply	L3	PO1 PO3 PO10 PSO1 PSO2	Apply (L3) Develop (L3) TR TR TR	3 3 1 2 2

Justification Statements:

CO1: Apply the concepts of engineering curves for technical drawing
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO1 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)
PO2 Verb: **Develop (L3)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO10 Verb: Thumb Rule (TR)
CO1: Engineering graphics involves creating visual representations and technical drawings to communicate design ideas, concepts and specifications. Therefore, the correlation is high (3)

CO2: Understand the quadrant system to locate the position of points and projection of lines.
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 planes as well as 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)

I YEAR II SEMESTER

Subject Code	Subject Name	L	T	P	CREDITS
20AES0102	BASICS OF CIVIL & MECHANICAL ENGINEERING LAB	0	0	3	1.5

BASICS OF CIVIL ENGINEERING (PART-A)

Course Outcomes:

After studying of the course, Student will be able to:

CO1: Analyze the elastic properties and torque of mild steel

CO2: Analyze the displacements of steel using electrical strain gauges

CO3: Analyze the compressive strength of brick

CO4: Apply the AUTOCAD Design process for basic drawings

CO5: Apply the AUTOCAD Design process for editing Modules

CO6: Apply the dimensional principles and conventional representations

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	elastic properties and torque		mild steel	L4
CO2	Analyze	Displacements	using electrical strain gauges	steel	L4
CO3	Analyze	compressive strength		brick	L4
CO4	Apply	the AUTOCAD Design process for basic drawings			L3
CO5	Apply	the AUTOCAD Design process for editing Modules			L3
CO6	Apply	the dimensional principles and conventional representations			L3

PART - A

Laboratory Experiments:

1. Tensile test on mild steel- (CO1)
2. Bending test on (Steel/Wood) simply supported beam-(CO1)
3. Use of electrical resistance strain gauges-(CO2)
4. Compression test on concrete cube/ brick-(CO3)
5. Torsion test on steel- (CO1)

PART – B

The following contents are to be done by any 2D software package

1. Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling-(CO4)

2. Mirroring, layers, templates, polyline, trimming, extending, stretching, fillets, arrays, dimensions-(CO5)

3. Dimensioning principles and conventional representations-(CO5)

4. Any three simple 2D diagram by using software package-(CO4,CO5,CO6)

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	2	3		3		3								
	CO2	2	3		3		3								
	CO3	2	3		3		3								
	CO4	3	3	3	3					3					
	CO5	3	3	3	3					3					
	CO6	3	3	3	3					3					

Unit No	Course Outcomes		Program Outcome (PO)	PO(s):Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	CO's Action Verb	BTL			
1	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
2	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
3	Analyze	L4	PO1 PO2 PO4 PO6	Apply (L3) Analyze (L4) Analyze (L4) Thumb Rule	2 3 3 3
4	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Apply-L3 Apply-L3 Thumb Rule (TR)	3 3 3 3
5	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Apply-L3 Apply-L3 Thumb Rule (TR)	3 3 3 3
6	Apply	L3	PO1 PO2 PO3 PO9	Apply-L3 Apply-L3 Apply-L3 Thumb Rule (TR)	3 3 3 3

Justification Statements:

CO1: Analyze the elastic properties and torque of mild steel

Action Verb: **Analyze (L4)**

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

PO4 Verb: **Analyze(L4)**

CO1 Action verb is same level as PO4 verb. Therefore, the correlation is high (3)

PO6 Verb: **Thumb Rule**

CO1 correlates highly with PO6. Therefore, the correlation is high (3)

CO2: Analyze the displacements of steel using electrical strain gauges

Action Verb: **Analyze (L4)**

PO1 Verb: **Apply (L3)**

CO2 Action verb is not same level as PO1 verb. Therefore, the correlation is medium (2)

PO2 Verb: **Analyze (L4)**

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

PO4 Verb: **Analyze (L4)**

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

PO6 Verb: **Thumb Rule**

CO2 correlates highly with PO6. Therefore, the correlation is high (3)

CO3: Analyze the compressive strength of brick

Action Verb: **Analyze (L4)**

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

PO4 Verb: **Analyze (L4)**

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

PO6 Verb: **Thumb Rule**

CO3 correlates highly with PO6. Therefore, the correlation is high (3)

CO4: Apply the AUTOCAD Design process for basic drawings

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: **Apply (L3)**

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

PO3 Verb: **Apply (L3)**

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

PO9 Verb: **TR**

CO4 correlates highly with PO9. Therefore, the correlation is high (3)

CO5: Apply the AUTOCAD Design process for editing Modules

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: **Apply (L3)**

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

PO3 Verb: **Apply (L3)**

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

PO9 Verb: **TR**

CO5 correlates highly with PO9. Therefore, the correlation is high (3)

CO6: Apply the dimensional principles and conventional representations

Action Verb: **Apply (L3)**

PO1 Verb: **Apply (L3)**

CO6 Action verb is same level as PO1 verb. Therefore, the correlation is high (3)

PO2 Verb: **Apply (L3)**

CO6 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)

PO3 Verb: **Apply (L3)**

CO6 Action verb is same level as PO3 verb. Therefore, the correlation is high (3)

PO9 Verb: **TR**

CO6 correlates highly with PO9. Therefore, the correlation is high (3)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES: TIRUPATI

(Autonomous)

I.B.Tech **AK20 Regulations**

Common to I Sem – CSE, CIC, II Sem ECE/EEE

Subject Code 20ABS9909	Subject Name CHEMISTRY LAB	L T P 0 0 3	Credits:1.5

Course Outcomes:

After studying of the course, Student will be able to:

CO1: Analyze the hardness of ground water sample.
CO2: Apply the internal and external indicators in volumetric analysis.
CO3: Analyze the preparation and applications of advanced polymer materials.
CO4: Apply the electro analytical technique to measure the strength of acids.
CO5: Analyze the mixture of components by chromatographic techniques.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	The Hardness of ground water sample.			L4
2	Apply	The internal and external indicators		In volumetric analysis	L3
3	Analyze	The preparation and applications advanced polymer materials			L4
4	Apply	The electro analytical technique to measure the strength of acids			L3
5	Analyze	The Mixture of components	By chromatographic techniques		L4

List of Experiments:

1. Determination of Hardness of a groundwater sample. (CO1)
2. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method) (CO2)
3. Determination of pH metric titration of strong acid vs. strong base (CO4)
4. Conductometric titration of strong acid vs. strong base (CO4)
5. Determination of Fe (II) in Mohr's salt by potentiometric method. (CO4)
6. Determination of percentage of Iron in Cement sample by colorimetry
7. Determination of Strength of an acid in Pb-Acid battery (CO2)
8. Preparation of phenol-formaldehyde resin (CO3)
9. Preparation of TIO_2/ZnO nano particles (Precipitation Method) (CO3)
10. Estimation of Calcium in port land Cement (CO2)
11. Adsorption of acetic acid by charcoal (CO2)
12. Thin layer chromatography (CO5)

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

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson

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	PO12	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	-	-	-	Analyze	**L4**	PO4	PO4: Analyze (L4)	3
2	-	-	-	Apply	**L3**	PO4	PO4: Analyze (L3)	2
3	-	-	-	Analyze	**L4**	PO4	PO4: Analyze (L4)	3
4	-	-	-	Apply	**L3**	PO4	PO4: Analyze (L3)	2
5	-	-	-	Analyze	**L4**	PO4	PO4: Analyze (L4)	3

CO1: Analyze the hardness of ground water sample.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

CO2: Apply the internal and external indicators in volumetric analysis.

Action Verb: Apply **(L3)**

PO4 Verb: Analyze (L3)

CO2 Action Verb is less than PO4 verb; therefore, correlation is less (2)

CO3: Analyze the preparation and applications of advanced polymer materials.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

CO4: Apply electro analytical technique to measure the strength of acids.

Action Verb: Apply **(L3)**

PO4 Verb: Analyze (L4)

CO4 Action Verb is less than PO4 verb; therefore, correlation is less (2)

CO5: Analyze mixture of components by chromatographic techniques.

Action Verb: Analyze **(L4)**

PO4 Verb: Analyze (L4)

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)

Course Code	Year & Sem	INTERNET OF THINGS LABORATORY	L	T	P	C
20AES0506	I-II		0	0	3	1.5

Course Outcomes:

After studying of the course, Student will be able to:

CO1: Analyze the parameter of Analog and digital sensors using Development board.

CO2: Evaluate the various actuators using Bluetooth communication technology.

CO3: Analyze the sensor data using socket Communication and Local Area Network.

CO4: Analyze the sensor and actuator data using cloud platform.

CO5: Create a prototype design to solve local area issues.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	The parameter of Analog and Digital sensors	Different Types of sensors pin configuration	Development board	L4
CO2	Evaluate	The various actuators		using Bluetooth device	L5
CO3	Analyze	The Sensor data using socket communication and local area network			L4
CO4	Analyze	the sensor and actuator data using cloud platform	Cloud Platform must compatible with development board		L4
CO5	Create	A prototype design to solve local area issue			L6

LIST OF EXPERIMENTS:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board **(CO1)**.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors **(CO1)**.
3. Control any two actuators connected to the development board using Bluetooth **(CO2)**.
4. Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network **(CO3)**.
5. Create any cloud platform account, explore IoT services and register a thing on the platform **(CO4)**.
6. Push sensor data to cloud **(CO4)**.
7. Control an actuator through cloud **(CO4)**.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services **(CO4)**.
9. Create a mobile app to control an actuator **(CO4)**.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project) **(CO5)**.

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**			**3**										
CO2	**3**			**3**										
CO3	**3**	**3**		**3**										
CO4	**3**	**3**		**3**										
CO5	**3**	**3**	**3**	**3**	**3**									

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S.No	Course Outcomes(CO)		Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	Analyze	L4	PO1, PO4	PO1: Apply (L3) PO4: Analyze (L4)	3 3
2	Evaluate	L5	PO1, P04	PO1: Apply (L3) P04: Analyze(L4)	3 3
3	Analyze	L4	PO1, PO2, P03	PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4)	3 3 3
4	Analyze	L4	PO1, PO2, P03	PO1: Apply (L3) PO2: Review (L2) P04: Analyze(L4)	3 3 3
5	Create	L6	PO1, PO2,PO3,P04, PO5	PO1: Apply (L3) PO2: Review (L2) PO3:Design(L6) P04: Analyze(L4) PO5: Create(L6)	3 3 3 3 3

Justification Statements:

CO 1: Analyze the parameter of Analog and digital sensors using Development board. **(L4)**

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3)

PO4 Verbs: Analyze (L4)

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

CO 2: Evaluate the various actuators using Bluetooth communication technology.(L4)

PO1 Verbs: Apply (L3)

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

PO4 Verbs: Analyze (L4)

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

CO 3: Analyze the sensor data using socket Communication and Local Area Network.(L4)

PO1 Verbs: Apply (L3)

CO3 Action Verb is greater than PO1 by one level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

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

PO4 Verbs: Analyze (L4)

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

CO 4: Analyze the sensor and actuator data using cloud platform.(L4)

PO1 Verbs: Apply (L3)

CO4 Action Verb is greater than PO1 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 Verbs: Analyze (L4)

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

CO 5: Create a prototype design to solve local area issues.(L6)

PO1 Verbs: Apply (L3)

CO5 Action Verb is greater than PO1 by three level; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

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

PO3 Verbs: Design (L6)

CO5 Action Verb is equal to PO3 verb; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

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

PO5 Verbs: Create (L4)

CO5 Action Verb is equal to PO5 verb; Therefore correlation is high (3).

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

Subject Code **20AMC9902**	Subject Name **CONSTITUTION OF INDIA**	L T P 3 0 0	Credit: 0

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Understand the historical background of the Constitution making and its importance for building a democratic India.
2. Remember the basic features of Indian Constitution
3. Understand the fundamental rights and duties for becoming a good citizen of India.
4. Understand the Powers and functions of Governor, President, and Judiciary.
5. Understand the functions of local administration bodies.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the historical background of the Constitution making and its importance	for building a democratic India.		**L2**
2	**Remember**	the basic features of Indian Constitution			**L1**
3	**Understand**	the fundamental rights and duties	for becoming a good citizen of India.		**L2**
4	**Understand**	the Powers and functions	of Governor, President, and Judiciary.		**L2**
5	**Understand**	the functions of local administration bodies			**L2**

Unit:1

History of Making of the Indian Constitution - History Drafting Committee, (Composition & Working)

Unit:2

Philosophy of the Indian Constitution - Preamble Salient Features

Unit:3

Contours of Constitutional Rights & Duties - Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.

Unit:4

Organs of Governance - Parliament – Composition - Qualifications and Disqualifications - Powers and Functions - Executive, President, Governor - Council of Ministers -Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.

Unit:5

Local Administration - District's Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Panchayati raj: Introduction, PRI: Zilla Panchayat - Elected officials and their roles, CEO Zilla Panchayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy.

Suggested books for reading:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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	**4**	14	2	**Understand**	**L2**	PO6, PO12	Thumb Rule Thumb Rule	2 2
2	**4**	14	1	**Remember**	**L1**	PO6, PO7	Thumb Rule Thumb Rule	1 1
3	**8**	**26**	**2**	**Understand**	**L2**	PO8, PO12	Thumb Rule Thumb Rule	2 2
4	**8**	**26**	**2**	**Understand**	**L2**	PO6, PO12	Thumb Rule Thumb Rule	2 2
5	**6**	**20**	**2**	**Understand**	**L2**	PO6, PO12	Thumb Rule Thumb Rule	2 2
	30							

CO1: Understand the historical background of the Constitution making and its importance for building a democratic India.
Action Verb: Understand (L2)

CO1 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO2: Remember the basic features of Indian Constitution
Action Verb: Remember (L1)
CO2 Action Verb is Remember of BTL 1. Using Thumb rule, L1 correlates PO6 to PO12 as low (1).

CO3: Understand the fundamental rights and duties for becoming a good citizen of India.
Action Verb: Understand (L2)
CO3 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO4: Understand the Powers and functions of Governor, President, and Judiciary.
Action Verb: Understand (L2)

CO4 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
CO5: Understand the functions of local administration bodies.
Action Verb: Understand (L2)
CO5 Action Verb is Understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

AK 20 Regulations

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

Subject Code:20ABS9912	Subject Name: Transform Techniques and Complex Variables	L T P 3 0 0	Credits 3	CLC 2

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Apply the Laplace transform techniques for solving differential equations.
2. Evaluate the Fourier series of periodic signals and half range series.
3. Apply the Fourier series and Fourier transforms for continuous functions.
4. Apply the Z -transform techniques for solving discrete functions.
5. Analyze the differentiation and integration of complex functions used in engineering fields.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Apply	Laplace Transform techniques	for solving differential equations.		**L3**
2	Evaluate	Fourier series of periodic signals and half range series.			**L5**
3	Apply	the Fourier series and Fourier transforms for continuous functions.			**L3**
4	Apply	the Z-Transform techniques for discrete time functions.			**L3**
5	Analyze	the concept of differentiation and integration	Complex functions		**L4**

Unit I: Laplace transforms

Definition of Laplace transform, existence conditions, properties of Laplace transforms, inverse Laplace transforms, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, convolution theorem, periodic functions, unit step function, unit impulse function, applications to ordinary differential equations. (Without proofs)

Unit II: Fourier series

Dirichlet's conditions, Fourier series, conditions for a Fourier expansion, functions of any period, odd and even functions - half range series.

Unit III: Fourier transforms

Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform, properties, convolution theorem

Unit IV: Z-Transforms

Definition of Z-transform, elementary properties, linearity property, damping rule, shifting u_n to the right and left, multiplication by n, initial value theorem, final value theorem, inverse Z-transform, convolution theorem, formation of difference equations, solution of difference equations using Z-transforms.

Unit V : Complex Variables

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Complex integration, Cauchy theorem (without proof), Cauchy integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues, Cauchy residue theorem (without proof).

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References:

1. Dr.T.K.VIyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N Prasad, Mathematics – II, S.Chand publications.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	**16**	21	3	**Apply**	**L3**	PO1	Apply (L3)	3
2	**17**	22	3	Evaluate	**L5**	PO2	Analyze (L4)	3
3	**16**	21	**3**	Apply	**L3**	PO1	Apply(L3)	3
4	**11**	14	**2**	Apply	**L3**	PO2	Analyze (L4)	2
5	**16**	21	**3**	Analyze	**L4**	PO2	Analyze (L4)	3

CO1: Apply the Laplace transform techniques for solving differential equations.
Action Verb: Apply (L3)
PO1 Verb: Apply (L3)
CO1 Action Verb is equalto PO1 verb; Therefore correlation is high (3).

CO2: Evaluate the Fourier series of periodic signals **and half range series.**
Action Verb: Evaluate (L5)
PO2 Verb: Analyze (L4)
CO2 Action Verb is high level to PO2 verb; Therefore correlation is high (3).

CO3: Apply the Fourier series and Fourier transforms for continuous functions.

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

CO4: Apply the Z -transform techniques for solving discrete functions.

Action Verb: Apply (L3)
PO1 Verb: Analyze **(L4)**)
CO4 Action Verb is low level to PO1 verb by one level; Therefore correlation is moderate (2).

CO5: Analyze the differentiation and integration of complex functions used in engineering fields.
Action Verb: Analyze(L4)
PO2 Verb: Analyze (L4)
CO5 Action verb is same level to PO2 verb; therefore the correlation is high (3).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / III
Branch of Study: EEE

Course Name: ELECTRICAL CIRCUITS-I
Course Code: 20APC0201

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Understand the basic concepts and analysis of electrical circuits.
CO2: Apply the network theorems for electrical circuits to study its properties.
CO3: Analyze the properties of series and parallel magnetic circuits.
CO4: Analyze the steady state response of single phase A.C circuits.
CO5: Analyze the properties of three phase balanced and unbalanced circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Fundamental concepts and operational analysis of electrical circuits.			L2
CO2	Apply	Network theorems for electrical circuits to study its properties.			L3
CO3	Analyze	Magnetic circuit properties.			L4
CO4	Analyze	Single phase AC circuit properties	Steady state domain		L4
CO5	Analyze	Properties of three phase balanced and unbalanced circuits.			L4

SYLLABUS:

UNIT-1INTRODUCTIONTOELECTRICALCIRCUITS

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Current division and voltage division rule Kirchhoff's Laws– Network Reduction Techniques-Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation & Examples
Definitions – Graph – Tree, Basic Cut set and Basic Tie set Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks.

UNIT-2NETWORKTHEOREMS

Nodal Analysis, Mesh Analysis, Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

UNIT-3MAGNETICCIRCUITS

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-DotConvention-CoefficientofCoupling-CompositeMagneticCircuit-AnalysisofSeriesand Parallel Magnetic Circuits, MMF Calculations.

UNIT-4SINGLEPHASEA.CCIRCUITS

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation-

Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples, Resonance

UNIT-5THREE PHASE A.C.CIRCUITS

Introduction-Analysis of Balanced Three Phase Circuits – Phase Sequence Star and Delta Connection- Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits- Measurement of Active and reactive Power –Advantages of Three Phase System. Measurementofcapacitanceandlossangle–Desaunty'sBridge-Wien'sbridge– ScheringBridge.

TEXTBOOKS:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew .N.O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, McGrawHillCompany,7th Edition, 2006.

REFERENCEBOOKS:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti Dhanpat Rai & Sons, 7th Revised Edition,2018.
2. Network Analysis M.E Van Valkenburg, Prentice Hall (India), 3rd Edition,1999.
3. Electrical Engineering Fundamentals V.DelToro, Prentice HallInternational,2nition,2dEd019.
4. Electric Circuits- Schaum's Series, McGraw Hill, 5th Edition,2010.
5. ElectricalCircuitTheoryandTechnologyJohnBird,Routledge,Taylor&Francis,5thEdition,2014.

Mapping of course out comes with program outcomes

Course Title	COs	Programme Outcomes (POs)& Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL CIRCUITS-I	CO1	2	2				2							3	
	CO2	3	2				2							3	
	CO3	3	3				3							3	
	CO4	2	3				3							3	
	CO5	3	3				3							3	

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / III
Branch of Study: EEE

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	20	26.66	3	Understand	L2	PO1, PO2, PO6	PO1: Apply(L3) PO2: Identifyy (L3) PO6; Thumb Rule	2 2 2
2	12	16	2	Apply	L3	PO1, PO2, PO6	PO1:Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule	3 2 2
3	14	18.66	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2:Identify(L3) PO6: Thumb Rule	3 3 3
4	14	18.66	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2: Analyze(L4) PO6: Thumb Rule	2 3 3
5	15	20	3	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule	3 3 3

CO1: Understand the basic concepts and analysis of electrical 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 levels; therefore correlation is moderate (2).

PO6: Using Thumb Rule, CO1 Correlated to PO6 as moderate (2)

CO2: Apply network theorems for electrical circuits to study its properties.

Action Verb: Apply

PO1: Apply (L3)

CO2 Action Verb is equal to 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).

PO6: Using Thumb Rule, CO2 Correlated to PO6 as moderate (2)

CO3: Analyze the properties of series and parallel magnetic circuits.

Action Verb: Analyze

PO1: Apply (L3)

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

PO2: Identify (L3)

CO3 Action Verb is greater than PO2 verb by one levels; therefore correlation is high (3).

PO6: Using Thumb Rule, CO3 Correlated to PO6 as high (3)

CO4: Analyze the steady state response of single phase A.C circuits.

Action Verb: Analyze

PO1: Apply (L3)

CO4 Action Verb is greater than to PO1 verb; Therefore correlation is Moderate (2).

PO2: Analyze (L4)

CO4 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO4 Correlated to PO6 as high (3)

CO5: Analyze the properties of three phase balanced and unbalanced circuits.

Action Verb: Analyze
PO1: Apply (L3)
CO5 Action Verb is greater than to PO1 verb; Therefore correlation is high (3).
PO2: Analyze (L4)
CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO5 Correlated to PO6 as high (3)

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

Course Code	Year & Sem	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
20APC0401	II-I	**(COMMON TO ECE AND EEE)**	**3**	**0**	**0**	**3**

Course Outcomes:

After studying of the course, Student will be able to:

CO1 **Understand** the characteristics of PN junction diode and special electronic devices.

CO2 **Analyze** the construction and operation of three rectifiers using without and with filters.

CO3 **Evaluate** the transistor parameters from its characteristics in three configurations.

CO4 **Understand** the transistor biasing methods and thermal stabilization concepts.

CO5 **Analyze** the transistor amplifier using h-parameter models for three configurations.

CO		Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The characteristics of PN junction diode and special electronic devices			L2
CO2	Analyze	The construction and operation of three rectifiers	Using without and with filters		L4
CO3	Evaluate	The transistor parameters from it's characteristics	in three configurations		L5
CO4	Understand	The transistor biasing methods and thermal stabilization concepts.			L2
CO5	Analyze	The transistor amplifiers	Using h- parameter models	For three configurations	L4

UNIT - I

PN JUNCTION DIODE & SPECIAL DIODE CHARACTERISTICS

Review of semiconductor Physics: Intrinsic &Extrinsic Semiconductors and their Fermi Levels, Open circuited p-n junction, Biased p-n junction, Current components in PN junction Diode, Diode Equation, V-I characteristics of p-n junction diode, Temperature dependence on V-I characteristics, Diode resistance,Diode capacitance.

Special Electronic Devices: Construction, Operation, V-I Characteristics of Zener diode, Breakdown mechanisms, Zener diode applications, Varactor diode, Tunnel diode, SCR, UJT.

UNIT - II

RECTIFIERS & FILTERS

Rectifiers: Introduction to DC Power supply, Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier,derivations of rectifier parameters, Rectifier circuits-Operation, Input and Output waveforms.

Filters: Capacitor filter, Inductor filter, L-section filter, π-section filter, Multiple L-section and Multiple π Section filter, comparison of various filter circuits in terms of ripple factors.

UNIT - III

TRANSISTOR CHARACTERISTICS

BJT: Bi-polar Junction Transistor, Transistor current components, Transistor as an amplifier, Transistor equation, Transistor configurations, Input- Output Characteristics of Transistor in Common Base, Common Emitter and Common Collector configurations, Punch through-Reach through, Photo transistor, Typical transistor junction voltage values.

FET: BJT Versus FET, Junction Field Effect Transistor JFET Types, Construction, Operation, parameters, Drain and Transfer characteristics, MOSFET Types -Enhancement and Depletion Types-Construction, Operation, Characteristics.

UNIT - IV

TRANSISTOR BIASING & THERMAL STABILIZATION

Need for biasing, operating point, Load line analysis, BJT biasing-Methods, Basic stability Fixed bias, Collector to base bias, Self-bias, Stabilization against variations in V_{BE}, I_C, and β, stability factors, (S', S'', S'''), Bias compensation, Thermal runaway, Thermal stability.

UNIT - V

SMALL SIGNAL LOW FREQUENCY TRANSISTOR AMPLIFIER MODELS

BJT: Two port network, Transistor hybrid model, determination of h-parameters, generalized analysis of transistor amplifier model using h-parameters, analysis of CB, CE and CC amplifiers using exact analysis, approximate hybrid model, analysis of CB, CE and CC amplifiers using approximate hybrid model, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, analysis of CG, CS and CD amplifiers, comparison ofFET amplifiers

Textbooks:
1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2015. 2. Thomas L. Floyd, "Electronic Devices", 9th Edition, Pearson Education, 2013 3. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices & Circuit Theory", 11th Edition,Pearson Education, 2013.
Reference Books:
1.Donald Neamen, "Electronic Circuits: Analysis and Design", 3rd Edition, McGraw-Hill Education,2011. 2.Muhammad Rashid, "Microelectronic Circuits: Analysis & Design", 2nd Edition, Cengage Learning,2010. 3.S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", 4th Edition, McGraw-HillEducation, 2017
Online Learning Resources:
nptel videos

Mapping of course outcomes with program outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	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 PO12)	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	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L3)	3 3 3 3
3	15	20	2	Evaluate	L5	PO1, PO2, PO3	PO1:Apply(L3) PO2:Identify(L3) PO3:Develop(L3)	3 3 3
4	14	18	2	Understand	L2	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	2 2 2 1
5	15	20	2	Analyze	L4	PO1, PO2, PO3, PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3) PO4: Analyze(L4)	3 3 3 3
	73	100%						

Justification Statements:

CO 1: Understand the characteristics of PN junction diode and special electronic devices.
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 construction, operations of three rectifiers without and with filters.**
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: Evaluate the transistor parameters from it's characteristics in three configurations
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO3 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO3 Action Verb is greater thanPO3verb; Therefore 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; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO4 Action Verb is less than PO2 verb; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO4 Action Verb is less than PO3 verb; Therefore correlation is moderate (2)
PO4 Verb: Analyze (L4)
CO4 Action Verb is less than PO4 verb; Therefore correlation is low (1).
CO5: Analyze the transistor amplifier using h-parameter models for three configurations.
Action Verb: (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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / III
Branch of Study: EEE

Course Name: POWER SYSTEMS-I
Course Code: 20APC0202

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Understand the operation of thermal, gas and nuclear power Stations.
CO2: Analyze the operation of A.C and D.C distribution systems.
CO3: Analyze the operation of air and gas insulated substations.
CO4: Apply the power factor improvement techniques and voltage control for effective distribution of electrical energy.
CO5: Analyze the economic aspects of power generation and tariff.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The operation of thermal, gas and nuclear power Stations.			L2
CO2	Analyze	The Operation Of A.C And D.C Distribution Systems.			L4
CO3	Analyze	The Air and Gas Insulated Substations.			L4
CO4	Apply	The Power factor improvement techniques and voltage control for		Effective distribution of electrical energy.	L3
CO5	Analyze	The economic aspects of power generation and tariff.			L4

SYLLABUS:

UNIT-I: Power Stations:
Thermal Power Station: Brief description of thermal power plant components - Line diagram of Thermal Power Station (TPS) showing paths of coal, steam, water, air, ash and flue gasses.

Nuclear Power Stations: Nuclear Fission and Chain reaction, Nuclear fuels, Principle of operation of Nuclear reactor, Reactor Components-Moderators, Control rods, Reflectors and Coolants, Radiation hazards- Shielding and Safety precautions, Types of Nuclear reactor sand brief description of PWR, BWR and FBR.
Gas Power Stations: Principle of Operation and Components (Block Diagram Approach Only).

UNIT-II: General Aspects of D.C & A.C Distribution Systems:
Bulk Power Grids and Micro-grids. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Synchronous Grids and Asynchronous (DC) interconnections. Classification of Distribution Systems - Comparison of DC vs. AC and Under-Ground vs. Over - Head Distribution Systems.

UNIT-III: Air Insulated & Gas Insulated (GIS) Substations:

Classification of substations: - Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams. Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

UNIT-IV: Power Factor & Voltage Control:

Causes of low power factor -Methods of Improving power factor - Phase advancing and generation of reactive KVAR using static Capacitors-Most economical power factor for constant KW load and constant KVA type loads, Numerical Problems. Methods of Voltage Control: Shunt Capacitors, Series Capacitors, Synchronous Capacitors, Tap changing and Booster Transformers.

UNIT-V: Economic Aspects of Power Generation Tariff:

Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems. Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method-Tariff Methods: Flat Rate, Block- Rate, two-part, three –part, and power factor tariff methods and Numerical Problems.

TEXT BOOKS:

1. Principles of Power Systems by V. K Mehta and Rohit Mehta, S. Chand Company Pvt. Ltd, New Delhi2004.
2. Electrical Power Systems, PSR. Murty, BS Publications.

REFERENCE BOOKS:

1. A Text book of Power system Engineering, R. K. Rajput, Laxmi Publications (P) Limited.
2. Electrical Power Generation, Transmission and Distribution, S.N.Singh.,PHI.
3. Electrical Power Systems by C.L.Wadhawa New Age International (P) Limited, Publishers.
4. Generation of Electrical Energy, Dr. B. R. Gupta, S.Chand.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes(PSOs)												
		PO 1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
	CO1	2	2				2							3	3

POWER SYSTEMS-I	CO2	3	3				3							3	3
	CO3	3	3				3							3	
	CO4	3	3				3							3	
	CO5	3	3				3							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	13	20.9	3	Understand	L2	PO1 , PO2, PO6	PO1:Apply (L3) PO2:Identify (L3) PO6: Thumb Rule	2 2 2
2	10	16.1	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2:Analyze (L4) PO6: Thumb Rule	3 3 3
3	11	17.7	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2:Indentify(L3) PO6: Thumb Rule	3 3 3
4	12	19.3	2	Apply	L3	PO1, PO2, PO6	PO1:Apply (L3) PO2:Indentify(L3) PO6: Thumb Rule	3 3 3
5	16	25.8	3	Analyze	L4	PO1, PO2, PO6	PO1:Apply (L3) PO2:Analyze (L4) PO6: Thumb Rule	3 3 3
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CO1: Understand the operation of thermal, gas and nuclear power Stations.
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 to PO2 verb; therefore correlation is Moderate (2).
PO6: Using Thumb Rule, CO1 Correlated to PO6 as moderate (2)

CO2: Analyze the operation of A.C and D.C distribution systems.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is Grete than to PO1 verb; Therefore correlation is high (3).
PO2: Analyze (L4)
CO2 Action Verb is same to PO1 verb; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO2 Correlated to PO6 as high (3).

CO3: Analyze the operation of air and gas insulated substations.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO2: Identify (L3)
CO3 Action Verb is Greater than PO2 verb by one level; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO3 Correlated to PO6 as high (3).

CO4: Apply power factor improvement techniques and voltage control for effective distribution of electrical energy.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action Verb is same to PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO4 Action Verb is same to PO1 verb; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO4 Correlated to PO6 as moderate (2).

CO5: Analyze the economic aspects of power generation and tariff.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action Verb is Grete than to PO1 verb; Therefore correlation is high (3).
PO2: Analyze (L4)
CO5 Action Verb is same to PO1 verb; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO5 Correlated to PO6 as high (3).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: II / III**

Course Name: ELECTRICAL MACHINES-I
Course Code: 20APC0203

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the process of Electro-mechanical energy conversion.
CO2: Understand the performance characteristics of D.C generators.
CO3: Evaluate the performance characteristics of D.C motors.
CO4: Understand the constructional features and operations of single-phase transformer.
CO5: Analyze the methods of operation of auto transformer and three phase transformers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	**Analyze**	The Electromechanical energy Conversion			L4
CO2	**Understand**	The Performance Characteristics of DC Generators			L2
CO3	**Evaluate**	The Performance Characteristics of DC Motors			L5
CO4	**Understand**	The Performance Characteristics of single-Phase Transformers			L2
CO5	**Analyze**	The Performance of Auto Transformer& 3-Phase Transformers			L4

SYLLABUS:

UNIT-I: Electro mechanical Energy Conversion:
Electromechanical Energy Conversion - Forces and torques in magnetic field system, Energy balance, singly excited and multiple excited magnetic systems, MMF, Flux, Reluctance, Series and Parallel Magnetic Circuits, B-H curve of magnetic materials.

UNIT-II: DC Generators:
Constructional details of a DC machine, principle of operation, armature windings and its types, EMF equation, armature reaction and its effects, commutation, methods of improving commutation, methods of excitation and classification of DC Generators, voltage build-up in a shunt generator, critical field resistance and critical speed, generator characteristics, parallel operation of DC shunt and series generators, applications of DC Generators.

UNIT-III: D.C Motors:
Principle of operation, significance of back EMF, torque equations, types of DC Motors, characteristics, speed control of DC Motors, necessity of starter, 3-point and 4- point starters, Losses and efficiency, applications of DC Motors.
Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Fields test, Separation of iron and friction all losses.

UNIT-IV: Transformers:
Constructional features, principle of operation, EMF equation, ideal transformer, transformer on No load and ON load and its phasor diagrams, equivalent circuit, voltage

regulation, losses and efficiency. Testing of transformer - polarity test, open circuit and short circuit tests, Sumpner's test, and separation losses.

UNIT-V:

Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

Three-phase transformer– construction, types of connection and their comparative features, Phase conversion - Scott connection, three-phase to six-phase conversion.

TEXTBOOKS:

1. P.S. Bimbhra, Electrical Machinery, Khanna Publishers,7th Edition ,Delhi,2011.
2. R. K. Rajput, Electrical Machines in S.I. Units, Laxmi Publications(P) Ltd, 6thEdition,New Delhi, 2017
3. JB Gupta, Theory and performance of Electrical Machines (DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria & Sons, New Delhi, 15th Edition, 2015.

REFERENCEBOOKS:

1. Electrical Machines by U A Bakshi and MV Bakshi, Technical Publications.
2. B. L. Theraja and A. K. Theraja , *A Text Book of Electrical Technology (in S.I.Units)*,Vol.2,S. Chand & Company Ltd, Multicolor illustrative Edition, New Delhi, 2014.

ADDITIONALLEARNINGRESOURCES:

1. http://www.nptelvideos.in/2012/11/electrical-machines-i.html
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://freevideolectures.com/course/3085/electrical-machines-i
4. https://www.youtube.com/playlist?list=PL9RcWoqXmzaJpnkjoNleyFNgGk9-znOji

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Electrical Machines - I	CO1	3	3	3	3					3				3	3
	CO2	2	2	2	1					2				1	2
	CO3	3	3	3	3					3				3	3
	CO4	2	2	2	1					2				1	2
	CO5	3	3	3	3					3				3	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	**10**	22	2	**Analyze**	**L4**	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
2	**10**	27	2	**Understand**	**L2**	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	2 2 2 1 2
3	**15**	**21**	**3**	**Evaluate**	**L5**	PO1,PO2,PO3 PO4, PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 **3** **3** **3**
4	**14**	**17**	**3**	**Understand**	**L2**	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	2 2 2 1 2
5	**14**	**13**	**3**	**Analyze**	**L4**	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
	63							

CO1: Analyze the process of Electro-mechanical energy conversion.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO1 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO1 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO1 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO1 level is 4, Using Thumb Rule its correlation is high (3).

CO2: Understand the performance characteristics of D.C generators
Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO4 Verb: Analyze (L4)
CO2 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).
Based on students' participate in CLC activities. From this: CO1 level is 2, Using Thumb Rule its correlation is moderate (2).

CO3: Evaluate the performance characteristics of D.C motors.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO3 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO3 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO3 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO3 level is 4, Using Thumb Rule its correlation is high (3).

CO4: Understand the constructional features and operations of single-phase transformer.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO4 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO4 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO4 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO4 Verb: Analyze (L4)
CO4 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).
Based on students' participate in CLC activities. Here, CO4 level is 2, by Using Thumb Rule its correlation is moderate (2).

CO5: Analyze the methods of operation of auto transformer and three phase transformers.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)

CO5 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO5 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO5 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO5 level is 4, Using Thumb Rule its correlation is high (3).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO2 Action Verb is less than PSO1 verb by two level; Therefore correlation is low (1).

CO3 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is less than PSO1 verb by two level; Therefore correlation is low (1).

CO5 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO2 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

CO3 Action Verb level is two level greater than PSO2 verb; Therefore correlation is high (3).

CO4 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

CO5 Action Verb level is one level greater than PSO2 verb; Therefore correlation is high(3).

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / III
Branch of Study: EEE

Course Name: ELECTRICAL CIRCUITS-I LAB
Course Code: 20APC0204

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Apply the Ohms Law, KCL & KVL for the given electrical circuits.
CO2: Apply the Mesh analysis & Nodal Analysis for the given electrical circuits.
CO3: Analyze the Superposition, Thevenin and Norton Theorems for the given DC circuits.
CO4: Analyze the maximum Power Transfer, Reciprocity, Compensation and Millman's theorems for the given DC circuits.
CO5: Understand the active power and reactive Power measurements in three phase balanced circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Apply	The Ohm's Law, KCL (Kirchhoff's Current Law), KVL (Kirchhoff's Voltage Law)		Verify	L4
CO2	Apply	The Mesh & Nodal Analysis		given circuits	L4
CO3	Analyze	The Superposition, Thevenin & Norton Theorems		given dc circuits	L4
CO4	Analyze	The Maximum Power Transfer, Reciprocity, Compensation, and Millman's theorems			L4
CO5	Understand	The Active, reactive Power measurements in three phase balanced and unbalanced circuits			L2

SYLLABUS:

List of Experiments:

1. Verification of Ohm law. (CO1)
2. Verification of KVL and KCL. (CO1)
3. Verification of Mesh and Nodal Analysis. (CO2)
4. Verification of Thevenin's and Norton's Theorems. (CO3)
5. Verification of Superposition Theorem for average and RMS values. (CO3)
6. Maximum Power Transfer Theorem for DC circuits. (CO3)
7. Verification of Reciprocity Theorem for DC circuits. (CO3)
8. Verification of Compensation Theorem for DC circuits. (CO4)
9. Verification of, Millmann's Theorems for DC circuits. (CO4)
10. Determination of Self, Mutual Inductances and Coefficient of Coupling. (CO4)
11. Measurement of Active Power for Star Connected Balanced Loads. (CO5)
12. Measurement of Reactive Power for Star Connected Balanced Loads. (CO5)
13. Measurement of Active Power for Delta Connected Balanced Loads. (CO5)
14. Measurement of Reactive Power for Delta Connected Balanced Loads. (CO5)

REFERENCEBOOKS:

1. CircuitTheoryAnalysis&SynthesisA.Chakrabarti,DhanpatRai&Sons,7thRevised Edition,2018.
2. NetworkAnalysisM.EVanValkenberg, PrenticeHall(India),3rdEdition,1999.
3. ElectricalEngineeringFundamentalsV.DelToro,PrenticeHallInternational,2ndEdition, 2019
4. ElectricCircuits-Schaum'sSeries, McGrawHill,5thEdition,2010.
5. ElectricalCircuitTheoryandTechnologyJohnBird,Routledge,Taylor&Francis,5th Edition,2014.

Mapping of course out comes with program out comes

Course Title	COs	Programme Outcomes (POs)& Programme Specific Outcomes(PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL CIRCUITS-I LAB	CO1	3	3							2				3	
	CO2	3	3							2				3	
	CO3	3	3							3				3	
	CO4	3	3							3				3	
	CO5	2	2							3				3	

Justification Table:

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

CO1: Apply the Ohms Law, KCL & KVL for the given circuit and verify practically.

Action Verb: Apply (L3)

PO1: Apply (L3)

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

PO2: Identify (L3)
CO1 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO1 Correlated to PO9 as moderate (2).

CO2: Apply the Mesh & Nodal Analysis for the given circuit and verify practically.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO2 Correlated to PO9 as moderate (2).

CO3: Analyze the Superposition, Theremin and Norton Theorems for the given circuit practically.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is Greaterthan to PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO3 Action Verb is Greaterthan to PO2 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO3 Correlated to PO9 as high (3).

CO4: Analyze the maximum Power Transfer, Reciprocity, Compensation and Millman's theorems for the given circuit practically.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is Greaterthan to PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO4 Action Verb is Greaterthan to PO2 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO4 Correlated to PO9 as high (3).

CO5: Understand the active, reactive Power measurements in three phase balanced and Unbalanced circuits.

Action Verb: understand (L2)
PO1: Apply (L3)
CO5 Action Verb is Lessthan to PO1 verb; therefore correlation is Moderate (2).
PO2: Identify (L3)
CO5 Action Verb is Lessthan to PO2 verb; therefore correlation is Moderate (2).
PO9: Using Thumb Rule, CO5 Correlated to PO9 as low (1).

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

Course Code	Year & Sem	ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	C
20APC0404	II-I	(COMMON TO ECE & EEE)	0	0	3	1.5

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

CO1: Analyze the V-I characteristics of PN Diode, Zener diodes, SCR and UJT.
CO2: Evaluate the parameters of Rectifiers with and without filters.
CO3: Evaluate the parameters from the characteristics of BJT and FET in different configurations.
CO4: Analyze the operation of DC biasing circuits of Transistors.
CO5: Analyze the frequency response of amplifiers using BJT and FET.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	The V-I characteristics of		PN Diode, Zener diodes, SCR and UJT.	L4
CO2	Evaluate	the parameters of Rectifiers	with and without filters.		L5
CO3	Evaluate	the parameters from the characteristics of BJT and FET		in different configurations	L5
CO4	Analyze	the operation of DC biasing circuits of Transistors			L4
CO5	Analyze	the frequency response of amplifiers		using BJT and FET.	L4

LIST OF EXPERIMENTS:

1. PN Junction Diode Characteristics(**CO1)**
2. Zener Diode Characteristics and Zener Diode as Voltage Regulator. **(CO1)**
3. Rectifiers (With and Without Filter). **(CO2)**
4. BJT Characteristics (CB Configuration). **(CO3)**
5. BJT Characteristics (CE Configuration). **(CO3)**
6. FET Characteristics (CS Configuration). **(CO3)**
7. SCR Characteristics **(CO1)**
8. Transistor Biasing **(CO4)**
9. BJT-CE Amplifier **(CO5)**
10. Emitter Follower-CC Amplifier **(CO5)**
11. FET-CS Amplifier **(CO5)**
12. UJT Characteristics **(CO1)**

Mapping of course outcomes with program outcomes

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

S.No	Course Outcomes(CO)		Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Co's Action verb	BTL			
1	Analyze	L4	PO1, PO2	PO1: Apply (L3) PO2: Review (L2)	3 3
2	Evaluate	L5	PO1, PO2,PO3,P04	PO1: Apply (L3) PO2: Review (L2) PO3:Develop(L3) P04: Analyze(L4)	3 3 3 3
3	Evaluate	L5	PO1, PO2, P03	PO1: Apply (L3) PO2: Review (L2) P03: design (L6)	3 3 2
4	Analyze	L4	PO1, PO2,PO3,P04	PO1: Apply (L3) PO2: Review (L2)	3 3

				PO3:Design(L6) P04: Analyze(L4)	1 3
5	Analyze	**L4**	PO1, PO2,PO3,P04	PO1: Apply (L3) PO2: Review (L2) PO3:Design(L6) P04: Analyze(L4)	3 3 1 3

Justification Statements:

CO 1: Analyze V-I characteristics of PN Diode, Zener diodes, SCR and UJT.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3)

PO2 Verbs: Review (L2)

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

CO 2: Evaluate the parameters of Rectifiers with and without filters.

Action Verb: evaluate (L5)

PO1 Verbs: Apply (L3)

CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

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

PO3 Verbs: Develop (L3)

CO2 Action Verb is equal to PO3 verb; Therefore correlation is high (3).

PO4 Verbs: Analyze (L4)

CO2 Action Verb is greater than to PO4 by one level verb; Therefore correlation is high (3).

CO 3: Evaluate the parameters from the characteristics of BJT and FET in different configurations.

Action Verb: evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

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

PO3 Verbs: Analyze (L4)

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

CO4: Analyze the operation of DC biasing circuits of Transistors.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO4 Action Verb is greater than PO1 verb by three levels; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

CO4 Action Verb is greater than PO2 verb by four level; Therefore correlation is high (3).

PO3 Verbs: Design (L6)

CO4 Action Verb is less than to PO3 verb by two levels; Therefore correlation is low (1).

PO4 Verbs: Analyze (L4)

CO4 Action Verb is greater than to PO4 by two level verb; Therefore correlation is high (3).

CO5: Analyze the frequency response of amplifiers using BJT and FET.

Action Verb: Analyze (L4)

PO1 Verbs: Design (L6)

CO5 Action Verb is greater than PO1 verb by three levels; Therefore correlation is high (3).

PO2 Verbs: Review (L2)

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

PO3 Verbs: Design (L6)

CO5 Action Verb is less than to PO3 verb by two levels; Therefore correlation is low (1).

PO4 Verbs: Analyze (L4)

CO5 Action Verb is greater than to PO4 by two level verb; Therefore correlation is high (3).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: II / III**

Course Name: ELECTRICAL MACHINES-I LAB
Course Code: 20APC0205

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Evaluate the magnetization characteristics of DC shunt generator.
CO2: Evaluate the characteristics of D.C machine by conducting direct and indirect tests.
CO3: Apply the speed control techniques for a D.C shunt motor.
CO4: Evaluate the characteristics of D.C shunt and compound generators by conducting load test.
CO5: Evaluate the performance parameters of single-phase transformer.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	Magnetization characteristics		of DC shunt generator	L5
CO2	Evaluate	Performance characteristics of DC Machine	By conducting direct and indirect Tests		L5
CO3	Apply	Speed control techniques	For a DC Motor		L3
CO4	Evaluate	Performance characteristics of DC Shunt & Compound Generators	By conducting Load Test		L5
CO5	Evaluate	Performance parameters of		Single-Phase Transformer	L5

SYLLABUS:

Minimum ten experiments from the following list are required to be conducted:

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed. - CO1
2. Load test on DC shunt generator. Determination of characteristics. - CO2
3. Brake test on DC shunt motor. Determination of performance curves. - CO2
4. Swinburne's test on DC shunt motor, Predetermination of efficiency. - CO2
5. Speed control of DC shunt motor (Armature control and Field control method). - CO3
6. Hopkinson's test on DC shunt machines. Predetermination of efficiency. - CO4
7. OC and SC test on single phase transformer. - CO5
8. Parallel operation of single phase transformers. - CO5
9. Sumpner's test on single phase transformers. - CO5
10. Load test on DC long shunt compound generator. Determination of characteristics. - CO4
11. Load test on DC short shunt compound generator. Determination of characteristics. - CO4
12. Separation of losses in DC shunt motor. - CO4
13. Separation of losses of single phase transformer. - CO5

References:
1. D. P. Kothari and B.S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing HousePvt.Ltd,2017.
2. D. R. Kohli and S. K. Jain, "A Laboratory Course in electrical Machines" NEM Chand & Bros.

3.Online Learning Resources/Virtual Labs: http://vem-iitg.vlabs.ac.in/

http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electricalengineering
http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html.

Mapping of course outcomes with program outcomes:

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Electrical Machines - I LAB	CO1	3	3		3					3				3	3
	CO2	3	3		3					3				3	3
	CO3	2	2		2					2				2	3
	CO4	3	3		3					3				3	3
	CO5	3	3		3					3				3	3

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Evaluate	L5	PO1, PO2, PO4,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9; Thumb Rule	3 3 3 3
2	Evaluate	L5	PO1, PO2, PO4,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3
3	Apply	L3	PO1, PO2, PO4,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9: Thumb Rule	3 2 2 2
4	Evaluate	L5	PO1, PO2, PO4,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3
5	Evaluate	L5	PO1, PO2, PO4,PO9	PO1: Apply (L3) PO2: Analyze(L4)	3 3

				PO4:Analyze(L4) PO9	 3 3

CO1: Evaluate magnetization characteristics of DC shunt generator.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO1 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

CO2: Evaluate the performance characteristics of DC Machine by conducting direct and indirect Tests.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
CO2 Action Verb is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 and PSOs as moderate (2).

CO3: Apply speed control techniques for a DC Shunt Motor.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO3 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

CO4: Evaluate the performance characteristics of 1- Phase Transformers.
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

CO5: Understand the performance of Auto Transformer and 3-Phase Transformer.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO1 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO2 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO3 Action Verb is less than PSO1 verb by one level; Therefore correlation is moderate (2).

CO4 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO5 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

CO2 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

CO3 Action Verb level is equal to PSO2 verb; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

CO5 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

Year: II Semester: I Branch of Study: EEE

Subject Code	Subject Name	L	T	P	Credits
20AHE9902	**Principles of Effective Public Speaking**	1	0	2	2

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Apply the knowledge of principles, concepts and skills learned in speech preparation.
2. Analyze the techniques of knowing audiences and in refining the speech
3. Understand the listening skills and styles in effective listening.
4. Analyze the diverse methods of speech in speech composition
5. Apply the supporting materials and presentation aids in speech preparation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Apply**	the knowledge of principles, concepts and skills learned	in speech preparation		**L3**
2	**Analyze**	the techniques of knowing audiences and	in refining the speech		**L4**
3	**Understand**	the listening skills and styles	in effective listening		**L2**
4	**Analyze**	the diverse methods of speech	in speech composition		**L4**
5	**Apply**	the supporting materials and presentation aids	in speech preparation		**L3**

Syllabus

Unit -1

Introduction to Public Speaking:

Basic communication concepts, processes – Models of Communication, concepts and principles of public speaking - Steps and methods of speech preparation.

Unit -2

Selecting Topic and Knowing your Audience:

Identifying sources; Tools and techniques for selecting and refining speech topics - Identifying speech purposes - Central idea statement - Audience analysis techniques.

Unit – 3

Listening with a purpose:

Effective listening, the listening process, and types of listening; Listening barriers; Identifying and improving listening styles.

Unit - 4

Speaking with a purpose:

Methods of speech preparation - Informative, persuasive, and ceremonial speeches.

Unit -5

Delivering your speech and using Visual Aids:

The mechanics of verbal and nonverbal communication in speech delivery - Effective delivery techniques - Incorporating presentation aids in presentation.

References:

1. DeVito, J.A. (2009). The Essential Elements of Public Speaking. (3rd ed.) Boston: Pearson Education, Inc.
2. Lucas, S.E. (2009). The Art of Public Speaking. (10th ed.) New York: McGraw - Hill Co.
3. Zarefsky, D. (2011). Public Speaking: Strategies for Success. (6th ed. Boston: Pearson

Education, Inc).

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1										2		
2										3		
3										2		
4										3		
5										2		

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

CO-PO mapping justification:

CO	**CO**		**Program Outcome (PO)**	**PO(s): Action verb and BTL (for PO1 to PO5)**	**Level of Correlation (0-3)**
	Verb	**BTL**			
1	**Apply**	**L3**	10	Thumb Rule	2
2	**Analyze**	**L4**	10	Thumb Rule	3
3	**Understand**	**L2**	10	Thumb Rule	2
4	**Analyze**	**L4**	10	Thumb Rule	3
5	**Apply**	**L3**	10	Thumb Rule	2

CO1: Apply the knowledge of principles, concepts and skills learned in speech preparation**.**
Action Verb: Apply (L3)
CO1 Action Verb is Apply of BTL3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).
CO2: Analyze the techniques of knowing audiences and in refining the speech
Action Verb: Analyze (L4)
CO2 Action Verb is Analyze of BTL4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3).
CO3: Understand the listening skills and styles in effective listening**.**
Action Verb: Apply (L3)
CO3 Action Verb is Apply of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)
CO4: Analyze the diverse methods of speech in speech composition**.**
CO4 Action Verb is Evaluate of BTL5. Using Thumb rule, L5 correlates PO6 to PO12 as high (3)
CO5: **Apply** the supporting materials and presentation aids in speech preparation**.**
CO5 Action Verb is Apply of BTL3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2)

Year: II **Semester: I** **Branch: Common to All**

Subject Code	Subject Name	L	T	P	Credits
20AMC9903	Environmental Studies	3	0	0	0

Course Outcomes (CO): After studying of the course, Student will be able to:

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

CO2. Understand the ecosystem and biodiversity to solve complex environmental problems

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

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

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

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

UNIT – I

Multidisciplinary Nature o**f 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

Ecosystems: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Causes, effects and its 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

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

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

TEXT BOOKS:

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

REFERENCES:

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

Mapping of COs to POs and PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 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	Thumb Rule Thumb Rule	2, 2
2	15	15	28	3	Understand	L2	PO7	Thumb Rule	2
3	8	8	15	2	Apply	L3	PO6 PO7	Thumb Rule Thumb Rule	2, 2
4	9	10	19	2	Apply	L3	PO6, PO7	Thumb Rule Thumb Rule	2, 2
5	8	8	15	2	Analyze	L4	PO7	Thumb Rule	2
	50	53	100						

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

Action Verb: Understand (L2)

Using Thumb rule, CO1correlates PO6 and PO7 as a moderate (2)

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

Action Verb: Understand (L2)

Using Thumb rule, CO2 correlates PO7 as a moderate (2)

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

Action Verb: APPLY (L3)

Using Thumb rule, CO3 correlates PO6 and PO7 as a moderate (2)

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

Action Verb: APPLY (L3)

Using Thumb rule, CO4 correlates PO6 and PO7 as a moderate (2)

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

Action Verb: Analyze (L4)

Using Thumb rule, CO5 correlates PO7 as a moderate (2)

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

Course Code	Year & Sem	Basics of Python Programming	L	T	P	C
20APC0526	II-I	(common to CSE,CIC)	3	0	0	3

Course Outcomes:

After studying of 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 Strings and Lists to perform iterative operations on data.
CO4: Apply the Mutable and Immutable data types to perform python Programs.
CO5: Analyze the oops concepts to develop applications with reusability.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the 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 Strings and Lists		to perform iterative operations on data	L3
CO4	Apply	the Mutable and Immutable data types		to perform python Programs	L3
CO5	Analyze	the oops concepts		to develop applications with reusability .	L4

UNIT – I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types. **Variables, Assignments and Statements**: Assignment statements, Script mode, Order of operations, string operations, comments. **Functions**: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

UNIT – II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring. **Conditionals and Recursion**: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input. **Fruitful Functions**: Return values, Incremental development, Composition, Boolean functions, more recursion, Leap of Faith, Checking types

UNIT – III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms. **Strings**: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison. **Case Study**: Reading word lists, Search, Looping with indices. **Lists**: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

UNIT – IV

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables. **Tuples:** Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences. **Files:** Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules. **Classes and Objects**: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying.

UNIT – V

Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus Planning **Classes and Methods**: Object oriented features, Printing objects, The init method, The __str__method, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation **Inheritance**: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Data encapsulation. **The Goodies:** Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, default dict, Named tuples, Gathering keyword Args

Textbooks:

1. Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.

Reference Books:
1. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
2. Kenneth A. Lambert, B.L. Juneja, "Fundamentals of Python", CENGAGE, 2015.
3. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	10	19%	2	CO1 :Understand	L2	PO1 PO2 PO5	PO1: Apply(L3) PO2: Review(L2) PO5: Apply(L3)	2 3 2
2	13	24%	3	CO2 : Apply	L3	PO1 PO2 PO3 PO5 PO12	PO1:Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO5: Apply(L3) PO12: Thumb rule	3 3 3 3 2
3	10	19%	2	CO3 : Apply	L3	PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO12: Thumb rule	3 3 3 2 2
4	9	17%	2	CO4 : Apply	L3	PO1 PO2 PO3 PO4 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze(L4) PO12: Thumb rule	3 3 3 2 2
5	11	20%	3	CO5 :Analyze	L4	PO1 PO2 PO3 PO4 PO12	PO1:Apply(L3) PO2: Review (L2) PO3: Develop (L3) PO4: Analyze (L4) PO12: Thumb rule	3 3 3 3 2
	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 medium (2)
PO2 Verb: Review (L2)
CO1 Action verb is same as PO2 verb.. Therefore the correlation is high (3)
PO5: Apply(L3)
CO1 Action verb is less than PO5 verb by one level. Therefore the correlation is medium (2)

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: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation high (3)
PO3: Develop (L3)
CO2 Action verb same as PO3 verb. Therefore the correlation high (3)
PO5: Apply(L3)
CO2 Action verb same as PO5 verb. Therefore the correlation high (3)
PO12: Thumb rule
For some modular applications user defined functions are created to meet societal needs. Therefore the correlation is medium (2)

CO3: Apply the concept of Strings and Lists to perform iterative operations on data.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO3 Action verb is less than PO1 verb by two level. Therefore the correlation is medium (2)
PO2: Review (L2)
CO3 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO3 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

CO4: Apply the Mutable and Immutable data types to perform python Programs.
Action Verb: Apply(L3)
PO1: Apply(L3)
CO4 Action verb is same as PO1 verb by one level. Therefore the correlation is high (3)
PO2: Review(L2)
CO4 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is same as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO4 Action verb is less than one level as PO4 verb. Therefore the correlation is medium (2)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

CO5: Analyze the oops concepts to develop applications with reusability.
Action Verb: Analyze (L4)
PO1: Apply(L3)
CO5 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO5 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO12: Thumb rule
For some of python Program Concepts are used to create programs. Therefore the correlation is medium (2)

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

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**
Branch of Study: EEE

Course Name: ELECTRICAL CIRCUITS-II
Course Code: 20APC0206

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the transient response of R-L, R-C and R-L-C circuits with D.C excitation.
CO2: Analyze the transient response of R-L, R-C & R-L-C circuits with A.C excitation.
CO3: Evaluate the two port network Z, Y, ABCD and hybrid parameters.
CO4: Apply Fourier transforms for A.C and D.C circuit parameters.
CO5: Design different types of filters and equalizers for electrical circuits.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Transient response of R-L, R-C and R-L-C circuits.	D.C excitation		L4
CO2	Analyze	Transient response of R-L, R-C and R-L-C circuits.	A.C excitation		L4
CO3	Evaluate	Two port network parameters			L5
CO4	Apply	Fourier transforms for A.C and D.C circuit parameters			L3
CO5	Design	Different types of filters and equalizers for electrical circuits.			L6

SYLLABUS:

UNIT-ID.CTRANSIENTANALYSIS

Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation Initial Conditions-Solution Method Using Differential Equation and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

UNIT-IIA.CTRANSIENTANALYSIS

Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations-Initial Conditions- Solution Method Using Differential Equations and Laplace Transforms.

UNIT-IIITWOPORTNETWORKS

Two Port Networks Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, Cascaded networks

UNIT-IVFOURIER TRANSFORMS

Fourier Theorem- Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry- Line Spectra and Phase Angle Spectra- Analysis of Electrical Circuits to Non-Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

UNITV: FILTERS & CIRCUITS SIMULATION

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series

and Shunt Equalizers – L Type, T type and Bridged – T and Lattice Equalizers.

TEXTBOOKS:

1. ElectricalCircuitTheoryandTechnology4thEdition, JohnBird,Rovtled/T&F,2011.
2. NetworkAnalysis3rdEdition, M.EVanValkenberg,PHI,.
3. EngineeringCircuitAnalysisbyWilliamHaytandJackE.Kemmerley,McGra wHillCompany, 6th edition

REFERENCES:

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
2. Public Domain Simulator: http:// www.ee.iitb.ac.in/~sequel 3. PSPICE A/D user's manual –Microsim, USA. 4. PSPICE reference guide – Microsim, USA.

Mapping of course out comes with program out comes

CourseTitle	COs	Programme Outcomes(POs)& Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL CIRCUITS-II	CO1	3	3				3							3	
	CO2	3	3				3							3	
	CO3	3	3				3							3	
	CO4	3	2				2							3	
	CO5	3	3	3		3	3							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	13	17.33	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 3
2	10	13.33	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 3
3	11	14.66	2	Evaluate	L5	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 3
4	10	13.33	2	Apply	L3	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 2 2
5	21	28	3	Design	L6	PO1, PO2, PO3, PO5,	PO1:Apply(L3) PO2:Analyze(L4) PO3: Design (L6) PO5:Create(L6)	3 3 3 3

						PO6	PO6: Thumb Rule	3
	75							

CO1: Analyze the transient response of R-L, R-C and R-L-C circuits with D.C excitation.
Action Verb: **Analyze** (L4)
PO1: Apply (L3)
CO1 Action Verb is Greater than PO1 verb by two level; Therefore correlation is high (3).
PO2: Analyze (L4)
CO1 Action Verb is Greater than PO2 verb by one levels; therefore correlation is high (3).
PO6: Using Thumb Rule, CO1 Correlated to PO6 as high (3)
CO2: Analyze the transient response of R-L, R-C & R-L-C circuits with A.C excitation.
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 PO2 verb; therefore correlation is high (3).
PO6: Using Thumb Rule, CO2 Correlated to PO6 as high (3)
CO3: Evaluate the two port network parameters.
Action Verb: **Evaluate** (L5)
PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by two level; Therefore correlation is high (3).
PO2: Analyze (L4)
CO3 Action Verb is Greater than PO2 verb by one level; Therefore correlation is high (3).
PO6: Using Thumb Rule, CO3 Correlated to PO6 as high (3)
CO4: Apply Fourier transforms for A.C and D.C circuit parameters.
Action Verb: **Apply** (L3)
PO1: Apply (L3)
CO4 Action Verb is same PO1 verb; therefore correlation is high (3).
PO2: Analyze (L4)
CO4 Action Verb is less than PO2 verb by one level; therefore correlation is Moderate (2).
PO6: Using Thumb Rule, CO4 Correlated to PO6 as moderate (2)
CO5: Design different types of filters and equalizers for electrical circuits.
Action Verb: **Design** (L6)
PO1: Apply (L3)
CO5 Action Verb is Greaterthan PO1 verb by Three level; Therefore correlation is high (3).
PO2: Analyze (L4)
CO5 Action Verb is Greaterthan PO2 verb by two levels; therefore correlation is high (3).
PO3: Design (L6)
CO5 Action Verb is same as PO3; therefore correlation is high (3).
PO5: Create (L6)
CO5 Action Verb is same PO6 verb; therefore correlation is high (3).
PO6: Using Thumb Rule, CO5 Correlated to PO6 as high (3).

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Department of Electrical and Electronics Engineering

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**

Course Name: ELECTRICAL MACHINES-II

Course Code: 20APC0207

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the concept of armature reaction and various regulation methods of alternators.
CO2: Understand the working principle and performance of synchronous motors.
CO3: Analyze the concept of circle diagram and the performance characteristics of three phase Induction motor.
CO4: Analyze different methods of starting and speed control of three phase Induction motors.
CO5: Analyze the operation of single-phase Induction motors and special machines.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Construction and performance analysis	Salient, non-salient pole alternators		L2
CO2	Understand	Working principles and performance analysis	Synchronous motors		L2
CO3	**Analyze**	Construction, working principle and performance analysis	Three phase induction motor		L2
CO4	Analyze	Different methods of starting and speed control	Three phase induction motor		L4
CO5	Analyze	**the operation of single-phase Induction motors and special machines**			L2

SYLLABUS:

UNIT-I: ALTERNATORS

Construction details, types of rotors, EMF Equation, harmonics, armature reaction, phasor diagram of non-salient pole synchronous generator, voltage regulation, direct load, EMF, MMF and ZPF methods, two reaction theory of salient pole machine, phasor diagram, slip test, synchronizing and parallel operation, synchronizing torque, change of excitation and mechanical input.

UNIT-II: SYNCHRONOUS MOTOR

Principle of operation – Operation on infinite bus bars – V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – damper windings- synchronous condenser.

UNIT-III: THREE HASE INDUCTION MOTOR

Constructional details – Types of rotors – Production of rotating magnetic field – Principle of operation – Slip – Equivalent circuit – Torque-Slip characteristics –

Condition for maximum torque – Loses and efficiency – Load test – No load and blocked rotor tests – Circle diagram – Separation of loses – Double cage induction motors – Induction generators.

UNIT-IV: STARTING AND SPEED CONTROL OF 3-øINDUCTIONMOTOR

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor: Plugging, dynamic braking and regenerative braking. Cogging and crawling.

UNIT-V: SINGLE PHASE AND SPECIAL MOTORS

Single Phase Induction Motors - Constructional Features – Double Revolving Field Theory- Elementary Idea of Cross Field Theory – Split Phase Motors – Capacitor Start and Run Motors – Shaded Pole Motor. Principle and Performance of A.C Series Motor - Universal Motor – Single Phase Synchronous Motors – Reluctance Motor – Hysteresis Motor – Stepper Motor.

TEXTBOOKS:

1. Electrical Machinery, P.S. Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electric Machinery Fundamentals, Stephen JChapman, McGraw HillSeries in electrical and Computer Engineering, 4th Edition, 2010, 10th Reprint 2015.
3. MG Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.

REFERENCEBOOKS:

1. ElectricMachines4thedition,D.P.Kothari and I.J. Nagrath, Mc GrawHill Education(India) Pvt. Ltd., 4th Edition, 2010, 16th Reprint 2015.
2. Electric Machinery, A.E. Fitzgerald, C. Kingsley and S. Umans, Mc Graw Hill Education (India) Pvt. Ltd., 6th Edition, 2005.
3. Electrical Machines, S K Bhattacharya, Mc Graw Hill Education (India) Pvt. Ltd., 4th Edition, 2014, 3rd Reprint 2015.

WEBREFERENCES:

1. https://www.electrical4u.com
2. https://www.freevideolectures.com

E-TEXTBOOKS:

1. https://www.freeengineeringbooks.com
2. https://www.pdfdrive.com/textbook-of-electrical-technology-ac-and-dc-machines-d184089760.html

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / IV

Mapping of course outcomes with program outcomes:-

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Electrical Machines - II	CO1	3	3	3	3					3				3	3
	CO2	2	2	2	1					2				1	2
	CO3	3	3	3	3					3				3	3
	CO4	3	3	3	3					3				3	3
	CO5	3	3	3	3					3				3	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	10	22	2	Analyze	L4	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
2	10	27	2	Understand	L2	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	2 2 2 1 2
3	15	21	3	Analyze	L4	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
4	14	17	3	Analyze	L4	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
5	14	13	3	Analyze	L4	PO1,PO2, PO3,PO4,PO9	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4) PO9: Thumb Rule	3 3 3 3 3
	63							

CO1: Analyze the concept of armature reaction and various regulation methods of alternators.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO1 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO1 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO1 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO1 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO1 level is 4, Using Thumb Rule its correlation is high (3).

CO2: Understand working principle and performance of a synchronous motors.
Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verb: Identify (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO3 Verb: Develop (L3)
CO2 Action Verb is less than to PO1 verb by one level; Therefore correlation is moderate (2).
PO4 Verb: Analyze (L4)
CO2 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).
Based on students' participate in CLC activities. From this: CO1 level is 2, Using Thumb Rule its correlation is moderate (2).

CO3: Analyzey the concept of circle diagram and the performance characteristics of three phase Induction motor.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO3 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO3 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO3 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO3 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO3 level is 4, Using Thumb Rule its correlation is high (3).

CO4: Analyze various methods of starting and speed control of 3-phase Induction motors.
Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)
CO1 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO1 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).

PO3 Verb: Develop (L3)
CO1 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO1 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO1 level is 4, Using Thumb Rule its correlation is high (3).

CO5: Analyze the operation of single-phase Induction motors and special machines.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb level is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO5 Action Verb level is greater to PO2 verb; Therefore correlation is high (3).
PO3 Verb: Develop (L3)
CO5 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO3 verb; Therefore correlation is high (3).
Based on students' participate in CLC activities. From this: CO5 level is 4, Using Thumb Rule its correlation is high (3).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO2 Action Verb is less than PSO1 verb by two level; Therefore correlation is low (1).

CO3 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO4 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO5 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO2 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

CO3 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO5 Action Verb level is one level greater than PSO2 verb; Therefore correlation is high(3).

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**
Branch of Study: EEE

Course name: ENGINEERING ELECTROMAGNETICS
Course code: 20APC0208

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the different aspects related to static electric fields equations.
CO2: Analyze the concept of conductors, dipole, dielectric and capacitance.
CO3: Understand the fundamental laws related to magneto statics.
CO4: Analyze the concepts of magnetic forces and magnetic potential.
CO5: Understand the fundamentals of time varying fields.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The Different aspects related to static electric fields equations			L4
CO2	Analyze	The Concept of conductors, dipole, Dielectric & Capacitance			L4
CO3	Understand	The Fundamental laws related to Magneto statics			L2
CO4	Analyze	The Concepts of Magnetic forces and Magnetic potential			L4
CO5	Understand	The Fundamentals of Time varying fields			L2

SYLLABUS:

UNIT – I Electrostatics:
Electrostatic Fields -Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge –Electric flux density – Gauss's law – Application of Gauss's Law –Work done in moving a point charge in an electric field – Electric Potential – Potential gradient – Energy density in electric field - Related Problems. Maxwell's First Law – Numerical Problems-

UNIT – II Conductors, Dipole, Dielectric & Capacitance:
Laplace's and Poison's equations – electric dipole – Conduction current and Convection current density – Continuity Equation and Relaxation **Time** - Ohm's law in point form – Conductors and Insulators - Electric field inside a dielectric material – Polarization – Dielectric – Conductor and Dielectric – Dielectric boundary conditions - Capacitance – Capacitance of parallel plate , co-axial and spherical capacitors - Related Problems.

UNIT – III Magneto Statics:
Biot-Savart's law – Magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular, square and solenoid current – Carrying wire – Relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0. Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – Point form of Ampere's circuital law - Related Problems.

UNIT – IV Magnetic Forces:
Forces due to magnetic field – force on a charged particle – force on a current

element – Force between two Parallel Current Carrying Conductors– magnetic torque and moment – Magnetic Dipole - Related Problems.

Magnetic Potential:

Scalar magnetic potential and vector magnetic potential – classification of magnetic materials – Self and Mutual inductances – Self inductances of a coaxial cable, solenoid, toroid and two wire transmission line – Mutual inductance between two co-axial solenoids and two coils wound on the same magnetic circuit – Energy stored in a magnetic field - Related Problems.

UNIT – V Time Varying Fields

Faraday's law in integral form and in differential form –Maxwell's fourth equation. Statically and Dynamically Induced E.M.F'S-simple problems– Modification of Maxwell's equations for time varying fields – Displacement current- Poynting Theorem and Poynting vector - Related Problems.

TEXT BOOKS:

1. Elements of Electromagnetics – by Matthew N O Sadiku, Oxford University Press, 3rd Edition 2004.
2. Engineering Electromagnetic – by W H hayt and J A Buck, TATA Mc-graw-hill Education – 7th Edition 2006.

REFERENCE BOOKS:

1 Engineering Electromagnetics – by Nathan Ida, Springer (India) Pvt. Ltd., New Delhi, 2nd Edition 2005

2 Introduction to Electro Dynamics - by D.J. Griffiths, PHI.

3 Electromagnetics – Theory and problems by Joseph A. Edminister, 2nd edition.,1993, Schaum's outline series, Mc-Graw Hill

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Engineering Electromagnetics	CO1	3	3				1							1	
	CO2	3	3				1							1	
	CO3	2	2				1							1	
	CO4	3	3				1							1	
	CO5	2	2				1							1	

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	18	21.42	3	Analyze	L4	PO1, PO2, PO6	Apply (L3) Analyze (L4) Thumb rule	3 3 1

2	**19**	22.61	3	Analyze	L4	PO1, PO2, PO6	Apply (L3) Identify(L3) Thumb rule	3 3 1
3	**14**	**16.66**	**2**	Understand	L2	PO1, PO2, PO6	Apply (L3) Identify(L3) Thumb rule	2 2 1
4	**15**	**17.85**	**2**	Analyze	L4	PO1, PO2, PO6	Apply (L3) Identify(L3) Thumb rule	3 3 1
5	**17**	**20.23**	**3**	Understand	L2	PO1, PO2, PO6	Apply (L3) Identify(L3) Thumb rule	2 2 1
	84							

CO1: Analyze the different aspects related to static electric fields equations.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO2 verb by same levels; Therefore, correlation is high (3).
PO6 Using Thumb Rule, CO1 Correlated to PO6 as high (1)
CO2: Analyze the concept of conductors, dipole, dielectric and capacitance.
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).
PO6 Using Thumb Rule, CO2 Correlated to PO6 as high (1)
CO3: Understand the fundamental laws related to magneto statics.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO3 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2 Verbs: Identify (L3)
CO3 Action Verb is less than to PO2 verb by one level; Therefore, correlation is moderate (2).
PO6 Using Thumb Rule, CO3 Correlated to PO6 as high (1)
CO4: Analyze the concepts of magnetic forces and magnetic potential.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
PO2 Verbs: Identify (L3)
CO4 Action Verb is greater than to PO2 verb by one level; Therefore, correlation is high (3).
PO6 Using Thumb Rule, CO4 Correlated to PO6 as high (1)
CO5: Understand the fundamentals of time varying fields.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore, correlation is moderate (2).
PO2 Verbs: Identify (L3)
CO5 Action Verb is less than to PO2 verb by one level; Therefore, correlation is moderate (2).
PO6 Using Thumb Rule, CO5 Correlated to PO6 as high (1)

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	T	P	C
20AHSMB01		0	0	3

(Common to All branches of Engineering)

Course Outcomes(CO):

After studying of the course, Student will be able to:

CO1: Understand the fundamentals of managerial economics and demand concept.
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	fundamentals of managerial economics			L2
CO2	Understand	production and cost concepts		To optimize the output	L2
CO3	Analyze	price output relationship in various 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-DemandElasticity-Types–Measurement.DemandForecasting-Factorsgoverning 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- Isoquants and Iso costs, MRTS -Cobb-DouglasProductionFunction-LawsofReturns-InternalandExternalEconomiesofscale.Cost&Break-EvenAnalysis-CostconceptsandCostbehavior-Break-EvenAnalysis(BEA)-Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT-III **Business Organizations and Markets**

Introduction–Nature,meaning,significance,functionsandadvantages.FormsofBusinessOrganizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-MonopolisticCompetition–Oligopoly-Price-OutputDetermination-PricingMethodsandStrategies.

UNIT-IV **Capital Budgeting**

Introduction to Capital, Sources of Capital. Short-term and Long-term Capital: Working capital, types, 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(simple problems).

UNIT-V **Financial Accounting and Analysis**

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

Textbooks:

1. Varshney &Maheswari: ManagerialEconomics, SultanChand,2013.
2. Aryasri:BusinessEconomicsandFinancialAnalysis,4/e,MGH,2019

ReferenceBooks:

1. AhujaHlManagerial economicsSchand,3/e,2013
2. S.A.SiddiquiandA.S.Siddiqui: ManagerialEconomicsandFinancialAnalysis, NewAgeInternational,2013.
3. JosephG.NellisandDavidParker: PrinciplesofBusinessEconomics,Pearson,2/e,NewDelhi.
4. DomnickSalvatore:Managerial EconomicsinaGlobalEconomy,Cengage,2013.

OnlineLearningResources:

https://www.slideshare.net/123ps/managerial-economics-ppthttps://www.slideshare.net/rossanz/production-and-cost-45827016https://www.slideshare.net/darkyla/business-organizations-19917607https://www.slideshare.net/balarajbl/market-and-classification-of-markethttps://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396https://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	PO12	PSO1	PSO2
Managerial Economics and Financial Analysis	CO1	2													
	CO2		1												
	CO3	3													
	CO4		3												
	CO5		3												

Course Outcome (CO)	Percentage of contact hours over the total planned contact hours	CO: Action verb and BTL	Program Outcome(PO)	PO:Action verb and BTL	Level of correlation (0-3)
CO1	16%	understand	PO1	Apply	2
CO2	22%	understand	PO2	Analyse	1
CO3	22%	Analyse	PO1	Apply	3
CO4	16%	Evaluate	PO2	Analyse	3
CO5	22%	Analyse	PO2	Analyse	3

Justification Statements:

CO1: Understand the fundamentals of Managerial economics and demand concept.
Action Verb: Understand (L2)

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

CO2: Understand the Concept of Production and cost analysis.
Action Verb: Understand (L2)
PO2: Analyze (L4)
CO2 Action verb is less than PO1 verb by two levels. Therefore the correlation is low (1)

CO3: Analyze the price output in various 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)

CO4: Evaluate the capital budgeting techniques.
Action Verb : Evaluate (L5)
PO2: Analyse
CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

CO5: Analyse the Accounting statements and evaluate the financial performance of business entity.
Action Verb: Analyze (L4)
PO2: Analyze (L4)
CO5 Action verb is same as PO2 verb. Therefore the correlation is high (3)

Year: II Semester: II Branch of Study: EEE

Subject Code	Subject Name	L	T	P	Credits
20AHS9905	Universal Human Values	3	0	0	3

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

CO1. Understand the essentials of human values, self-exploration, happiness and prosperity for value added education.

CO2. Analyze the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.

CO3. Apply the nine universal human values in relationships for harmony in the family and orderliness in the society.

CO4. Evaluate the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence.

CO5. Apply the holistic understanding of harmony on professional ethics through augmenting universal human order.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	the essentials of human values, self-exploration, happiness and prosperity for value added education			**L2**
CO2	**Analyze**	the harmony in the human being as sentient 'I' and the material 'Body' in various aspects.			**L4**
CO3	**Apply**	the nine universal human values in relationships for harmony in the family and orderliness in the society			**L3**
CO4	**Evaluate**	the interconnectedness of four orders of nature and holistic perception of harmony at all levels of existence			**L5**
CO5	**Apply**	the holistic understanding of harmony on professional ethics through augmenting universal human order.			**L3**

UNIT – 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current. scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II: Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT III: **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**.

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT IV: **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT- V: Implications of the above Holistic Understanding of Harmony on Professional Ethics.

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions Eg. To discuss the conduct as an engineer or scientist etc.

TEXT BOOKS

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

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

REFERENCE BOOKS:

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

Articulation matrix

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Universal Human Values	CO1								2				12		
	CO2							3	3						
	CO3						2	2	2						
	CO4						3	3	3				3		
	CO5						2	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	**7**	19.4	2	**Understand**	**2**	PO8,PO12	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,PO12	Thumb Rule	3,3,3,3
5	**7**	19.4	**2**	**Apply**	**3**	PO6,PO7,PO8,PO12	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 PO12 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 PO12 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 PO12 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 PO12 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 PO12 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(AUTONOMOUS)
Computer Science and Engineering

Course Code	Year & Sem	Basics of Python Programming Lab	L	T	P	C
20APC0527	II-I		0	0	3	1.5

Course Outcomes:

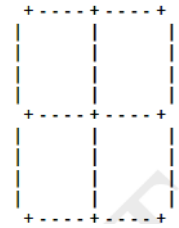
After studying of the course, Student will be able to:

CO1: Analyze the basic concepts of Python Programming
CO2: Apply the loops and conditional statements of python using IDLE and programs.
CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions.
CO4: Apply the development applications using python datatypes to read and write data from files.
CO5: Design the solutions using OOPs concepts for real world problems in python.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the basic concepts of Python Programming			L4
CO2	Apply	the loops and conditional statements of python	using IDLE and programs.		L3
CO3	Analyze	the compound data using Lists, Tuples and dictionaries	using functions.		L4
CO4	Apply	the development applications	using python datatypes	to read and write data from files	L3
CO5	Design	the solutions	using OOPs concepts.	for real world problems in python	L6

List of Experiments:

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all **(CO1)**
the operations present in a Scientific Calculator
2. Write a function that draws a grid like the following:**(CO1)**



3. Write a function that draws a Pyramid with # symbols**(CO1)**

```
    #
   # # #
  # # # # #
 # # # # # # #
```

4. Using turtles concept draw a wheel of your choice**(CO1)**
5. Write a program that draws Archimedean Spiral**(CO1)**
6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.**(CO1)**
7. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point. On UNIX systems, the
epoch is 1 January 1970.

```
>>> import time
>>>time.time()
1437746094.5735958
```

Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.**(CO1)**

8. Given n+r+1 <= 2r . n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above**(CO2)**

9. Write a program that evaluates Ackermann function**(CO2)**

10. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of 1/ π :

Write a function called estimate_pi that uses this formula to compute and return an estimate of π.

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

It should use a while loop to compute terms of the summation until the last term is smaller than 1e-15 (which is Python notation for 10 -15). You can check the result by comparing it to math.pi.**(CO2)**

11. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.**(CO2)**

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.**(CO2)**

13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.**(CO2)**

14. Given rows of text, write it in the form of columns.**(CO2)**

15. Given a page of text. Count the number of occurrences of each latter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same**(CO2)**

16. Write program which performs the following operations on list's. Don't use built-in functions**(CO3)**

a) Updating elements of a list
b) Concatenation of list's
c) Check for member in the list
d) Insert into the list
e) Sum the elements of the list
f) Push and pop element of list
g) Sorting of list
h) Finding biggest and smallest elements in the list
i) Finding common elements in the list

17. Write a program to count the number of vowels in a word.**(CO3)**

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.**(CO4)**

19. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.**(CO4)**

20. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.**(CO4)**

21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.**(CO4)**

22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Useobject oriented approach.**(CO5)**

23. Write a program illustrating the object oriented features supported by Python.**(CO5)**

24. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.**(CO5)**

25. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.**(CO5)**
26. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)**(CO5)**

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	Co's Action verb	BTL	Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
1	CO1 : Analyze	L4	PO1	PO1: Apply(L3)	2
			PO2	PO2: Analyze(L4)	3
2	CO2 : Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	2
			PO12	PO12: Thumb rule	2
3	CO3 :Analyze	L4	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	3
			PO3	PO3: Design (L6)	2
			PO4	PO4: Design (L6)	2
			PO9	PO9: Thumb rule	1
			PO12	PO12: Thumb rule	1
4	CO4 :Apply	L3	PO1	PO1: Apply(L3)	3
			PO2	PO2: Analyze (L4)	2
5	CO5 : Design	L6	PO2	PO2: Analyze (L4)	1
			PO3	PO3: Design (L6)	3
			PO4	PO4: Design (L6)	3
			PO5	PO5: Develop (L6)	3
			PO8	PO8: Thumb rule	2
			PO9	PO9: Thumb rule	1
			PO12	PO12: Thumb rule	2

Justification Statements:

CO1: Analyze the basic concepts of Python Programming
Action Verb: Analyze (L4)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb: Analyze (L4)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the loops and conditional statements of python using IDLE and programs.
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: Analyze (L4)
CO1 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)
PO12: Thumb rule
For usage of the loops and conditional statements of python using IDLE is medium. Therefore the correlation is medium (2)

CO3: Analyze the compound data using Lists, Tuples and dictionaries using functions.
Action Verb: Analyze (L4)

PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Design (L6)
CO3 Action verb is less than PO3 verb by one level. Therefore the correlation is medium (2)
PO4: Design (L6)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO9: Thumb rule
Team work is required to Analyze the compound data using. Hence the correlation is low (1)
PO12: Thumb rule
Construct real time applications using functions can be lifelong learning. Therefore the correlation is low (1)

CO4: Apply the development applications using python datatypes to read and write data from files.
Action Verb: Apply (L3)
PO1: Apply(L3)
CO4 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze (L4)
CO4 Action verb is less than PO2 verb by one level. Therefore the correlation is medium (2)

CO5: Design the solutions using OOPs concepts for real world problems in python.
Action Verb: Design (L6)
PO2: Analyze (L4)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)
PO3: Design (L6)
CO5 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Design (L6)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Develop(L6)
CO5 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8: Thumb rule
IOT Applications can be used to make society better place. Therefore the correlation is medium (2)
PO9: Thumb rule
Team work is required to Create BPP applications. Hence the correlation is low (1)
PO12: Thumb rule
In real time oops concepts are used to solve the societal problems. Therefore the correlation is medium (2)

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

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**
Branch of Study: EEE

Course Name: ELECTRICAL CIRCUITS-II LAB
Course Code: 20APC0209

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the DC circuit properties using PSPICE.
CO2: Evaluate the time constant for RL and RC series circuit using PSPICE.
CO3: Analyze the frequency response for RLC series circuit using PSPICE
CO4: Analyze the RL and RC series circuits with DC & AC excitation using PSPICE.
CO5: Evaluate the Z, Y, h and ABCD parameters of two port networks.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The D.C circuit properties	Using PSPICE		L4
CO2	Evaluate	The Time Constant For RL And RC Series Circuit	Using PSPICE		L5
CO3	Analyze	The Frequency Response For RLC Series Circuit	Using PSPICE		L4
CO4	Analyze	The RL and RC series circuits	Using PSPICE	With DC & AC excitation	L5
CO5	Evaluate	The Z, Y, h and ABCD parameters of two port networks.			L5

SYLLABUS:

List of Experiments

1. Simulation of DC Circuits (CO1).
2. DC Transient Response (CO1).
3. Mesh Analysis in p-spice (CO1).
4. Nodal Analysis in p-spice (CO1).
5. Measure and calculate RC time constant for a given RC circuit (CO2).
6. Measure and calculate RL time constant for a given RL circui (CO2).
7. Frequency response of RLC Series Circuits (CO3).
8. Analysis of RL and RC Series circuits for DC Excitation (CO4).
9. Analysis of RL and RC Series circuits for AC Excitation (CO4).
10. Verification of the maximum power dissipation (plot the power dissipated versus the load).(CO1).
11. Measure and calculate Z, Y parameters of two-port network (CO5).
12. Measure and calculate ABCD & h parameters of two-port network (CO5).

REFERENCES:

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.

2. Public Domain Simulator: http:// www.ee.iitb.ac.in/~sequel 3. PSPICE A/D user's manual –Microsim, USA. 4. PSPICE reference guide – Microsim, USA.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs)& Programme Specific Outcomes (PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL CIRCUITS-II LAB	CO1	3	3			3				3				3	
	CO2	3	3			3				3				3	
	CO3	3	3			3				3				3	
	CO4	2	3							3				3	
	CO5	2	3							3				3	

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO2, PO5, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO5:Apply(L3) PO9: Thumb Rule	3 3 3 3
2	Evaluate	L5	PO1, PO2, PO5, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO5:Select(L5) PO9: Thumb Rule	3 3 3 3
3	Analyze	L4	PO1, PO2, PO5, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO5:Apply(L3) PO9:Thumb Rule	3 3 3 3
4	Analyze	L5	PO1, PO2, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO9: Thumb Rule	2 3 3
5	Evaluate	L5	PO1, PO2, PO9	PO1:Apply(L3) PO2:Analyze(L4) PO9: Thumb rule	2 3 3

CO1: Analyze DC circuit properties using PSPICE.

Action Verb: **Analyze** (L4)

PO1: Apply (L3)

CO1 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).

PO2: Analyze (L4)

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

PO5: Apply (L3)

CO1 Action Verb is Greater than PO5 verb by one level; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO1 Correlated to PO9 as high (3)

CO2: Evaluate the time constant for RL and RC series circuit using PSPICE.

Action Verb: **Evaluate** (L5)
PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by two level; Therefore correlation is moderate (3).
PO2: Analyze (L4)
CO2 Action Verb is Greater than PO2 verb by two level; Therefore correlation is high (3).
PO5: Select (L5)
CO2 Action Verb is same as PO5 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO2 Correlated to PO9 as high (3)

CO3: Analyze frequency response for RLC series circuit using PSPICE

Action Verb: **Analyze** (L4)
PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO2: Analyze (L4)
CO3 Action Verb is same PO2 verb; Therefore correlation is high (3).
PO5: Apply (L3)
CO3 Action Verb is Greater than PO5 verb by one level; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO3 Correlated to PO9 as high (3)

CO4: Analyze RL and RC series circuits with DC & AC excitation using PSPICE.

Action Verb: **Evaluate** (L5)
PO1: Apply (L3)
CO4 Action Verb is greater than to PO1 verb by two level; therefore correlation is Moderate (2).
PO2: Analyze (L4)
CO4 Action Verb is greater than to PO2 verb by one level; Therefore correlation is Moderate (3).
PO9: Using Thumb Rule, CO4 Correlated to PO9 as high (3)

CO5: Evaluate Z,Y,h and ABCD parameters of two port networks.

Action Verb: **Evaluate** (L5)
PO1: Apply (L3)
CO5 Action Verb is greater than to PO1 verb by two level; therefore correlation is Moderate (2).
PO2: Analyze (L4)
CO5 Action Verb is greater than to PO2 verb by one level; therefore correlation is Moderate (3).
PO9: Using Thumb Rule, CO5 Correlated to PO9 as high (3)

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Department of Electrical and Electronics Engineering

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**

Course name: ELECTRICAL MACHINES-II LAB
Course code: 20APC0210

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the performance of Three-Phase Induction motor by conducting direct and indirect tests.
CO2: Analyze the performance of single-phase induction motor by conducting direct and indirect tests.
CO3: Evaluate the Voltage regulation of alternator by EMF, MMF and ZPF methods.
CO4: Evaluate the direct and quadrature axis reactance by conducting slip test.
CO5: Evaluate the V and inverted V curves of three phase synchronous motor.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The Performance of Three-Phase Induction motor	By Conducting direct and indirect tests		L4
CO2	Analyze	The Performance of single-phase induction motor	Performance of single-phase induction motor		L4
CO3	Evaluate	Voltage regulation of alternator	By EMF, MMF and ZPF methods		L5
CO4	Evaluate	Direct and quadrature axis reactance	By Conducting slip test		L5
CO5	Evaluate	The V and inverted V curves of three phase synchronous motor			L5

SYLLABUS:

All the following ten experiments are required to be conducted:

1. No-load&Blocked-rotortestson3-øInduction motor. - CO1
2. Brake Test on Three Phase Induction Motor. - CO1
3. Speed control of three phase induction motor. - CO1
4. Separation of no-load losses of three phase induction motor. - CO1
5. Determination of Equivalent circuit of a single phase induction motor. - CO2
6. Load test on single phase induction motor. - CO2
7. Predetermination of Regulation of a three phase alternator by Synchronous impedance & m.m.f methods. - CO3
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method. - CO3
9. Determination of Xd and Xq of a salient pole synchronous machine by sliptest. - CO4
10. V and inverted V curves of a 3-phase synchronous motor. - CO5

References:

1. D.P.KothariandB.S.Umre,"LaboratoryManualforElectricalMachines"I.KInternational PublishingHousePvt.Ltd,2017.
2. D.R.KohliandS.K.Jain,"ALaboratoryCourseinElectricalMachines"NEMChand&Bros.

Online Learning Resources/Virtual Labs: http://vem-iitg.vlabs.ac.in/

http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain =Electrical engineering http://vlabs.iitb.ac.in/vlabs-dev/vlab_boot camp /boot camp /Sadhya /experimentlist.html.

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Program: B. Tech Regulation: AK20 Year/Semester: II / IV

Mapping of course out comes with program outcomes:

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Electrical Machines – II LAB	CO1	3	3		3					3				3	3
	CO2	3	3		3					3				3	3
	CO3	3	3		3					3				3	3
	CO4	3	3		3					3				3	3
	CO5	3	3		3					3				3	3

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3
2	Analyze	L4	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze (L4) PO9: Thumb Rule	3 3 3 3
3	**Evaluate**	L5	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3
4	**Evaluate**	L5	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3
5	**Evaluate**	L5	PO1, PO2, PO4, PO9	PO1: Apply (L3) PO2: Analyze (L4) PO4:Analyze(L4) PO9: Thumb Rule	3 3 3 3

CO1: Analyze the performance of Three-Phase Induction motor by conducting direct and indirect tests.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO1 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO2: Analyze the performance of single-phase induction motor by conducting direct and indirect tests

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: Analyze (L4)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
CO2 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO3: Evaluate the Voltage regulation of alternator by EMF, MMF and ZPF methods.

Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO3 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO3Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO3 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
CO3 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

CO4: Evaluate the direct and quadrature axis reactance of Alternator by conducting slip test.

PO1 Verbs: Apply (L3)
CO4 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
CO4 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

CO5: Evaluate V and inverted V curves of three phase synchronous motor.

Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO5 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO5 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
CO5 Action Verb is of BTL 5. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as high (3).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb by one level; Therefore correlation is high (3).

CO2 Action Verb equal to PSO1 verb by one level; Therefore correlation is high (3).

CO3 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO5 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO2 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO3 Action Verb level greater than PSO2 verb by two level; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

CO5 Action Verb is greater than PSO2 verb by two level; Therefore correlation is high (3).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: II / IV**
Branch of Study: EEE

Course name: SIMULATION OF CIRCUITS USING PSIPCE
Course code: 20ASC0201

L	T	P	Credits
1	0	2	2

COURSE OUTCOMES:
After studying of the course, Student will be able to:

CO1: Analyze the features and programming basics of PSPICE.
CO2: Apply the procedures for simulation of AC circuits using PSPICE.
CO3: Apply the procedures for simulation of DC circuits using PSPICE.
CO4: Apply the nodal analysis for the given circuits using PSPICE.
CO5: Analyze the frequency response analysis of circuits using PSPICE.

CO	Action Verb	Knowledge Statement	Condition		Criteria	Bloom's level
CO1	Analyze	The Features and programming basics of PSPICE				L4
CO2	Apply	The Procedures for simulation of AC circuits using PSPICE	Using PSPICE			L3
CO3	Apply	Procedures for simulation of DC circuits using PSPICE	Using PSPICE			L3
CO4	Apply	The Nodal analysis of circuits	Using PSPICE			L3
CO5	Analyze	The Frequency response analysis of circuits	Using PSPICE			L4

SYLLABUS:

List of Experiments

1. Introduction to the use of P-Spice. (CO1)
2. Procedure to use P-Spice. (CO1)
3. Design a circuit for 3-node system using following data. Voltage=20V, R1= 3Ω & R2= 2Ω. (CO2)
4. Design an RC circuit with a suitable switch for DC transient analysis. Voltage=20V, R=10 Ω, C=0.1F. (CO3)
5. Perform the nodal analysis for a 4-node circuit. Voltage=10V, R1=10 Ω, R2=5 Ω, R3= 3 Ω, R4=10 Ω. (CO4)
6. Perform the frequency response of an RC network. Vrms=100V, R=10Ω, C=50μF (CO5)
7. Perform the analysis of an RL series circuit for DC Excitation. Voltage= 20V, R= 500Ω, L=2mH (CO3).

REFERENCES:

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
2. Public Domain Simulator: http:// www.ee.iitb.ac.in/~sequel 3. PSPICE A/D user's manual – Microsim, USA. 4. PSPICE reference guide – Microsim, USA.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: II / IV
Branch of Study: EEE

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
Simulation of Circuits Using PSIPCE	CO1	3				3									1
	CO2	3				3									1
	CO3	3				3									1
	CO4	3				3									1
	CO5	3				3									1

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO5	Apply (L3) Select (L3)	3 3
2	Apply	L3	PO1, PO5	Apply (L3) Apply(L3)	3 3
3	Apply	L3	PO1, PO5	Apply (L3) Apply(L3)	3 3
4	Apply	L3	PO1, PO5	Apply (L3) Apply(L3)	3 3
5	Analyze	L4	PO1, PO5	Apply (L3) Apply(L3)	3 3

CO1: Analyze features and programming basics of PSPICE.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore, correlation is high (3).
PO5 Verbs: Select (L3)
CO1 Action Verb is greater than PO5 verb by one level; therefore, correlation is high (3).
CO2: Apply the procedures for simulation of AC circuits using PSPICE.
Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).
PO5 Verbs: Apply (L3)
CO2 Action Verb is equal to PO5 verb; therefore, correlation is high (3).
CO3: Apply the procedures for simulation of DC circuits using PSPICE.
Action Verb: Apply (L3)

PO1 Verbs: Apply (L3)
CO3 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).
PO5 Verbs: Apply (L3)
CO3 Action Verb is equal to PO5 verb; therefore, correlation is high (3).

CO4: Apply nodal analysis for the given circuits using PSPICE.

Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO4 Action Verb is equal to PO1 verb; therefore, correlation is high (3).
PO5 Verbs: Apply (L3)
CO4 Action Verb is equal to PO5 verb; therefore correlation is high (3)

CO5: Analyze frequency response analysis of circuits using PSPICE.

Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater than PO1 verb by one level; therefore, correlation is high (3).
PO5 Verbs: Apply (L3)
CO5 Action Verb is greater than PO5 verb by one levels; therefore correlation is high (3).

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Department of Electrical and Electronics Engineering

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course Name: ELECTRICAL MACHINES-III
Course Code: 20APC0211

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the performance characteristics of permanent magnet brushless D.C motor.
CO2: Understand construction and operation of Permanent Magnet Synchronous Motor.
CO3: Analyze the performance characteristics of synchronous reluctance motors.
CO4: Analyze the operation and control of switched reluctance motors.
CO5: Understand the construction and operation of modern special machines.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The Performance characteristics of brushless D.C motor	Closed loop control		L4
CO2	Understand	The Construction and operation of PMSM			L2
CO3	Analyze	The Performance characteristics of synchronous reluctance motors			L4
CO4	Analyze	The Operation and control of switched reluctance motors			L4
CO5	Understand	The Construction and operation of modern special machines			L2

SYLLABUS:

UNITI: PERMANENT MAGNET BRUSHLESS D.C MOTORS
Fundamentals of Permanent Magnets -Construction-Principle of operation – Magnetic circuit analysis – EMF and torque equations – Performance characteristics - Closed loop control– Applications

UNITII: PERMANENT MAGNET SYNCHRONOUSMOTORS
Principle of operation – EMF and Torque equations – Phasor diagram – Performance characteristics – Closed loop control– Applications.

UNITIII: SYNCHRONOUS RELUCTANCE MOTORS
Constructional features – Types – Axial and Radial flux motors – Operating principles – Phasor diagram- Voltage and Torque Equations - Performance Characteristics – Applications.

UNITIV: SWITCHED RELUCTANCE MOTORS
Constructional features – Principle of operation – Torque production - Power Converters and their controllers – Performance Characteristics – Closed loop control – Applications.

UNITV: OTHER SPECIAL MACHINES
Constructional features – Principle of operation and characteristics of: Stepper Motor, Hysteresis motor, AC series motors, Linear motor, Hybrid motor, Poly phase induction motors, premium efficiency motors.

TEXTBOOKS:

1. K. Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
3. E. G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi,2014.

REFERENCE:

1. R. Krishnan, 'Switched Reluctance Motor Drives–Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T.Kenjo and S.Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London,1988.
3. T.J.E.Miller, 'Brush less Permanent - Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. Energy - Efficient Electric Motors, Revised an Expanded by AliEmadi ,3rd Edition, ISBN 9780824757359, Published August 30, 2004 by CRC Press.
5. R. Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
ELECTRICAL MACHINES-III 20APC0211	CO1	3	3										1	3	3
	CO2	2	1										1	1	2
	CO3	3	3										1	3	3
	CO4	3	3										1	3	3
	CO5	2	1										1	1	2

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)	%	correlation	Verb	BTL			
1	12	17.39	2	Analyze	L4	PO1, PO2, PO12	PO1: Apply(L3) PO2: Analyze (L4) PO12: Thumb Rule	3 3 1
2	11	15.94	2	Understand	L2	PO1,	PO1: Apply(L3)	2

						PO2, PO12	PO2: Analyze (L4) PO12: Thumb Rule	1 1
3	**17**	**24.63**	**3**	Analyze	**L4**	PO1, PO2, PO12	PO1: Apply (L3) PO2: Analyze (L4) PO12: Thumb Rule	3 3 1
4	**16**	**23.18**	**3**	Analyze	**L4**	PO1, PO2, PO12	PO1: Apply (L3) PO2: Analyze (L4) PO12: Thumb Rule	3 3 1
5	**13**	**18.8**	**2**	Understand	**L2**	PO1, PO2, PO12	PO1: Apply (L3) PO2: Analyze (L4) PO12: Thumb Rule	2 1 1
	69							

CO1: Analyze the performance characteristics and closed loop control of brushless D.C motor.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is higher than PO1 verb by one level; therefore, correlation is high (3).
PO2: Analyze (L4)
CO1 Action Verb is equal in level with PO2 verb; therefore, correlation is high (3).
PO12: Using thumb rule, CO1 correlates to PO12 as Low (1).

CO2: Understand construction and operation of PMSM.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is less than PO2 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).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

CO3: Analyze the performance characteristics of synchronous reluctance motors.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is higher than PO1 verb by one level; therefore, correlation is high (3).
PO2: Analyze (L4)
CO3 Action Verb is equal in level with PO2 verb; therefore, correlation is high (3).
PO12: Using thumb rule, CO1 correlates to PO12 as Low (1).

CO4: Analyze the operation and control of switched reluctance motors.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is higher than PO1 verb by one level; therefore, correlation is high (3).
PO2: Analyze (L4)
CO4 Action Verb is equal in level with PO2 verb; therefore, correlation is high (3).
PO12: Using thumb rule, CO1 correlates to PO12 as Low (1).

CO5: Understand the construction and operation of modern special machines.

Action Verb: Understand (L2)

PO1: Apply (L3)
CO5 Action Verb is less than PO2 verb by one level; therefore, correlation is moderate (2).
PO2: Analyze (L4)
CO5 Action Verb is less than PO2 verb by two level; therefore, correlation is low (1).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO2 Action Verb less than to PSO1 verb by two level; Therefore correlation is low (1).

CO3 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO4 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO5 Action Verb less than to PSO1 verb by two level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO2 Action Verb is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO3 Action Verb level greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO2 verb by one level; Therefore correlation is high (3).

CO5 Action Verb is less than PSO2 verb by one level; Therefore correlation is moderate (2).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course Name: POWER ELECTRONICS
Course Code: 20APC0212

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:
After studying of the course, Student will be able to:

CO1: Analyze the switching characteristics of Power semiconductor devices.
CO2: Understand the operation of AC to DC converters and their control.
CO3: Understand the operation of DC to DC Converters and their control.
CO4: Analyze the 120^0 and 180^0 modes of operation of DC to AC Converters.
CO5: Analyze the operation of AC to AC Converters and their control.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The switching characteristics of		Power semiconductor devices	L4
CO2	Understand	Operation of AC-DC Converters and their Control.			L2
CO3	Understand	Operation of DC-DC Converters and their Control.			L2
CO4	Analyze	Operation of DC-AC Converters and their Control.	The 120 and 180 degree modes		L4
CO5	Analyze	Operation of AC-AC Converters and their Control.			L4

SYLLABUS:

UNIT-I POWERSEMICONDUCTOR DEVICES
Basic structure and switching characteristics of Power Diode, Power Transistor, Power MOSFET, IGBT and GTO.SCR-Basic Operation, VI characteristics, Turn-on, Turn-off methods, Switching characteristics, Combination of SCRs, Snubber circuits, Ratings and Protection circuits.

UNIT-II AC-DC CONVERTERS
Principles of Phase control - Natural commutation - Operation of single-phase half and full wave- controlled converters with R, RL, RL+FWD, RLE Loads - Operation of three phase half wave- controlled converters and full wave-controlled converters with R, RL loads - Effect of source inductance on single phase and three phase-controlled converters - Operation of dual converters.

UNIT-III DC-DC CONVERTERS
Analysis and design of DC-to-DC converters- Control of DC-DC converters- Buck Converters-Boost converters- Buck-Boost converters- Cuk converters – Principles of chopper- Classification and operation of Choppers (A, B, C, D and E).

UNIT-IV DC-AC CONVERTERS
Single phase and three phase inverters – Voltage source and Current source inverters-120° and180° mode operation of 3 phase inverter – Single Pulse Modulation- Multiple Pulse Width Modulation- SPWM- Space Vector

Modulation- Harmonic Elimination Techniques.

UNIT-V AC-AC CONVERTERS
AC to AC power conversion using voltage controllers. Single phase AC Voltage Controller using Rand RL load– single phase step up, step down cyclo-converters – Mid-point Type and Bridge type Cyclo-converters

TEXTBOOKS:

1. M.H.Rashid, PowerElectronics:Circuits,DevicesandApplications,Prent ceHallofIndia 3rd Edition, 2014.
2. TheoryofPowerElectronics,"K.L.Rao,C.H.SaiBabu-S.Chand&CompanyLtd.",NewDelhi.- 2006

REFERENCEBOOKS:

1. M.D.Singh&K.B.Kanchandhani,"PowerElectronics",TataMcGra w–HillPublishing Company, 2nd Edition, 2010.
2. N.Mohan,T.M.Undeland,W.P.Robbins,"PowerElectronics,Converter sandApplications& Design",3rd Edition John Wiley & sons.
3. Dr PSBimbhra"PowerElectronics",Khanna Publishers,NewDelhi,Edition2012.
4.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
POWER ELECTRONICS	CO1	3	3				1							1	
	CO2	2	1				1							1	
	CO3	2	1				1							1	
	CO4	3	3				1							1	
	CO5	3	3				1							1	

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	13	19.11	2	Analyze	L4	PO1, PO2, PO6	PO1: Apply (L3) PO2: Analyze (L4) PO6: Thumb Rule	3 3 1
2	15	22	3	Understand	L2	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	2 1 1
3	14	20.5	3	Understand	L2	PO1, PO2,	PO1:Apply(L3) PO2:Analyze(L4)	2 1

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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / V
Branch of Study: EEE

						PO6	PO6: Thumb Rule	1
4	**14**	**20.5**	**3**	Analyze	**L4**	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 1
5	**12**	**17.6**	**2**	Analyze	**L4**	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 1
	68							

CO1: Analyze the switching characteristics of Power Diode, Power Transistor, Power MOSFET, IGBT and GTO.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2: Analyze (L4)
CO1 Action Verb is equal to PO2 verb; therefore correlation is high (3).
PO6: using thumb Rule CO1 is correlates with PO6 is low (1).
CO2: Understand the operation of AC to DC converters and their control.
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 is correlates with PO6 is low (1).
CO3: Understand the operation of DC to DC Converters and their control.
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 is correlates with PO6 is low (1).
CO4:- Analyze the 120^0 and 180^0 degree modes of operation of DC to AC Converters.
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 equal to PO2 verb; Therefore correlation is high (3).
PO6: using thumb Rule CO4 is correlates with PO6 is low (1).
CO5:- Analyze the operation of AC to AC Converters and their control.
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 equal to PO2 verb; Therefore correlation is high (3).
PO6: using thumb Rule CO5 is correlates with PO6 is low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / V
Branch of Study: EEE, ECE & CIC

Course Name: CONTROL SYSTEMS
Course code: 20APC0213

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Understand the mathematical modelling and transfer function of physical systems.
CO2:- Apply the time response analysis to I order systems & controllers and their stability.
CO3:- Analyze the stability of a system using Routh-Hurwitz criteria and root locus.
CO4:- Evaluate the stability of a system using Bode and Nyquist plot methods.
CO5:- Apply state space analysis to study response of continuous system.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Mathematical Model And Transfer Function Of the Physical Systems.			L2
CO2	Apply	Time response analysis to first order systems & controllers and study their stability.			L3
CO3	Analyze	The stability of a system using Routh-Hurwitz criteria and root locus.			L4
CO4	Evaluate	The stability of a system using Bode and Nyquist plot methods.			L5
CO5	Apply	State Space Analysis to Study Continuous System.			L3

SYLLABUS:

UNIT – I CONTROL SYSTEMS CONCEPTS
Basic elements of control systems- open and close loop systems - Transfer function – Modelling of Electrical systems and mechanical systems – Block diagram reduction techniques – Signal flow graphs.

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, P, PI, PID Controllers.

UNIT- III STABILITY ANALYSIS IN TIME DOMAIN
Stability - concept and definition, Characteristic equation – Location of poles – Routh Hurwitz criterion - Limitations of Routh's stability - The Root locus concept - construction of root loci-

UNIT- IV FREQUENCY RESPONSE ANALYSIS
Bode plot - Correlation between frequency domain and time domain specifications-Bode
Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots -Nyquist

Plots- Phase margin and Gain Margin–Stability Analysis.

UNIT- V STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state models - differential equations & Transfer function models - Transfer function from state model-State Transition Matrix and it's Properties-System response through State Space models-The concepts of controllability and observability, Duality between controllability and observability.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CONTROL SYSTEMS	CO1	2	1				1							3	
	CO2	3	2	1			1							3	
	CO3	3	3	1			1							3	
	CO4	3	3	2			1							3	
	CO5	3	2				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	17	22.6	3	Understand	L2	PO1, PO2	PO1:Apply(L3) PO2:Analyze(L4)	2 1

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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / V
Branch of Study: EEE, ECE & CIC

						PO6	PO6: Thumb Rule	1
2	**15**	20	2	Apply	L3	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 2 1
3	**14**	**18.6**	**2**	Analyze	L4	PO1, PO2 PO3 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6: Thumb Rule	3 3 1 1
4	**16**	**21.3**	**3**	Evaluate	L5	PO1, PO2 PO3 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO3:Design(L6) PO6:Thumb Rule	3 3 2 1
5	**13**	**17.3**	**2**	Apply	L3	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 2 1
	75							

CO1:- Understand the mathematical modelling and transfer function of physical systems.

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).

PO6: using thumb rule, CO1 correlation with PO6 is low (1)

CO2:- Apply the time response analysis to I order systems & controllers and their stability.

Action Verb: Apply (L3)

PO1: Apply (L3)

CO2 Action Verb is equal to 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).

PO6: using thumb rule, CO2 correlation with PO6 is low (1)

CO3:- Analyze the stability of a system using Routh-Hurwitz criteria and root locus.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO3 Action Verb is greater than PO1 verb by one level; therefore correlation is High (3).

PO2: Analyze (L4)

CO3 Action Verb is same as PO2 verb; therefore correlation is High (3).

PO3: Design (L6)

CO3 Action Verb is less than as PO3 verb by two level; therefore correlation is Low (1).

PO6: using thumb rule, CO3 correlation with PO6 is low (1)

CO4:- Evaluate the stability of a system using Bode and Nyquist plot methods.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

CO4 Action Verb is greater than PO1 verb by two level; therefore correlation is High (3).

PO2: Analyze (L4)

CO4 Action Verb is greater than PO2 verb by one level; therefore correlation is High (3).

PO3: Design (L6)

CO1 Action Verb is less than as PO3 verb by one level; therefore correlation is Moderate (2).

PO6: using thumb rule, CO4 correlation with PO6 is low (1)

CO5:- Apply state space analysis to study response of continuous system.

Action Verb: Apply (L3)

PO1: Apply (L3)

CO5 Action Verb is same PO1 verb; therefore correlation is High (3).
PO2: Analyze (L4)
CO5 Action Verb is less than PO2 verb by one level; therefore correlation is Moderate (2).
PO6: using thumb rule, CO5 correlation with PO6 is low (1)

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

Course Code	Year & Sem	ANALOG AND DIGITAL IC APPLICATIONS	L	T	P	C
20APC0425	III-I		3	0	0	3

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

CO1 Understand the basics of operational amplifier and its applications.

CO2 Analyze the Multivibrator circuits using IC555, A/D and D/A converters.

CO3 Analyze the operation of various filters, oscillators and waveform generators using Op-amp.

CO4 Evaluate the static and dynamic electrical behaviour of CMOS logic families.

CO5 Understand the logic families of integrated circuits using TTL and CMOS.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	basics of operational amplifier and its applications.	_		L2
CO2	Analyze	Multivibrator circuits,	using IC555	D/A & A/D converters	L4
CO3	Analyze	operation of various filters, oscillators and waveform generators	using Op-amp		L4
CO4	Evaluate	static and dynamic electrical behaviour of CMOS logic families	_		L5
CO5	Understand	logic families of integrated circuits	using TTL and CMOS		L2

UNIT - I		17Hrs
OP-AMP CHARACTERISTICS: Basic information of Op-amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics - DC and AC characteristics, 741 Op-amp and its features, modes of operation-inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, sample & Hold circuits, multiplier and divider, Differentiator and Integrator, Comparators, Schmitt trigger, multivibrator.		
UNIT - II		12Hrs
TIMERS, D-A AND A-D CONVERTERS: Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications.		
UNIT - III		12Hrs
ACTIVE FILTERS & OSCILLATORS: Introduction, 1st order LPF, HPF filters, Band pass, Band reject and all pass filters. Oscillator types and principle of operation- RC, Wien, and quadrature type, waveform generators- triangular, sawtooth, square wave and VCO.		
UNIT - IV		10Hrs
CMOS LOGIC: introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.		
UNIT - V		12Hrs
INTIGRATED CIRCUITS: Classification, Chip size and circuit complexity, Classification of integrated circuits, comparison of various logic families, standard TTL NAND Gate-Analysis & characteristics, TTL open collector outputs, Tristate TTL, MOS & CMOS open drain and tri- state outputs, CMOS transmission gate, IC interfacing-TTL driving CMOS & CMOS driving TTL.		
Textbooks:		
1. Linear Integrated Circuits – D.RoyChowdhury, New Age International (p) Ltd, 2nd Edition., 2003. **2. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.**		
Online Learning Resources:		
nptel videos		

Mapping of course outcomes with program outcomes

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	17	27	3	Understand	L2	PO1, PO2, PO3	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop(L3)	2 2 2
2	12	19	2	Analyze	L4	PO1, PO2, PO3,	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3)	3 3 3
3	12	19	2	Analyze	L4	PO1, PO2, PO3,PO4	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3) PO4: Analyze (L4)	3 3 3 3
4	10	16	2	Evaluate	L5	PO1, PO2, PO3,	PO1: Apply (L3) PO2: Identify (L3) PO3: Develop (L3)	3 3 3
5	12	19	2	Understand	L2	PO1, PO2, PO3,	PO1: Apply (L3) PO2: Review (L2) PO3: Develop (L3)	2 3 2
	63	100						

Correlation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	

Justification Statements:
CO 1: Understand the basics of operational amplifier and its applications. 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: Evaluate the static and dynamic electrical behavior of CMOS logic families. 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 Verb: Identify (L3) CO4 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3).
PO3 Verb: Develop (L3) CO4 Action Verb is greater than PO2 verb by two level; 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).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year-Semester: III-V
Branch of Study:EEE&ECE

Course Name: PROGRAMMABLE LOGIC CONTROLLERS
Subject Code: 20AOE0202

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Understand the purpose, functions, and operations of a PLC and identify the basic components of the PLC and how they function.
CO2: Analyze the directory of processor files using PLC software.
CO3: Understand the different types of devices to which PLC input and output modules are connected and various types of PLC registers.
CO4: Create the ladder diagrams from process control descriptions.
CO5: Apply the PLC timers and counters for the control of industrial processes.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	The purpose, functions, and operations of a PLC and identify the basic components of the PLC and how they function.			L2
2	Analyze	The directory of processor files.	Using PLC software.		L4
3	Understand	The different types of devices to which PLC input and output modules are connected and various types of PLC registers.			L2
4	Create	The ladder diagrams from process control descriptions.			L6
5	Apply	The PLC timers and counters for the control of industrial processes.			L3

SYLLABUS:

UNIT - I
PLC Basics PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

UNIT - II
PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT - III
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number

comparison functions, number conversion functions.

UNIT - IV

Data handling functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axes and three axis Robots with PLC, Matrix functions.

UNIT - V

Analog PLC operation: Analog modules and systems Analog signal processing multi bit data processing , analog output application examples, PID principles position indicator with PID control, PID modules, PID tuning, PID functions

TEXTBOOKS:

1. "John W Webb and Ronald A Reiss", Programmable Logic Controllers – Principle and Applications, PHI, 5th Edition 2003.
2. "JR Hackworth and F. D Hackworth Jr", Programmable Logic Controllers –
3. Programming Method and Applications by - Pearson, 2004.

REFERENCE BOOKS:

1. "W. Bolton", Programmable Logic Controllers, Newnes, 4th Edition 2000.

Mapping of course outcomes with program outcomes

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	PO 11	PO 12	PSO 1	PSO 2
PROGRAMMABLE LOGIC CONTROLLERS	CO1	2	2			2							1		1
	CO2	3	3			3							1		1
	CO3	2	2			2							1		1
	CO4	3	3			3							1		1
	CO5	3	3			3							1		1

Justification Table:

CO			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, PO5, PO12	PO1: Apply (L3) PO2: Identify (L3) PO5: Select (L3) PO12: Thumb Rule	2 2 2 1
2	Analyze	L4	PO1, PO2, PO5,	PO1: Apply (L3) PO2: Analyze (L4) PO5: Apply (L3)	3 3 3

			PO12	PO12: Thumb Rule	1
3	Understand	L2	PO1, PO2, PO5, PO12	PO1: Apply (L3) PO2: Select (L3) PO5: Apply (L3) PO12: Thumb Rule	2 2 2 1
4	Create	L6	PO1, PO2, PO5, PO12	PO1: Apply (L3) PO2: Analyze (L4) PO5: Create (L6) PO12: Thumb Rule	3 3 3 1
5	Apply	L3	PO1, PO2, PO5, PO12	PO1: Apply (L3) PO2: Identify (L3) PO5: Apply (L3) PO12: Thumb Rule	3 3 3 1

CO1: Understand the purpose, functions, and operations of a PLC and identify the basic components of the PLC and how they function.
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).
PO5: Select (L3)
CO1 Action Verb is Less than PO5 verb by one level; Therefore, correlation is moderate (2).
PO12: Using thumb rule, CO1 correlates to PO12 as low (1).
CO2: Analyze the directory of processor files using PLC software.
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 equal to PO2 verb; Therefore, correlation is high (3).
PO5: Apply (L3)
CO2 Action Verb is greater than PO5 verb by one level; Therefore, correlation is high (3).
PO12: Using thumb rule, CO2 correlates to PO12 as low (1).
CO3: Understand the different types of devices to which PLC input and output modules are connected and various types of PLC registers.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action Verb is less than PO1 verb by two level; Therefore, correlation is moderate (2).
PO2: Select (L3)
CO3 Action Verb is less than PO2 verb by one level; Therefore, correlation is moderate (2).
PO5: Apply (L3)
CO2 Action Verb is less than PO5 verb by one level; Therefore, correlation is moderate (2).
PO12: Using thumb rule, CO3 correlates to PO12 as Low (1).
CO4: Create the ladder diagrams from process control descriptions.
Action Verb: Create (L6)
PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by three levels; Therefore, correlation is high (3).

PO2: Analyze (L4)
CO4 Action Verb is greater than PO2 verb by two levels; Therefore, correlation is high (3).
PO5: Cretae (L6)
CO4 Action Verb is equal to PO5 verb; Therefore, correlation is high (3)
PO12: Using thumb rule, CO4 correlates to PO12 as Low (1).

CO5: Apply the PLC timers and counters for the control of industrial processes.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action Verb is equal to PO1 verb; Therefore, correlation is high (3).
PO2: Identify (L3)
CO5 Action Verb is equal to PO2 verb level; Therefore, correlation is high (3).
PO5: Apply (L3)
CO5 Action Verb is equal to PO5 verb level; Therefore, correlation is high (3)
PO12: Using thumb rule, CO5correlates to PO12 as Low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI

(AUTONOMOUS)

COMPUTER SCIENCE AND ENGINEERING (CSE)

Course Code	Year & Sem	Operating Systems	L	T	P	C
20APC0515	II-II	**(common to CSE,CIC,AIDS,AIML,CSE(DS),EEE)**	**3**	**0**	**0**	**3**

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

CO1: **Understand** the basic concepts of Operating Systems and its services.
CO2: **Apply** the concepts of process synchronization and CPU scheduling by drawing Gantt chart
CO3: **Analyze** the methods to handle deadlock and memory management
CO4: **Evaluate** the various disk scheduling algorithms and file system interfaces
CO5: **Understand** the issues and goals of protection various security

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

UNIT - I		
Operating Systems Overview: Operating system functions, Operating system structure, operating systems Operations, protection and security, Computing Environments, Open- Source Operating Systems **System Structures**: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot. **Processes:** Process concept, process Scheduling, Operations on processes, Inter process Communication, Examples of IPC systems.		
UNIT - II		
Threads: overview, Multi-core Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues. **Process Synchronization:** The critical-section problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches. **CPU Scheduling:** Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.		
UNIT - III		
Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table. **Virtual memory:** demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory **Deadlocks:** System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.		
UNIT - IV		
Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation. **File system Interface:** The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection. **File system Implementation:** File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.		
UNIT - V		
I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations. **Protection:** Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability- Based systems, Language – Based Protection		

Security: The Security problem, Program threats, System and Network threats, Cryptography as a security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications.

Textbooks:

1. Operating System Concepts, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, Wiley, Eight Edition, 2018

Reference Books:

1. Operating systems by A K Sharma, Universities Press,
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Operating Systems, A.S.Godbole, Second Edition, TMH.
4. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
5. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.
6. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/ http://peterindia.net/OperatingSystems.html

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	16	19%	2	CO1 : Understand	L2	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	2 3 2
2	19	22%	3	CO2 :Apply	L3	PO1 PO2 PO6 PO12	PO1: Apply(L3) PO2: Review(L2) PO6: Thumb rule PO12: Thumb rule	3 3 2 3
3	16	19%	2	CO3 : Analyze	L4	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3)	3 3 3 3 3
4	18	21%	3	CO4 : Evaluate	L5	PO1 PO2 PO3 PO4 PO5 PO6 PO8 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO6: Thumb rule PO8: Thumb rule PO12: Thumb rule	3 3 3 3 3 2 3 2
5	17	19%	2	CO5 : Understand	L2	PO1 PO2 PO8 PO12	PO1: Apply(L3) PO2: Review(L2) PO8: Thumb rule PO12: Thumb rule	2 3 3 2
	86	100 %						

Justification Statements:

CO1: Understand the basic concepts of Operating Systems and its services.
Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same as PO2 verb. Therefore the correlation is high(3)
PO12: Thumb rule

In today's world operating system services are updating, those services needs to understand. Therefore the correlation is medium (2)

CO2: Apply the concepts of process synchronization & CPU scheduling by drawing gantt chart
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2 Verb : Review(L2)
CO1 Action verb is greater than PO2 verb by one level. Therefore the correlation is high (3)
PO6: Thumb rule
Most of the scheduling algorithm were used to solve some of the societal problems like forming Queue line. Therefore the correlation is Moderate (2)
PO12: Thumb rule
Scheduling is the one of the daily activity done in many sectors. Therefore the correlation is High(3)

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

CO4: Evaluate the various disk scheduling algorithms and file system interfaces.
Action Verb : Evaluate (L5)
PO1: Apply(L3)
CO4 Action verb is greater level as PO1 verb. Therefore the correlation is high (3)
PO2: Review (L2)
CO4 Action verb is greater level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high(3)
PO4: Analyze (L4)
CO4 Action verb is greater than PO4 verb by one level. Therefore the correlation is high(3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high(3)
PO6: Thumb rule
Disk scheduling and file system interfaces are applied to provide solutions for E-Commerce database access . Therefore the correlation is medium (2)
PO8: Thumb rule
Since ethical principles shall be followed in file manipulations and data storage. Therefore the correlation is high(3)
PO12: Thumb rule
File manipulation of data and storage of data is playing major role in current scenario. Therefore, the correlation is medium (2)

CO5: Understand the various security issues and goals of protection
Action Verb : Understand (L2)
PO1: Apply(L3)
CO5 Action verb is less than PO1 verb by one level. Therefore, the correlation is medium (2)
PO2: Review (L2)
CO5 Action verb is same asPO2 verb. Therefore, the correlation is high(3)
PO8 : Thumb rule
Ethical principles should be followed for various security issues. Therefore the correlation is high(3)
PO12: Thumb rule
Security services and principles are keep on updating in the today's world. Therefore, the correlation is medium (2)

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course Name: POWER SYSTEMS-II
Course Code: 20APE0201

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Understand the types of conductors and transmission line parameters.
CO2:- Analyze the performance of short, medium and long length transmission lines.
CO3:- Analyze the power system transients and its effect on transmission lines.
CO4:- Analyze the properties of overhead lines, sag and tension calculations.
CO5:- Understand the types and construction of underground cables.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The Types Of Conductors And Transmission Lines parameters.			L2
CO2	Analyze	The Performance Of Short, Medium And Long Length Transmission Lines.			L4
CO3	Analyze	The Power System Transients And This Effect On Transmission Lines			L4
CO4	Analyze	Properties Of Overhead Lines, Sag And Tension Calculations.			L4
CO5	Understand	Types And Construction of		Underground Cables	L2

SYLLABUS:

UNIT-I: TRANSMISSION LINE PARAMETER

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition, Numerical Problems. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

UNIT-II: PERFORMANCE OF SHORT, MEDIUM AND LONG LENGTH TRANSMISSION LINES:

Classification of Transmission Lines - Short, medium and long line and their model representations - Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical &Asymmetrical Networks. Long Transmission Line-Rigorous Solution, evaluation of A, B, C, D Constants, Interpretation of the Long Line Equations Surge Impedance and SIL of Long Lines, Wave Length and Velocity of Propagation of Waves.

UNIT – III POWER SYSTEM TRANSIENTS & FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSIONLINES

Types of System Transients- Travelling or Propagation of Surges - Attenuation,

Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line,T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).Skin and Proximity effects - Description and effect on Resistance of Solid Conductors - Ferranti effect - Charging Current - Effect on Regulation of the Transmission Line. Corona-Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

UNIT-IV OVERHEAD LINE INSULATORS & SAG, TENSION CALCULATIONS:

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems - voltage distribution, calculation of string efficiency, Capacitance grading and Static Shielding.Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.

UNIT-V UNDERGROUND CABLES

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress. Capacitance of Single and 3-Core belted cables. Grading of Cables - Capacitance grading, Description of Inter-sheath grading, HV cables.

TEXT BOOKS:

1. Electrical power systems, C.L.Wadhwa, New Age International (P) Limited, Publishers.
2. Electrical Power Systems, PSR. Murty, BS Publications.

REFERENCE BOOKS:

1. A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, DhanpatRai& Co Pvt.Ltd.
2. A Textbook of Power System Engineering, R. K. Rajput, Laxmi Publications (P) Limited.
3. Electrical Power Generation, Transmission and Distribution, S.N.Singh, PHI.
4. Principles of Power Systems**,** V. K Mehta and Rohit Mehta S. Chand Company Pvt.Ltd.
5. Power System Engineering, I.J.Nagarath&D.PKothari,TMH.
6. Power System Analysis and Design, Dr. B. R. Gupta, S. Chand CompanyLimited.
7. Power System Analysis, Operation and control, AbhijitChakrpabarti, SunithaHalder, PHI, 3/e,2010 Electrical Power Transmission system engineering Analysis and design by TuranGonen, CRCPress(Taylor&FrancisGroup)Special IndianEdition,2/e.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
POWER SYSTEMS-II	CO1	2	1				1							1	
	CO2	3	3				3							1	
	CO3	3	3				3							3	1
	CO4	3	3				3							3	1
	CO5	2	1				1							1	

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	18	23.6	3	Understand	L2	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	2 1 1
2	16	21.05	3	Analyze	L4	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 3 3
3	17	22.36	3	Analyze	L4	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 3 3
4	15	19.73	2	Analyze	L4	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	3 3 3
5	7	9.21	1	Understand	L2	PO1, PO2 PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6:Thumb Rule	2 1 1
total	76							

CO1:- Understand the types of conductors and transmission line parameters.
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 levels; therefore correlation is Low (1).
PO6: Using Thumb Rule, CO1 Correlated to PO6 as low (1)
CO2:- Analyze the performance of short, medium and long length transmission lines.
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 Correlated to PO6 as high (3).

CO3:- Analyze the power system transients and this effect on transmission lines.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is greater than PO1 verb by one level; therefore correlation is High (3).
PO2: Analyze (L4)
CO3 Action Verb is same as PO2 verb; therefore correlation is High (3).
PO6: Using Thumb Rule, CO3 Correlated to PO6 as high (3).

CO4:- Analyze the properties of overhead lines, sag and tension calculations.

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).
PO6: Using Thumb Rule, CO2 Correlated to PO6 as high (3).

CO5:- Understand the types and construction of underground cables.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2: Analyze (L4)
CO5 Action Verb is less than PO2 verb by two levels; therefore correlation is Low (1).
PO6: Using Thumb Rule, CO1 Correlated to PO6 as low (1)

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

Course Code	Year & Sem	SIGNALS AND SYSTEMS	L	T	P	C
20APC0403	II-I		3	0	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 **Analyze** the signals in frequency domain using Fourier series and Fourier Transforms

CO3 **Apply** the Sampling theorem to convert continuous time signals into discrete time signals

CO4 **Analyze** the properties of systems and characteristics of LTI systems

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

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

UNIT - I

SIGNALS Introduction: Definition of Signals, classification of signals: continuous time and discrete time signals, standard signals: impulse function, step function, ramp function complex exponentialand sinusoidal signals, Signum, Sinc and Gaussian functions. Operations on signals and sequences. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, mean square error, Orthogonality of complex functions

.

UNIT - II

FOURIER SERIES AND FOURIER TRANSFORMS

Fourier series: Representation of signals using Fourier Series, Trigonometric Fourier series(TFS) and complex exponential Fourier series (CEFS). Illustrative problems. Continuous Time Fourier Transform, definition, properties, Fourier Transforms of standard signals, complex Fourier spectrum, inverse Fourier Transform. Discrete Time Fourier Transform, definition, properties of Discrete Time Fourier Transform transforms of standard signals. Introduction to Hilbert Transform. Illustrative problems.

UNIT - III

SAMPLING THEOREM

Definition of sampling, types: impulse and pulse sampling. Sampling theorem for band limited signals-Graphical and analytical proof, Nyquist criterion, Reconstruction of signal from itssamples, effect of under sampling – Aliasing. Sampling theorem for Band pass signals. Illustrative problems.

UNIT - IV

SYSTEMS

Definition of Systems, Classification of Systems, impulse response, response of a Linear Time Invariant system, Convolution and Correlation: time domain, frequency domain and Graphical representation. Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time. Illustrative problems.

UNIT - V

LAPLACE TRANSFORMS & Z TRANSFORMS

Laplace Transforms: Review of Laplace Transforms, concept of Region of Convergence (ROC) for Laplace Transforms, Inverse Laplace Transform, constraints on ROC for various classes of signals, properties of Laplace Transforms. Analysis of CT-LTI systems using Laplace Transforms: causality and stability.

Z-Transforms: Review of Z-Transforms, concept of Region of Convergence (ROC) for Z-Transforms, Inverse Z-Transform, constraints on ROC for various classes of signals, properties of Z-Transforms. Analysis of DT-LTI systems using Z- Transforms: causality and stability. Illustrative problems.

Textbooks:

1. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2003.
2. A.V. Obppenheim, A.S. Willsky and S.H. Nawab, Signals and Systems PHI, 2nd Edition.2009

Reference Books:

1. Simon Haykin and Van Veen, Signals & Systems, Wiley, 2nd Edition.
2. John G.Proakis, Dimitris G. Manolakis, Digital Signal Processing,Principles,Algorithms, and Applications, 4 th Edition, PHI, 2007
3. BP Lathi, Principles of Linear Systems and Signals Oxford University Press, 2015.

Online Learning Resources:

nptel videos

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	21	28%	3	Understand	L2	PO1, PO2,	PO1: Apply (L3) PO2: Review(L2)	2 3
2	16	21%	3	Analyze	L4	PO1,PO2,PO4	PO1: Apply (L3) PO2: Identify (L3) PO4:Analyze(L4)	3 3 3
3	12	16%	2	Apply	L3	PO1,PO2,PO12	PO1:Apply(L3) PO2:Identify(L4)	3 3
4	12	16%	2	Analyze	L4	PO1, PO2,PO4	PO1:Apply(L3) PO2:Identify(L3) PO4:Analyze(L4)	3 3 3
5	20	20%	2	Evaluate	L5	PO1,PO2,PO4	PO1:Apply(L3) PO2:Review(L2) PO4:Analyze(L4)	3 3 3
	75	100%						

Justification Statements :

CO1: Understand the representation of continuous time and discrete time signals
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Develop (L3)
CO1 Action Verb is less than PO3 verb by one level; therefore correlation is moderate (2).
CO2: 2.Analyze the signals in frequency domain using Fourier series and Fourier Transforms
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: Review (L2)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analysis (L4)
CO2 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).
CO3 Apply the Sampling theorem to convert continuous time signals into discrete time signals
Action Verb: Apply(L3)
PO1 Verbs: Apply (L3)
CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verb: Identify (L3)
CO3 Action Verb level is equal to PO2 verb; Therefore correlation is high (3).
CO4: Analyze the properties of systems and characteristics of LTI systems
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Identify (L2)
CO4 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO4 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).
CO5: Evaluate Continuous Time and Discrete Time LTI systems by using Laplace and Z-Transforms.
Action Verb: Evaluate (L5)
PO1 Verbs: Apply (L3)
CO5 Action Verb is greater to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Identify (L2)
CO5 Action Verb is greater than PO2 verb; Therefore correlation is high (3).
PO4 Verb: Analyze (L4)
CO5 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

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

Course Code	Year &Sem	LINEAR SYSTEM ANALYSIS	L	T	P	C
20APC0426	III-V		3	0	0	3

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

CO1 **Analyze** the Spectral characteristics of CT periodic signal using Fourier series

CO2 **Analyze** the spectrum of CT aperiodic signal using Fourier transform.

CO3 **Apply** the Laplace transform to continuous time signals and systems.

CO4 **Apply** the Z transform to continuous time signals and systems.

CO5 **Analyze** the process of converting CT signal to DT signal using sampling Theorem

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	The Spectral characteristics of CT periodic signal	using Fourier series .		L4
CO2	Analyze	the spectrum of CT aperiodic signal	using Fourier transform		L4
CO3	Apply	the Laplace transform	to continuous time signals and systems.		L3
CO4	Apply	the Z transform.	to continuous time signals and systems		L3
CO5	Analyze	the process of converting CT signal to DT signal	using sampling Theorem		L4

UNIT - I		
FOURIER SERIES REPRESENTSATION AND ITS APPLICATIONS Introduction, Trigonometric form of Fourier series, Exponential form of Fourier series, Wave symmetry, Introduction, Effective value and average values of non sinusoidal periodic waves, currents, Power Factor, Effects of harmonics, Application in Circuit Analysis, Circuit Analysis using Fourier Series.		
UNIT - II		
FOURIER TRANSFORM REPRESENTSATION AND ITS APPLICATIONS Fourier integrals and transforms, Fourier transform of a periodic function , Properties of Fourier Transform , Parseval's theorem , Fourier transform of some common signals, Fourier transform relationship with Laplace Transform..		
UNIT - III		
LAPLACE TRANSFORM REPRESENTSATION AND ITS APPLICATIONS Applications of Laplace transform Methods of Analysis – Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions, Shifting Theorem – Convolution Integral – Applications.		
UNIT - IV		
Z-TRANSFORMS Fundamental difference between continuous and discrete time signals, discrete time complex, exponential and sinusoidal signals, periodicity of discrete time complex exponential, concept of Z Transform of a discrete sequence. Distinction between Laplace, Fourier and ZTransforms. Region of convergence in Z-Transforms, constraints on ROC for various classes of signals, Inverse Z-Transform properties of Z-Transforms.		
UNIT - V		
SAMPLING: Sampling theorem – Graphical and Analytical proof for Band Limited Signal impulse sampling, natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, introduction to Band Pass sampling, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and Energy / Power spectral density function.		
Textbooks:		
1. Signals, Systems and Communications by B.P. Lathi, BS Publications 2003. 2. Network Analysis and Synthesis – UmeshSinha- SatyaPrakashan Publication		
Reference Books:		
1. Linear System Analysis – A N Tripathi, New Age InternationaL. 2. Network and Systems – D Roy Chowdhary, New Age International. 3. Engineering Network Analysis and Filter Desgin- Gopal G Bhisk&Umesh. 4. Linear system anlysis by A.Cheng, Oxford publishers.		

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1				Analyze	**L4**	PO1, PO2, PO3, PO4, PO5	PO1:Apply(L3) PO2: Review(L2) PO3:Develop(L6) PO4:Analyze(L4) PO5:Apply(L3)	3 3 1 3 3
2				Analyze	**L4**	PO1, PO2, PO4, PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Analyze(L4) PO5:Apply(L3)	3 3 3 3
3				Apply	**L3**	PO1, PO2, PO4, PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Analyze(L4) PO5:Apply(L3)	3 3 2 3
4				Apply	**L3**	PO1, PO2, PO4, PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Analyze(L4) PO5:Apply(L3)	3 3 2 3
5				Analyze	**L4**	PO1, PO2, PO4, PO5	PO1: Apply(L3) PO2: Review(L2) PO4:Analyze(L4) PO5:Apply(L3)	3 3 3 3

Mapping of course outcomes with program outcomes

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

Justification Statements :

CO 1: Analyze the Spectral characteristics of CT periodic signal using Fourier series

Action Verb:Analyze(L4)

PO1 Verbs: CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: CO1 Action Verb is greater than PO2 verb by two level; Therefore correlation is high (3)
PO3 Verbs:CO1 Action Verb is less than PO3 verb by two level; Therefore correlation is low (3).
PO4Verbs:CO1 Action Verb is equal to PO4 verb; Therefore correlation is high (3).
PO5Verbs:CO1 Action Verb is greater than PO5 verb by one level; Therefore correlation is high (3).

CO2: Analyze the spectrum of CT aperiodic signal using Fourier transform**..**

Action Verb: Analyze(L4)

PO1 Verbs: CO2 Action Verb is same as PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO4 Verbs: CO2 Action Verb is same as PO4 verb by one level; Therefore correlation is high (3).
PO5 Verbs: CO2 Action Verb is same as PO5 verb by one level; Therefore correlation is high (3).

CO3: Apply the Laplace transform to continuous time signals and systems

Action Verb: Apply(L3)

PO1 Verbs: CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: CO3 Action Verb is greater than PO2 verb by one level; Therefore correlation is high (3).
PO4 Verbs: CO3 Action Verb is less than PO4 verb by one level; Therefore correlation is moderate (2).
PO5 Verbs: CO3 Action Verb is equal to PO1 verb; Therefore correlation is high (3).

CO4 Apply the Z transform to continuous time signals and systems.

Action Verb: Apply(L3)

PO1 Verbs: CO4 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: CO4 Action Verb is greater than PO2 verb by one level; Therefore correlation is high(3).
PO4 Verbs: CO4 Action Verb is less than PO4 verb by one level; Therefore correlation is moderate(2)
PO5 Verbs: CO4 Action Verb is equal to PO5 verb; Therefore correlation is high (3)..

CO5: Analyze the process of converting CT signal to DT signal using sampling Theorem **Theorem**

Action Verb: Analyze(L4)

PO1 Verbs: CO5 Action Verb is same as PO1 verb by one level; Therefore correlation is high (3).
PO2 Verbs: CO5 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO4 Verbs: CO5 Action Verb is same as PO4 verb by one level; Therefore correlation is high (3).
PO5 Verbs: CO5 Action Verb is same as PO5 verb by one level; Therefore correlation is high (3).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course name: CONTROL SYSTEMS LAB
Course code: 20APC0214

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Analyze the transfer function and feedback control of D.C & A.C servo motors P, PD, PI and PID Controllers & Compensators.
CO2: Analyze the stability of systems using PSPICE/MATLAB.
CO3: Apply the programmable logic controllers to demonstrate industrial controls in the laboratory.
CO4: Apply the time domain and frequency domain analysis for linear time invariant systems.
CO5: Analyze the op-amp based circuits using PSPICE.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The transfer function and feedback control of D.C & A.C servo motors P, PD, PI and PID Controllers & Compensators.			L4
CO2	Analyze	The stability of systems	Using PSPICE/MATLAB		L4
CO3	Apply	The Programmable logic controllers to demonstrate industrial controls in the laboratory.			L3
CO4	Apply	The Time domain and frequency domain analysis for linear time invariant systems.			L3
CO5	Analyze	The op-amp based circuits	Using PSPICE		L4

SYLLABUS:

Any Eight of the following experiments are to be conducted:

1. Time response of Second order system-(CO2).
2. Characteristics of Synchros-(CO1).
3. Programmable logic controller - Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor-(CO3).
4. Effect of feedback on DC servo motor-(CO1).
5. Transfer function of DC Machine-(CO1).
6. Effect of P, PD, PI, PID Controller on a second order system-(CO1).
7. Lag and lead compensation - Magnitude and phase plot-(CO3).
8. Temperature controller using PID-(CO1).
9. Characteristics of magnetic amplifiers-(CO1).
10. Characteristics of AC servo motor-(CO).

Any two simulation experiments are to be conducted:

1. PSPICE simulation of Op-Amp based Integrator and Differentiator circuits-(CO5).

2. Linear system analysis (Time domain analysis, Error analysis) using MATLAB-(CO2).
3. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using MATLAB-(CO2).
4. State space model for classical transfer function using MATLAB – Verification-(CO2).

REFERENCE BOOKS:

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

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CONTROL SYSTEMS LAB	CO1				3		1							3	
	CO2				3	3	1							3	1
	CO3				2		1							3	
	CO4				2		1							3	
	CO5				3	3	1							3	1

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO4, PO6	PO4: Analyze (L4) PO6:Thumb Rule	3 1
2	Analyze	L4	PO4, PO5, PO6	PO4: Analyze (L4) PO5: Apply (L3) PO6:Thumb Rule	3 3 1
3	Apply	L3	PO4, PO6	PO4:Analyze (L4) PO6:Thumb Rule	2 1
4	Apply	L3	PO4, PO6	PO4:Analyze (L4) PO6:Thumb Rule	2 1
5	Analyze	L4	PO4, PO5, PO6	PO4:Analyze (L4) PO5: Apply (L3) PO6:Thumb Rule	3 3 1

CO1: Analyze the transfer function and feedback control of D.C & A.C servo motors P, PD, PI and PID Controllers & Compensators.

Action Verb: Analyze (L4)

PO4: Analyze (L4)

CO1 Action Verb is equal to PO4 verb; therefore correlation is high (3).

PO6: Thumb Rule

CO2: Analyze the stability of systems using PSPICE/MATLAB.

Action Verb: Analyze (L4)
PO4: Analyze (L4)
CO2 Action Verb is equal to PO4 verb; therefore correlation is high (2).
PO5: Apply (L3)
CO2 Action Verb is greater than PO5 verb by one level; therefore correlation is high (3)
PO6: Thumb Rule

CO3: Apply the programmable logic controllers to demonstrate industrial controls in the laboratory.

Action Verb: Apply (L3)
PO4: Analyze (L4)
CO3 Action Verb is less than PO4 verb by one level; therefore correlation is moderate (2).
PO6: Thumb Rule

CO4: Apply the time domain and frequency domain analysis for linear time invariant systems.

Action Verb: Apply (L3)
PO4: Analyze (L4)
CO4 Action Verb is less than PO4 verb by one level; therefore correlation is moderate (2).
PO6: Thumb Rule

CO5: Analyze the op-amp based circuits using PSPICE.

Action Verb: Analyze (L4)
PO4: Analyze (L4)
CO5 Action Verb is equal to PO4 verb; therefore correlation is high (3).
PO5: Apply (L3)
CO5 Action Verb is greater than PO5 verb by one level; therefore correlation is High (3).
PO6: Thumb Rule

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course name: POWER ELECTRONICS LAB
Course code: 20APC0215

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Analyze the various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
CO2:- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
CO3:- Analyze the operation of dc-dc converters, single-phase ac voltage controllers.
CO4:- Analyze the operation of cyclo converters with different loads.
CO5:- Evaluate the performance of various power electronic converters using MATLAB.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	The various Characteristics of Power Electronic Devices With Gate Firing Circuits And Forced Commutation Techniques.			L4
CO2	Analyze	The Operation of Single-Phase Half & Fully-Controlled Converters and Inverters		With Different Types of Loads.	L4
CO3	Analyze	The Operation of DC-DC Converters, Single-Phase AC Voltage Controllers.			L4
CO4	Analyze	The Operation of Cyclo-Converters		With Different Loads.	L4
CO5	Evaluate	The Power Electronic Converters	Using MATLAB Software.		L5

SYLLABUS:

Any Eight of the Experiments in Power Electronics Lab

1. Study of Characteristics of SCR, MOSFET & IGBT-(CO1).
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering-(CO1).
3. Single Phase AC Voltage Controller with R and RL Loads-(CO3).
4. Single Phase fully controlled bridge converter with R and RL loads-(CO2).
5. Forced Commutation circuits (Class A, Class B, Class C, and Class D & Class E)-(CO1).
6. DC Jones chopper with R and RL Loads-(CO3).
7. Single Phase Parallel, inverter with R and RL loads-(CO2).
8. Single Phase Cyclo converter with R and RL loads-(CO4).
9. Single Phase Half controlled converter with R load-(CO2).
10. Three Phase half-controlled bridge converter with R-load-(CO2).
11. Single Phase series inverter with R and RL loads-(CO2).

12. Single Phase Bridge converter with R and RL loads-(CO2).
13. Single Phase dual converter with RL loads-(CO2).

Any two simulation experiments with MATLAB

14. Simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads-(CO5).
15. Simulation of resonant pulse commutation circuit and Buck converters and chopper-(CO5).
16. Simulation of single-phase Inverter with PWM control-(CO5).

REFERENCES:

1. Simulation of Power Electronics Circuit, MBPatil, V.Ramanarayan and VTRanganat, Alpha Science International Ltd., 2009.
2. PublicDomainSimulator:http://www.ee.iitb.ac.in/~sequel3.PSPICEA/Duser'smanual–Microsim,USA.4.PSPICEreferenceguide–Microsim, USA.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs)&Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
POWER ELECTRONICS LAB	CO1				1		1							1	
	CO2				1		1							1	
	CO3				1		1							1	
	CO4				1		1							1	
	CO5				2	3	1							1	2

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO4, PO6	PO4:Design (L6) PO6:Thumb Rule	1 1
2	Analyze	L4	PO4, PO6	PO4:Design (L6) PO6:Thumb Rule	1 1
3	Analyze	L4	PO4, PO6	PO4:Design (L6) PO6:Thumb Rule	1 1
4	Analyze	L4	PO4, PO6	PO4:Design (L6) PO6:Thumb Rule	1 1
5	Evaluate	L5	PO4, PO5, PO6	PO4:Design(L6) PO5: Apply (L3) PO6:Thumb Rule	2 3 1

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Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

CO1:- Analyze the various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.

Action Verb: Analyze (L4)

PO4: Design (L6)

CO1 Action Verb is less than PO4 verb by two level; therefore correlation is low (1).

PO6: using thumb rule CO1 correlates with PO6 is low (1).

CO2:- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.

Action Verb: Analyze (L4)

PO4: Design (L6)

CO2 Action Verb is less than PO4 verb by two level; therefore correlation is low (1).

PO6: using thumb rule CO2 correlates with PO6 is low (1).

CO3:- Analyze the operation of dc-dc converters, single-phase ac voltage controllers.

Action Verb: Analyze (L4)

PO4: Design (L6)

CO3 Action Verb is less than PO4 verb by two level; therefore correlation is low (1).

PO6: using thumb rule CO3 correlates with PO6 is low (1).

CO4:- Analyze the operation of cyclo converters with different loads.

Action Verb: Analyze (L4)

PO4: Design (L6)

CO4 Action Verb is less than PO4 verb by two level; therefore correlation is low (1).

PO6: using thumb rule CO4 correlates with PO6 is low (1).

CO5:- Evaluate the performance of various power electronic converters using MATLAB.

Action Verb: Evaluate (L5)

PO4: Design (L6)

CO5 Action Verb is less than PO4 verb by one level; therefore correlation is Moderate (2).

PO5: Apply (L3)

CO5 Action Verb is greater than PO5 verb by two level; therefore correlation is High (3).

PO6: using thumb rule CO5 correlates with PO6 is low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / V
Branch of Study: EEE

Course Name: INTRODUCTION TO PROGRAMMING WITH MATLAB
Course Code: 20ASC0202

L	T	P	Credits
1	0	2	2

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1: Understand the syntax, semantics, basic operators and matrix systems in MATLAB.
CO2: Analyze the various functions and scripts in MATLAB.
CO3: Apply the various tool box functions on MATLAB and execute simple simulations.
CO4: Analyze the various statements, persistent variables and loop systems in MATLAB.
CO5: Understand the data types and file systems in MATLAB.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms Level
CO1	Understand	The syntax, semantics, basic operators and matrix systems in MATLAB			L2
CO2	Analyze	The various functions and scripts in MATLAB			L4
CO3	Apply	The various tool box functions on MATLAB and execute simple simulations			L3
CO4	Analyze	The various statements, persistent variables and loop systems in MATLAB			L4
CO5	Understand	The Data types and file systems in MATLAB.			L2

SYLLABUS:

MODULE-1 (CO1)
Introduction – Running MATLAB – The MATLAB Desktop – MATLAB as a Calculator – Syntax and Semantics – Help – Plotting

MODULE-2 (CO1)
Introduction to Matrices and Operators – The Colon Operator – Accessing Parts of a Matrix – Combining and Transforming Matrices – Arithmetic

MODULE-3 (CO2)
Introduction to Functions – Function I/O – Formal Definition of Functions – Sub functions – Scope – Advantages of Functions – Scripts

MODULE-4 (CO3)
Introduction to Programmer's Toolbox – Matrix Building – Input / Output – Plotting – Debugging

MODULE-5 (CO4)
Selection – If-Statements, Continued – Relational and Logical Operators – Nested If-Statements – Variable Number of Function Arguments – Robustness – Persistent Variables

MODULE-6 (CO4)
Loops – For-Loops – While-Loops – Break Statements – Logical Indexing – Preallocation

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Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

MODULE-7 (CO5)
Introduction to Data Types – Character Arrays – Structures – Cells – The String Type (Introduced in 2017a) – The Date, time and Duration Types (Introduced in 2014b)

MODULE-8 (CO5)
File Input/output – Excel Files – Text Files – Binary Files

REFERENCE & TRAINING RSOURCE: Coursera course "INTRODUCTION TO PROGRAMMING WITH MATLAB"

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
INTRODUCTION TO PROGRAMMING WITH MATLAB 20ASC0202	CO1	2				2							1	1	1
	CO2	2			3	2							1	1	1
	CO3	3				2							1	1	1
	CO4	2			3	2							1	1	1
	CO5	2				2							1	1	1

Justification Table:

CO			Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Understand	L2	PO1, PO5, PO12	PO1: Apply (L3) PO5: Apply (L3) PO12: Thumb Rule	2 2 1
2	Analyze	L4	PO1, PO4, PO5, PO12	PO1: Apply (L3) PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb Rule	3 3 3 1
3	Apply	L3	PO1, PO5, PO12	PO1: Apply (L3) PO5: Apply(L3) PO12: Thumb Rule	3 3 1
4	Analyze	L4	PO1, PO4, PO5, PO12	PO1: Apply (L3) PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb Rule	3 3 3 1
5	Understand	L2	PO1, PO5, PO12	PO1: Apply (L3) PO5: Apply (L3) PO12: Thumb Rule	2 2 1

CO1: Understand the syntax, semantics, basic operators and matrix systems in MATLAB.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is less than PO2 verb by one level; therefore, correlation is moderate (2).

PO5: Apply (L3)
CO2 Action Verb is less than PO2 verb by one level; therefore, correlation is moderate (2).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

CO2: Analyze the various functions and scripts in MATLAB.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; therefore, correlation is high (3).
PO4: Analyze (L4)
CO2 Action Verb is equal in level with PO4 verb; therefore, correlation is high (3).
PO5: Apply (L3)
CO2 Action Verb is greater than PO5 verb by one level; therefore, correlation is high (3).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

CO3: Apply the various tool box functions on MATLAB and execute simple simulations.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action Verb is equal in level with PO1 verb; therefore, correlation is high (3).
PO5: Analyze (L4)
CO3 Action Verb is less than PO4 verb by one level; therefore, correlation is moderate (2).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

CO4: Analyze the various statements, persistent variables and loop systems in MATLAB.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; therefore, correlation is high (3).
PO4: Analyze (L4)
CO4 Action Verb is equal in level with PO4 verb; therefore, correlation is high (3).
PO5: Apply (L3)
CO4 Action Verb is greater than PO5 verb by one level; therefore, correlation is high (3).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

CO5: Understand the data types and file systems in MATLAB.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO5 Action Verb is less than PO2 verb by one level; therefore, correlation is moderate (2).
PO5: Apply (L3)
CO5 Action Verb is less than PO2 verb by one level; therefore, correlation is moderate (2).
PO12: Using thumb rule, CO2 correlates to PO12 as Low (1).

Year: III.B.Tech Semester: II Branch: Common to All

Subject Code	Subject Name	L	T	P	Credits
20AMC9901	BIOLOGY FOR ENGINEERS	3	0	0	0

Course Outcomes (CO): After studying of the course, Student will be able to:

1. Understand the structure of cells and basics in living organisms
2. Understand the importance of various biomolecules and enzymes in living organisms
3. Analyze the functioning of physiology in respiratory system and digestive system.
4. Understand the DNA technology and gen cloning in living organisms.
5. Apply the biological principles in different technologies for the production of medicines and pharmaceuticals.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the structure of cells and basics in living organisms			L2
2	**Understand**	the importance of various biomolecules and enzymes		in living organisms	L2
3	**Analyze**	the functioning of physiology		in respiratory system and digestive system	L4
4	**Understand**	the DNA technology and gen cloning		in living organisms	L2
5	**Apply**	the biological principles in different technologies	for the production of medicines and pharmaceuticals		L3

Unit I: Introduction to Basic Biology

Evolution: Different patterns of evolution, Darwin's theory of evolution, Cell as Basic unit of life, cell theory, Cell shapes, Cell structure, Cell cycle. Chromosomes. Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification, Tissue Engineering.

Unit II: Introduction to Biomolecules

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Enzyme application in Industry. Large scale production of enzymes by Fermentation.

Unit III: Human Physiology

Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, respiratory cycle, Central Nerves System and Excretory system.

Unit IV: Introduction to Molecular Biology and recombinant DNA Technology

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation. DNA technology. Introduction to gene cloning.

Unit V: Application of Biology

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biosensors, Properties and Classification of virus, Immune response to virus, Definitions-Pandemic, Epidemic and outbreak, pandemic alert system ranges, Prevention of pandemic disease and pandemic preparation.

Text books:

1. P.K.Gupta, Cell and Molecular Biology, 5th Edition, Rastogi Publications
2. U. Satyanarayana. Biotechnology, Books & Allied Ltd 2017

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A Global Approach", Pearson Education Ltd, 2018.

2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2nd ed. Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology – 2014.
6. Richard Dawkins, River Out of Eden: A Darwinian View of Life.

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1						2								
2						2								
3						2								
4						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)**
	Lesson Plan (Hrs)	**%**	**corr**	**Verb**	**BTL**			
1	**10**	20	2	**Understand**	**L2**	PO6	Thumb Rule	2
2	**10**	20	2	**Understand**	**L2**	PO6	Thumb Rule	2
3	**9**	18	1	**Analyze**	**L4**	PO6	Thumb Rule	2
4	**9**	18	1	**Understand**	**L2**	PO6	Thumb Rule	2
5	**10**	20	2	**Apply**	**L3**	PO6	Thumb Rule	2
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CO1: Understand the structure of cells and basics in living organisms
Action Verb: Understand (L2)
Using Thumb rule, CO1 correlates PO6 as moderate (2).

CO2: Understand the importance of various biomolecules and enzymes in living organisms
Action Verb: Understand (L2)
Using Thumb rule, CO2 correlates PO6 as moderate (2).

CO3: Analyze the functioning of physiology in respiratory system and digestive system.
Action Verb: Analyze (L4)
Using Thumb rule, CO3 correlates PO6 as moderate (2).

CO4: Understand the DNA technology and gen cloning in living organisms.
Action Verb: Understand (L2)
Using Thumb rule, CO4 correlates PO6 as moderate (2).

CO5: Apply the biological principles in different technologies for the production of medicines and pharmaceuticals**.**
Action Verb: Apply (L3)
Using Thumb rule, CO4 correlates PO6 as moderate (2).

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / VI
Branch of Study: EEE

Course Name: ELECTRICAL MEASUREMENTS AND INSTRUMENTATION
Course code: 20APC0216

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Understand the construction and operation of various measuring instruments.
CO2:- Analyze the measurement methods and instruments suitable for measurement of unknown resistance, capacitance, Inductance, Voltage and current.
CO3:- Understand the construction and operation of wattmeter and energy meter.
CO4:- Analyze the A.C & D.C Bridge circuits used for measurement of unknown resistance, capacitance and Inductance.
CO5:- Apply the appropriate transducers for measurement of electrical and non-electrical quantities.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The construction and operation of various measuring instruments.			L2
CO2	Analyze	The measurement methods and instruments suitable for measurement of unknown resistance, capacitance, Inductance, Voltage and current.			L4
CO3	Understand	The construction and operation of wattmeter and energy meter.			L2
CO4	Analyze	The A.C & D.C Bridge circuits used for measurement of unknown resistance, capacitance and Inductance.			L4
CO5	Apply	The appropriate transducers for measurement of electrical and non-electrical quantities.			L3

SYLLABUS:

UNIT- I INTRODUCTION TO MEASURING INSTRUMENTS:
Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance.

UNIT– II POTENTIOMETERS & INSTRUMENT TRANSFORMERS:
Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors

UNIT –III MEASUREMENT OF POWER & ENERGY:
Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Single phase induction type energy meter – driving and braking torques – errors and compensations –testing by phantom loading using R.S.S. meter. Three phase energy meter – tri-vector meter, maximum demand meters.

UNIT – IV DC & AC BRIDGES:

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method.
Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge.
Measurement of capacitance and loss angle –Desaunty's Bridge - Wien's bridge – Schering Bridge.

UNIT-V TRANSDUCERS

Definition of transducers, Classification of transducers, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes, Velocity, Angular Velocity, Acceleration, Force, Torque, Pressure, Vacuum, Flow and Liquid level.

TEXT BOOKS:

1. "G. K. Banerjee", "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016
2. "S. C. Bhargava", "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

REFERENCE BOOKS:

1. "A. K. Sawhney", "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co.
   Publications, 2005.
2. "R. K. Rajput", "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. "Buckingham and Price", "Electrical Measurements", Prentice – Hall, 1988.
4. "Reissland, M.U", "Electrical Measurements: Fundamentals, Concepts,
   Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
5. "E.W. Golding and F. C. Widdis", "Electrical Measurements and measuring Instruments", fifth
   Edition, Wheeler Publishing, 2011.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL MEASUREMENTS AND	CO1	2	1				1							1	
	CO2	3	3				1							1	
	CO3	2	1				1							1	
	CO4	3	3				1							1	

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Branch of Study: EEE

INSTRUMENTATION	CO5	3	2				1							1	

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	**20**	22.47	3	Understand	L2	PO1, PO2 , PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	2 1 1
2	**17**	19.10	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 1
3	**18**	**20.22**	**3**	Understand	L2	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	2 1 1
4	**17**	**19.10**	**2**	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 1
5	**17**	**19.10**	**2**	Apply	L3	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 2 1
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CO1:- Understand the construction and operation of various measuring instruments.

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 levels; therefore correlation is low (1).

PO6: Using Thumb Rule CO1 is correlates with PO6 is low (1).

CO2:- Analyze the measurement methods and instruments suitable for measurement of unknown resistance, capacitance, Inductance, Voltage and current.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO2 Action Verb is greater than as PO1 verb by one levl; therefore correlation is high (3).

PO2: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; therefore correlation is high (3).

PO6: Using Thumb Rule CO2 is correlates with PO6 is low (1).

CO3:- Understand the construction and operation of wattmeter and energy meter.

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 levels; therefore correlation is low (1).

PO6: Using Thumb Rule CO3 is correlates with PO6 is low (1).

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Branch of Study: EEE

CO4:- Analyze the A.C & D.C Bridge circuits used for measurement of unknown resistance, capacitance and Inductance.

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 equal to PO2 verb; therefore correlation is High (3).

PO6: Using Thumb Rule CO4 is correlates with PO6 is low (1).

CO5:- Apply the appropriate transducers for measurement of electrical and non-electrical quantities.

Action Verb: Apply (L3)

PO1: Apply (L3)

CO5Action Verb is equal to PO1 verb; Therefore correlation is high (3).

PO2: Analyze (L4)

CO5 Action Verb is less than PO2 verb by one level; therefore correlation is moderate (2).

PO6: Using Thumb Rule CO5 is correlates with PO6 is low (1).

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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / VI
Branch of Study: EEE

Course Name: POWER SYSTEM ANALYSIS
Course Code: 20APC0217

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

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

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The concepts of Per unit system and Ybus Formation		For A Power System Network.	L2
CO2	Apply	The Zbus For a power System		Modification Of Zbus	L3
CO3	Analyze	Gauss-Seidel and Newton Raphson algorithms			L4
CO4	Analyze	The Symmetrical and unsymmetrical faults		occurring in a power system	L4
CO5	Analyze	Steady Sate ,Dynamic And Transient State Stabilities and methods	To Improve System Stability		L4

SYLLABUS:

UNIT-I P.U. SYSTEM AND Y_{bus} FORMATION

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

UNIT-II FORMATION OF Z_{bus}

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

UNIT –III POWER FLOW ANALYSIS

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

UNIT – IV SHORT CIRCUIT ANALYSIS

Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components: Positive, Negative and Zero sequence Networks. Unsymmetrical Fault Analysis: LG, LL, LLG and LLLG faults with and without fault impedance, Numerical Problems.

UNIT –V STABILITY ANALYSIS

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

TEXT BOOKS:

1. Hadi Saadat, "Power System Analysis", McGraw Hill, 1998.
2. I.J.Nagrath & D.P.Kothari, "Modern Power system Analysis", 4th Edition, Tata McGraw-Hill Publishing Company, 2011.

REFERENCE BOOKS:

1. Grainger and Stevenson, "Power System Analysis", McGraw Hill, 1994.
2. G.W.Stagg and A.H.El "Computer Methods in Power System Analysis", Abiad, Mc Graw- Hill, 2006 B.R.Gupta, "Power System Analysis and Design", S. Chand & Company, 2005.

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	PO12	PSO1	PSO2
POWER SYSTEM ANALYSIS	CO1	2	2											3	
	CO2	3	3											3	
	CO3	3	3											3	
	CO4	3	3				3							3	
	CO5	3	3				3							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	16	17.3	2	Understand	L2	PO1, PO2	PO1:Apply(L3) PO2:Identify(L3)	2 2
2	19	20.6	3	Apply	L3	PO1, PO2	PO1:Apply(L3) PO2:Identify(L3)	3 3

3	23	24.7	3	Analyze	L4	PO1, PO2	PO1:Apply(L3) PO2:identify(L4)	3 3
4	19	20.6	3	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 3
5	15	16.3	2	Analyze	L4	PO1, PO2, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	3 3 3
	92							

CO1:- Understand concepts of Perunit system and formation of Y bus for a power system network.
Action Verb: understand (L2)
PO1: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2: Identify (L3)
CO1 Action Verb is less than PO2 verb by one levels; therefore correlation is moderate (2).
CO2:- Apply the Z bus building and modification algorithm for a power system.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO2: Action Verb is same PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO2: Action Verb is same PO2 verb; Therefore correlation is high (3).
CO3:- Analyze the power flow using Gauss-Seidel and Newton Raphson algorithms.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; therefore correlation is High (3).
PO2: Analyze (L4)
CO3 Action Verb is same PO2 verb; therefore correlation is high (3).
CO4:- Analyze the symmetrical and unsymmetrical faults occurring in a power system.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by one level; Therefore correlation is moderate (3).
PO2: Analyze (L4)
CO4 Action Verb is same PO2 verb; therefore correlation is high (3).
PO6: Using Thumb Rule, CO4 Correlated to PO6 as high (3)
CO5:- Analyze steady sate, dynamic, transient state stabilities and methods to improve system stability.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is moderate (3).
PO2: Analyze (L4)
CO5 Action Verb is same PO2 verb; therefore correlation is high (3).
PO6: Using Thumb Rule, CO5 Correlated to PO6 as high (3).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Course Name: SWITCH GEAR AND PROTECTION
Course Code: 20APC0218

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Understand the operation of various types of fuses and breakers used for power system protection.
CO2:- Analyze the various types of Relay based power system protection systems.
CO3:- Analyze the various protection system for generators and transformers.
CO4:- Analyze the various types of the relays in protecting feeders, lines and bus bars.
CO5:- Understand the protection of a power system from over voltages.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The operation of various types of fuses and breakers used for power system protection.			L2
CO2	Analyze	The various types of Relay based power system protection systems.			L4
CO3	Analyze	The various protection system for generators and transformers.			L4
CO4	Analyze	The various types of the relays in protecting feeders, lines and bus bars.			L4
CO5	Understand	The protection of a power system from over voltages.			L2

SYLLABUS:

UNIT – I SWITCHGEAR FOR PROTECTION

Fuses: Definitions, characteristics, types, HRC fuses.
Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage-Restriking Phenomenon, Average and Maximum RRRV, Current Chopping and Resistance Switching CB Ratings and Specifications – Auto Reclosures - Types of Circuit Breakers: Air blast, Air Break, Oil, SF6, Vacuum circuit breakers, Minimum Oil Circuit Breakers and Earth leakage circuit breakers - Difference between circuit breakers and isolators– making and breaking capacity.

UNIT – II RELAYS

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays.

UNIT – III PROTECTION OF GENERATORS & TRANSFORMERS

Principles and need for protective schemes – Equipment earthing and neutral grounding - Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected. Protection of Transformers: Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholz Relay Protection,

Numerical Problems.

UNIT – IV PROTECTION OF FEEDERS & LINES

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.

UNIT – V OVER VOLTAGES IN POWER SYSTEMS

Generation of Over Voltages in Power Systems - Protection against Lightning over Voltages Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination – Surge arresters – Special earthing for lightning arresters.

TEXT BOOKS:

1. Badri Ram, D.N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 2011.
2. Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 1992.

REFERENCE BOOKS:

1. C.L.Wadhwa, "Electrical Power Systems", New Age international (P) Limited, Publishers, 2012.
2. Y.G. Paithankar , "Transmission network Protection", Taylor and Francis,2009.
1. Bhuvanesh Oza, "Power system protection and switch gear", TMH, 2010.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
SWITCHGEAR AND PROTECTION	CO1	2	1				1							2	
	CO2	3					1							2	1
	CO3	3	3	1			1							2	
	CO4	3					1							2	
	CO5	2					1							2	

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	21	28	3	Understand	L2	PO1, PO2 , PO6	PO1:Apply(L3) PO2:Analyze(L4) PO6: Thumb Rule	2 1 1
2	23	30.6	3	Analyze	L4	PO1, PO6	PO1:Apply(L3) PO6: Thumb Rule	3 1

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3	**13**	**17.3**	**17**	Analyze	L4	PO1, PO2, PO3, PO6	PO1:Apply(L3) PO2:Analyze(L4) PO3: Design(L6) PO6:Thumb Rule	3 3 1 1
4	**6**	**8**	**1**	Analyze	L4	PO1, PO6	PO1:Apply(L3) PO6: Thumb Rule	3 1
5	**7**	**9.3**	**1**	Understand	L2	PO1, PO6	PO1:Apply(L3) PO6: Thumb Rule	2 1
	75							

CO1:- Understand the operation of various types of fuses and breakers used for power system protection.
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 levels; therefore correlation is low (1).
PO6: Using Thumb Rule CO1 is correlates with PO6 is low (1).
CO2:- Analyze the various types of Relay based power system protection systems.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO6: Using Thumb Rule CO2 is correlates with PO6 is low (1).
CO3:- Analyze the various protection system for generators and transformers.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is greater than PO1 verb by one level; therefore correlation is high (3).
PO2: Analyze (L4)
CO3 Action Verb is equal to PO2 verb; therefore correlation is high (3).
PO3: Design (L6)
CO3 Action Verb is less than PO3 verb by two levels; Therefore correlation is low (1).
PO6: Using Thumb Rule CO3 is correlates with PO6 is low (1).
CO4:- Analyze the various types of the relays in protecting feeders, lines and bus bars.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; therefore correlation is high (3).
PO6: Using Thumb Rule CO4 is correlates with PO6 is low (1).
CO5:- Understand the protection of a power system from over voltages.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO6: Using Thumb Rule CO5 is correlates with PO6 is low (1).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course Name: POWER SEMICONDUCTOR DRIVES
Course Code: 20APE0202

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES:

After studying of the course, Student will be able to:

CO1:- Understand the electric drive system requirements based on their applications.
CO2:- Understand the operation of single and multi-quadrant electric drives.
CO3:- Analyze single phase and three phase rectifiers fed DC motors and chopper fed DC motors.
CO4:- Evaluate the motor and power converter requirements for a specific application.
CO5:- Analyze the speed control methods for AC-AC & DC-AC converters fed to Induction motors and Synchronous motors with closed loop and open loop operations.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Electric Drive System	Based on their Applications		L2
CO2	Understand	Operation of Single and Multi-Quadrant Electric Drives.			L2
CO3	Analyze	Single Phase and Three Phase Rectifiers Fed DC Motors as well as Chopper Fed DC Motors.			L4
CO4	Evaluate	Motor and Power Converter for a Specific Application.			L5
CO5	Analyze	Speed Control Methods for AC-AC&DC-AC Converters fed to Induction Motors and Synchronous Motors	With Closed Loop, and open Loop operations.		L2

SYLLABUS:

UNIT–I CONVERTER FED DC MOTORS

Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase, Three Phase Semi and Fully Controlled Converters Connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics- Problems.

UNIT–II FOURQUADRANT OPERATION OF DC DRIVES

Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

UNIT–III CHOPPER FED DC MOTORS

Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output

Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics – Problems on Chopper Fed D.C Motors.

UNIT–IV CONTROL OF INDUCTION MOTOR

Induction Motor Stator Voltage Control and Characteristics – AC Voltage Controllers – Waveforms – Speed Torque Characteristics – Stator Frequency Control and Characteristics. Voltage Source and Current Source Inverter – PWM Control – Comparison of VSI and CSI Operations – Closed Loop Operation of Induction Motor Drives (Block Diagram Only) –Principles of Vector Control Static Rotor Resistance Control – Slip Power Recovery – V/f control of Induction Motor.

UNIT–V CONTROL OF SYNCHRONOUS MOTORS

Separate Control & Self Control of Synchronous Motors – Operation of Self Controlled Synchronous Motors by VSI and CSI Cycloconverters. Load Commutated CSI Fed Synchronous Motor – Operation– Waveforms – Speed Torque Characteristics – Applications – Advantages and Numerical Problems – Closed Loop Control Operation of Synchronous Motor Drives (Block Diagram Only), Introduction to variable frequency control.

TEXTBOOKS:

1. Powersemiconductorcontrolleddrives,GKDubey,PrenticeHall,1995.
2. ModernPowerElectronicsandACDrives,B.K.Bose,PHI,2002.

REFERENCEBOOKS:

1. Power Electronics, MD Singh and KB Khan chandani, Tata Mc Graw - Hill Publishing company, 2008.
2. Power Electronic Circuits, Devices and applications, M. H .Rashid, PHI, 2005. Electric Drives Concepts and Applications, Vedam Subramanyam, Tata Mc Graw Hill Publications, 2nd Edition, 2011.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
POWER SEMI CONDUCTOR DRIVES	CO1	2	2			2								1	2
	CO2	2	2			2	2							1	2
	CO3	3	3			3	3							3	3
	CO4	3	3			3	3							3	3
	CO5	3	3			3	3							3	3

Justification Table:

CO	CO		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,PO5	PO1:Apply (L3) PO2:Identify (L3) PO5:Apply(L3)	2 2 2
2	Understand	L2	PO1,PO2,PO5 PO6	PO1:Apply (L3) PO2:Identify (L3) PO5:Apply(L3) PO6: Thumb Rule	3 3 3 2
3	Analyze	L4	PO1,PO2,PO5 PO6	PO1:Apply (L3) PO2:Identify (L3) PO5:Apply(L3) PO6: Apply(L3)	3 3 3 3
4	Evaluate	L5	PO1,PO2,PO5 PO6	PO1:Apply (L3) PO2:Identify (L3) PO5:Apply(L3) PO6: Apply(L3)	3 3 3 3
5	Analyze	L4	PO1,PO2,PO5 PO6	PO1:Apply (L3) PO2:Identify (L3) PO5:Apply(L3) PO6: Apply(L3)	3 3 3 3

CO1:- Understand the electric drive system requirements based on their 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: Identify(L3)
CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO5: Apply(L3)
CO1 Action Verb is less than PO5 verb by one level; Therefore correlation is moderate (2).

CO2:- Understand the operation of single and multi-quadrant electric drives.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2: Identify(L3)
CO2 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO5: Apply(L3)
CO2 Action Verb is less than PO5 verb by one level; Therefore correlation is moderate (2).
PO6: Using thumb rule, CO2 correlates to PO6 as moderate (2).

CO3:- Analyze single phase and three phase rectifiers fed DC motors as well as chopper fed DC motors.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO2: Identify(L3)
CO3 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply(L3)
CO3 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO6: Using thumb rule, CO3 correlates to PO6 as high (3).

CO4:- Evaluate the motor and power converter requirements for a specific application.
Action Verb: Evaluate (L2)
PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by two level; Therefore correlation is high (3).
PO2: Identify(L3)
CO3 Action Verb is Greater than PO1 verb by two level; Therefore correlation is high (3).
PO5: Apply(L3)
CO3 Action Verb is Greater than PO1 verb by two level; Therefore correlation is high (3).
PO6: Using thumb rule, CO4 correlates to PO6 as high (3).

CO5:- Analyze the speed control methods for AC-AC & DC-AC converters fed to Induction motors and Synchronous motors with closed loop and open loop operations.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO2: Identify(L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply(L3)
CO5 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO6: Using thumb rule, CO5 correlates to PO6 as high (3).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is less than to PSO1 verb by two level; Therefore correlation is low (1).

CO2 Action Verb is less than to PSO1 verb by two level; Therefore correlation is low (1).

CO3 Action Verb is equal to PSO1verb; Therefore correlation is high (3)

CO4 Action Verb level is greater than to PSO1 verb by one level; Therefore correlation is high (3)

CO5 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

PSO2 Verb: Develop (L3)

CO1 Action Verb is less than PSO2 verb by one level; Therefore correlation is moderate (2).

O2 Action Verb is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO3 Action Verb is one level greater than PSO2 verb; Therefore correlation is high (3)

CO4 Action Verb is two level greater than PSO2 verb; Therefore correlation is high (3).

CO5 Action Verb is one level greater than PSO2 verb; Therefore correlation is high (3).

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

Course Code	Year & Sem	Microprocessors and Microcontrollers	L	T	P	C
20APC0418	III-II	**(common to ECE and EEE)**	**3**	**0**	**0**	**3**

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

CO1: **Understand** the basic concepts of 8085 architecture and Instruction set
CO2: **Understand** the architecture details of 8086 processor.
CO3: **Apply** various Instructions in assembly language programs by using 8086 Instruction set.
CO4: **Analyze** the architectural features of different MSP 430 family processors.
CO5: **Evaluate** the operational behavior of peripheral devices by using low power modes

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The basic concepts of 8085 architecture and Instruction set			L2
CO2	Understand	the architecture details of 8086 processor			L2
CO3	Apply	various Instructions in	Assembly language programs	By using 8086 instruction set	L3
CO4	Analyze	The architectural features of different MSP 430 family processors			L4
CO5	Evaluate	the operational behaviour of peripheral devices	By using Low power modes of MSP 430		L5

UNIT - I		
OVERVIEW OF 8085 MICROPROCESSOR: Overview of microcomputer systems and their building blocks, Introduction to 8-bit microprocessor (8085) Architecture, Addressing modes, Instruction set, Machine cycles, instruction cycle and timing states.		
UNIT - II		
INTRODUCTION TO 8086: Introduction-8086 Architecture-Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table. Memory organization and memory banks accessing.		
UNIT - III		
PROGRAMMING OF 8086: Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives- Macros and Procedures.- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.		
UNIT - IV		
INTRODUCTION TO LOW POWER RISC MSP 430: Low power RISC MSP430 – block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets. Sample embedded system on MSP430 microcontroller.		
UNIT - V		
PERIPHERAL DEVICES OF MSP 430: I/O ports pull up/down resistors concepts, Interrupts, Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active Vs Standby current consumption. Timer & Real Time Clock (RTC), timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.		
Textbooks:		
1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.		
2. Douglas V. Hall, "Microprocessors and interfacing: Programming and hardware", 2nd Edition. Tata McGraw Hill, 1991.		
3. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanath Oxford Publishers. 1st Edition, 2010		
Reference Books:		
1.Carl Hamacher, ZvonksVranesic, SafwatZaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.		
2.Andrew S.Tanenbaum, "Structured Computer Organization",4th Edition PHI/Pearson		
3.John L.Hennessy and David A.Patterson, "Computer Architecture a quantitative approach", Fourth Edition Elsevier		
Online Learning Resources:		
nptel videos		

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	B TL			
1	10	16%	2	Understand	L2	PO1, PO3,	PO1: Apply (L3) PO3: Develop (L3)	2 2
2	10	16%	2	Understand	L2	PO1,PO2	PO1: Apply (L3) PO2:Review(L2) PO3: Apply(L3)	2 3 2
3	15	23%	3	Apply	L3	PO1,PO2,PO3	PO1:Apply PO2:Identify(L3) PO3:Develop (L3)	3 3 3
4	14	22%	3	Analyze	L4	PO1, PO4	PO1:Apply PO4:Analyze(L4)	3 3
5	14	22%	3	Evaluate	L5	PO1,PO3,PO4,PO12	PO1:Apply(L3) PO3:Develop(L3) PO4:Analyze(L4) PO12: Thumb's rule	3 3 3 2
	63	100%						

Justification Statements :

CO1: Understand the basic concepts of 8085 architecture and Instruction set

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO3 Verbs: Develop (L3)

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

CO2: Understand the characteristics and features of 8086 processor.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Review (L2)

CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).

PO3 Verb: Apply (L3)

CO3 Action Verb is less than PO3 verb; Therefore correlation is moderate (2).

CO3: Apply various techniques in assembly language programs by using 8086 Instruction set .

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).

PO3 Verb: Develop (L3)

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

CO4: Analyze different MSP 430 family processors using low power design implementation.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO4 Verb: Analyze (L4)

CO4 Action Verb level is equal to PO4 verb; Therefore correlation is high (3).

CO5: Evaluate the operational behavior of peripheral devices by using low power modes.

Action Verb: Evaluate (L5)

PO1 Verb: Apply (L3)

CO5 Action verb is greater to PO1 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 PO3 verb therefore the correlation is high (3).

PO 12: CO5 Using Thumb rule, L5 correlates PO12 as moderate (2).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / V**
Branch of Study: EEE

Course Name: POWER QUALITY
Course code: 20APE0205

L	T	P	Credits
3	0	0	3

Course outcomes:

After studying of the course, Student will be able to:

CO1: Understand the power quality issues in connection with standards.
CO2: Analyze the voltage sags and transient over voltages.
CO 3: Analyze the harmonic sources and devices for controlling harmonic distortion
CO4: Analyze the long duration voltage variations
CO5: Understand the power quality bench marking and monitoring.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	power quality issues in connection with standards			L2
2	Analyze	voltage sags and transient over voltages			L4
3	Analyze	harmonic sources and devices for controlling harmonic distortion			L4
4	Analyze	long duration voltage variations			L4
5	Analyze	power quality bench marking and monitoring			L4

SYLLABUS:

UNIT I POWER QUALITY ISSUES

Power quality, voltage quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-duration voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

UNIT II VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES

Sources of sags and interruptions, Estimating voltage sag performance, fundamental principles of protection,solutions attheend-uselevel, Motor-startingsags andutilitysystem fault-clearingissues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

UNIT III FUNDAMENTALS OF HARMONICS

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortionevaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

UNITI V LONG-DURATION VOLTAGE VARIATIONS

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation, End user capacitor applications, flicker.

UNIT V POWER QUALITY BENCH MARKING AND MONITORING

Benchmarking process, RMS Voltage variation Indices, Harmonic indices Power Quality Contracts, Monitoring considerations, power quality

measurement equipment, Power quality Monitoring standards.

Textbooks:

1. ElectricalPowerSystemsQualitybyRogerC.Dugan,MarkF.McGranaghan,SuryaSantoso,H.Wayne Beaty, 2nd Edition, TMH Education Pvt. Ltd, 2012
2. PowerqualitybyC.Sankaran,CRCPress,2017

Reference Books:

Electrical systems qualityAssessmentbyJ.Arrillaga, N.R.Watson,S.Chen,JohnWiley&Sons, 2000. 2. Understanding Power quality problems by Math H. J. Bollen, Wiley-IEEE Press, 2000

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	PO 11	PO 12	PSO 1	PSO 2
POWER QUALITY	CO1	2	1							2				1	2
	CO2	3	3							3				3	3
	CO3	3	3							3				3	3
	CO4	3	3							3				3	3
	CO5	2	1							2				1	2

CO			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,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	2 1 2
2	Analyze	L2	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9:Thumb Rule	3 3 3
3	Analyze	L4	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	3 3 3
4	Analyze	L2	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	3 3 3
5	Understand	L2	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	2 1 2

CO1: Understand the power quality issues in connection with standards.

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: Analyze(L4)

CO1 Action Verb is less than PO2 verb by two level; Therefore correlation is low (1).

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

CO2: Analyze the voltage sags and transient over voltages

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: Analyze (L4)

CO2 Action Verb is equal to PO verb; therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO2 level is 4, Using Thumb Rule its correlation is high (3)

CO3: Analyze the harmonic sources and devices for controlling harmonic distortion.

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 Verbs: Analyze (L4)

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

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

CO4: Analyze the long duration voltage variations
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: Analyze (L4)

CO1 Action Verb is less than PO2 verb by teo level; Therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO4 level is 2, Using Thumb Rule its correlation is moderate (2)

CO5: Understand the power quality bench marking and monitoring

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Analyze(L4)

CO5 Action Verb is less than PO2 verb by teo level; Therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO5 level is 2, Using Thumb Rule its correlation is moderate (2)

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is less than to PSO1 verb by two level; Therefore correlation is low (1).

CO2 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

CO3 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

CO4 Action Verb is equal to PSO1verb; Therefore correlation is high (3)

CO5 Action Verb is less than to PSO1 verb by two level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb level is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO2 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO3 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO5 Action Verb level is less than to PSO2 verb by one level; Therefore correlation is moderate (2).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Course Name: ELECTRICAL MEASUREMENTS LAB
Course Code: 20APC0219

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1:-Analyze calibration of various electrical measuring instruments.
CO2:- Evaluate the values of inductance and capacitance using AC bridges.
CO3:- Analyze the coefficient of coupling between two coupled coils.
CO4:- Evaluate the values of very low resistances.
CO5:- Understand the working principles of displacement transducers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	**Analyze**	Calibration Of Various Electrical Measuring Instruments.			L4
CO2	Evaluate	Values Of Inductance And Capacitance Using AC Bridges.			L5
CO3	Analyze	Coefficient Of Coupling Between Two Coupled Coils.			L4
CO4	Evaluate	Values Of Very Low Resistances.			L5
CO5	Understand	Working Principles Of Displacement Transducers.			L2

SYLLABUS:

Thefollowingexperimentsarerequiredtobeconductedascompulsoryexperiments:

1. Calibration and Testing of single-phase energy Meter - (CO1).
2. Calibration of dynamo meter power factor meter - (CO1).
3. Calibration of D.C. Potentiometer: PMMC ammeter and PMMC voltmeter - (CO1).
4. Kelvin's double Bridge- Measurement of low resistance- Determination of Tolerance - (CO4).
5. Determination of Coefficient of coupling between two mutually coupled coils - (CO3).
6. Schering Bridge & Anderson bridge - (CO2).
7. Measurement of 3-phase reactive power with single - phase wattmeter - (CO1).
8. Measurement of parameters of a choke coil using 3 - volt meter and 3-ammeter methods - (CO1).

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Maxwell's bridge and DeSauty bridge - (CO2).
10. Calibration of LPF wattmeter - by Phantom loading - (CO1).
11. Wheatstone bridge- measurement of medium resistances - (CO4).
12. LVDT and capacitance pickup- characteristics and Calibration - (CO5).
13. Resistance strain gauge - strain measurement and Calibration - (CO1).
14. Measurement of Earth Resistance by Megger - (CO1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Reference Books:

1. Patranabis,'SensorsandTransducers',PrenticeHallofIndia,2004
Cooper W.D., "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, New Delhi, 2003. Joseph J Carr, Elements of Electronic Instrumentation & Measurement, Pearson, 3rd Edition 1995.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRICAL MEASUREMENTS LAB	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	1		1					2				1	2

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1,PO2 PO4,PO9	PO1: Apply (L3) PO2: Analyze(L2) PO4:Analyze(L4) PO9:Thumb Rule	3 3 3 3
2	**Evaluate**	L5	PO1,PO2 PO4,PO9	PO1: Apply (L3) PO2: Analyze(L2) PO4:Analyze(L4) PO9:Thumb Rule	3 3 3 3
3	Analyze	L4	PO1,PO2 PO4,PO9	PO1: Apply (L3) PO2: Analyze(L2) PO4:Analyze(L4) PO9:Thumb Rule	3 3 3 3
4	**Evaluate**	L5	PO1,PO2 PO4,PO9	PO1: Apply (L3) PO2: Analyze(L2) PO4:Analyze(L4) PO9:Thumb Rule	3 3 3 3
5	Understand	L2	PO1,PO2 PO4,PO9	PO1: Apply (L3) PO2: Analyze(L2) PO4:Analyze(L4) PO9:Thumb Rule	2 1 1 2

CO1:-Analyze calibration of various electrical measuring instruments.
Action Verb: **Analyze** (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO1 verb ; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO1 Action Verb is equal to PO1 verb ; Therefore correlation is high (3).
CO1 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO2: Evaluate the values of inductance and capacitance using AC bridges
Action Verb: **Evaluate** (L5)
PO1 Verbs: Apply (L3)
CO2 Action Verb is greater than PO1 verb by two level; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO2 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO2 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO3: Analyze the coefficient of coupling between two coupled coils.
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 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO1 verb ; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO1 verb ; Therefore correlation is high (3).
CO3 Action Verb is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO4:- Evaluate the values of very low resistances.
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: Analyze (L4)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO4 Verbs: Analyze (L4)
CO4 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
CO4 Action Verb is of BTL 5. Using Thumb rule, L4 correlates PO6 to PO12 and PSOs as high (3).

CO5:- Understand the working principles of displacement transducers.
Action Verb: **Understand** (L2)
PO1 Verbs: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Analyze (L4)
CO5 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).
PO4 Verbs: Analyze (L4)
CO5 Action Verb is less than to PO1 verb by two level; Therefore correlation is low (1).
CO5 Action Verb is of BTL 2. Using Thumb rule, L5 correlates PO6 to PO12 and PSOs as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO2 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO3 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO1 verb by one level; Therefore correlation is high (3).

CO5 Action Verb is less than to PSO1 verb by two level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb is greater than to PSO1 verb by one level; Therefore correlation is high (3).

CO2 Action Verb is greater than PSO1 verb by two level; Therefore correlation is high (3).

CO3 Action Verb is greater than to PSO1 verb by one level; Therefore correlation is high (3).

CO4 Action Verb is greater than PSO1 verb by two level; Therefore correlation is high (3).

CO5 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / VI
Branch of Study: EEE

Course Name: POWER SYSTEM ANALYIS LAB
Course Code: 20APC0220

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1:- Evaluate sequence impedance and sub transient reactance of synchronous machine, fault currents.
CO2:- Create the equivalent circuit of three winding transformer.
CO3:-Understand MATLAB program for formation of Y and Z buses.
CO4:- Evaluate MATLAB program for Gauss-Seidel and Fast Decouple Load Flow studies.
CO5:- Apply SIMULINK model for single area load frequency problem.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Evaluate	Sequence impedance's, sub transient reactance for synchronous Machine and fault currents.			L5
CO2	Create	Equivalent Circuit of three winding transformer			L6
CO3	Understand	Formation of Ybus & Zbus	By using MATLAB program		L2
CO4	Evaluate	Gauss Seidel & Fast Decoupled Load flow studies.	By Using MATLAB		L5
CO5	Apply	Model for single area load frequency problem.	By Using Simulink		L3

SYLLABUS:

List of Experiments

Conduct any 8 experiments (4 from S.Nos.1 to 7 & 4 from Sl.Nos.8 to 12)

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.(CO1)
2. LG Fault Analysis on an un loaded alternator.(CO1)
3. LL Fault Analysis on conventional phases.(CO1)
4. LLG Fault Analysis.(CO1)
5. LLLG Fault Analysis.(CO1)
6. Determination of Sub transient reactance of silent pole synchronous machine(CO1)
7. Equivalent circuit of three winding transformer.(CO2)
8. Y_{Bus} formation using MATLAB.(CO3)
9. Z_{Bus} formation using MATLAB.(CO3)
10. Gauss-Seidel load flow analysis using MATLAB.(CO4)
11. Fast decoupled load flow analysis using MATLAB.(CO4)
12. Develop a Simulink model for a single area load frequency problem and simulate the same.(CO5)

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Program: B. Tech Regulation: AK20 Year/Semester: III / VI
Branch of Study: EEE

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
POWER SYSTEM ANALYSIS LAB	CO1	1	2							3				3	
	CO2	1	3							3				3	
	CO3	2	2			2				3				3	
	CO4	1	2			1				3				3	
	CO5	3	3			3				3				3	

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Evaluate	L5	PO1, PO2. PO9	PO1:Apply (L3) PO2:Formulate(L6) PO9: Thumb Rule	1 2 3
2	Create	L6	PO1, PO2. PO9	PO1:Apply (L3) PO2:Formulate(L6) PO9: Thumb Rule	1 3 3
3	Understand	L2	PO1, PO2. PO5, PO9	PO1:Apply (L3) PO2:Identify (L3) PO5: Apply (L3) PO9: Thumb Rule	2 2 2 3
4	Evaluate	L5	PO1, PO2. PO5, PO9	PO1:Apply (L3) PO2:Formulate(L6) PO5: Apply (L3) PO9: Thumb Rule	1 2 1 3
5	Apply	L3	PO1, PO2. PO5, PO9	PO1:Apply (L3) PO2:Identify (L3) PO5: Apply (L3) PO9: Thumb Rule	3 3 3 3

CO1:- Evaluate sequence impedance and sub transient reactance of synchronous machine, fault currents.

Action Verb: Evaluate (L5)

PO1: Apply (L3)

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

PO2: Formulate (L6)

CO1 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).

PO9: Using Thumb Rule, CO1 Correlated to PO9 as high (3)

CO2:- Create the equivalent circuit of three winding transformer.
Action Verb: Create (L6)
PO1: Apply (L3)
CO2 Action Verb is Greater than PO1 verb by two level; Therefore correlation is low (1).
PO2: Formulate (L6)
CO2: Action Verb is same PO2 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO2 Correlated to PO9 as high (3)

CO3:-Understand MATLAB program for formation of Y and Z buses.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action Verb is Less than PO1 verb by one level; Therefore correlation is low (2).
PO2: Identify (L3)
CO3 Action Verb is Less than PO2 verb by one level; Therefore correlation is low (2).
PO5: Apply (L3)
CO3 Action Verb is Less than PO5 verb by one level; Therefore correlation is low (2).
PO9: Using Thumb Rule, CO3 Correlated to PO9 as high (3)

CO4:- Evaluate MATLAB program for Gauss-Seidel and Fast Decouple Load Flow studies.
Action Verb: Evaluate (L5)
PO1: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by two level; Therefore correlation is low (1).
PO2: Formulate (L6)
CO4 Action Verb is Less than PO2 verb by one level; Therefore correlation is moderate (2).
PO5: Apply (L3)
CO4 Action Verb is Greater than PO5 verb by two level; Therefore correlation is low (1).
PO9: Using Thumb Rule, CO4 Correlated to PO9 as high (3)

CO5:- Apply SIMULINK model for single area load frequency problem.
Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action Verb is same PO1 verb; Therefore correlation is high (3).
PO2: Identify (L3)
CO5 Action Verb is same PO2 verb; Therefore correlation is high (3).
PO5: Apply (L3)
CO5 Action Verb is same PO5 verb; Therefore correlation is high (3).
PO9: Using Thumb Rule, CO5 Correlated to PO9 as high (3)

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Course Name: SWITCH GEAR AND PROTECTION LAB
Course Code: 20APC0221

L	T	P	Credits
0	0	3	1.5

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1:- Understand the operation and characteristics of switch gear used in protection of power systems.
CO2:- Analyze the over voltage and over current relays.
CO3:- Evaluate the ABCD parameters of Transmission lines.
CO4:- Analyze the protection of parallel, radial feeders and over voltage induction relay.
CO5:- Analyze the functioning of various protection schemes using MATLAB.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The operation and characteristics of switch gear used in protection of power systems.			L2
CO2	Analyze	The over voltage and over current relays.			L4
CO3	Evaluate	The ABCD parameters of Transmission lines.			L5
CO4	Analyze	The protection of parallel, radial feeders and over voltage induction relay.			L4
CO5	Analyze	The functioning of various protection schemes.	Using MATLAB		L4

SYLLABUS:

Conduct any 10 from the following:

1. Study the characteristics of miniature circuit breaker-(CO1).
2. Study the characteristics of fuse and thermal overload protection-(CO1).
3. Study the operation and characteristics of over voltage, over current relays-(CO2).
4. Obtain the ABCD parameters of a given power system-(CO3).
5. Modeling of Differential Relay using MATLAB-(CO5).
6. Radial Feeder Protections-(CO4).
7. Parallel Feeder Protections-(CO4).
8. Principle of Reverse Power Protection-(CO2).
9. Differential Protection of Transformer-(CO5).
10. To the study time Vs voltage characteristics of over voltage induction relay-(CO4).
11. Characteristics of single, combined and lightning earth pits-(CO1).
12. Study of efficiency and regulation of a transmission line-(CO5).
13. Study of string efficiency of insulators-(CO5).

TEXT BOOKS:

1. A.G. Phadkeand J.S.Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press, 2009.
2. A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press, 1999

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: III / VI
Branch of Study: EEE

REFERENCE BOOKS:

1. Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006 S.R. Bhide "Digital Power System Protection" PHI Learning Pvt. Ltd. 2014.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
SWITCHGEAR AND PROTECTION LAB	CO1	2			1		1							2	
	CO2				3		1							2	
	CO3				3		1							2	
	CO4				3		1							2	
	CO5				3	3	1							2	1

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Understand	L2	PO1, PO4, PO6	PO1:Apply(L3) PO4:Analyze(L4) PO6: Thumb Rule	2 1 1
2	Analyze	L4	PO4, PO6	PO4:Analyze(L4) PO6: Thumb Rule	3 1
3	Evaluate	L5	PO4, PO6	PO4:Analyze(L4) PO6: Thumb Rule	3 1
4	Analyze	L4	PO4, PO6	PO4:Analyze(L4) PO6: Thumb Rule	3 1
5	Analyze	L4	PO4, PO5, PO6	PO4:Analyze(L4) PO5: Apply(L3) PO6: Thumb Rule	3 3 1

CO1:- Understand the operation and characteristics of switch gear used in protection of power systems.

Action Verb: Understand (L2)

PO1: Apply (L3)

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

PO4: Analyze (L4)

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

PO6: Using thumb rule CO1 is correlates with PO6 is low (1).

CO2:- Analyze the over voltage and over current relays.

Action Verb: Analyze (L4)

PO4: Analyze (L4)

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

PO6: Using thumb rule CO2 is correlates with PO6 is low (1).

CO3:- Evaluate the ABCD parameters of Transmission lines.

Action Verb: Evaluate (L5)

PO4: Analyze (L4)
CO3 Action Verb is greater than PO4 verb by one level; therefore correlation is high (3).
PO6: Using thumb rule CO3 is correlates with PO6 is low (1).

CO4:- Analyze the protection of parallel, radial feeders and over voltage induction relay.

Action Verb: Analyze (L4)
PO4: Analyze (L4)
CO4 Action Verb is equal to PO4 verb; therefore correlation is high (3).
PO6: Using thumb rule CO4 is correlates with PO6 is low (1).

CO5:- Analyze the functioning of various protection schemes using MATLAB.

Action Verb: Analyze (L4)
PO4: Analyze (L4)
CO5 Action Verb is equal to PO4 verb; therefore correlation is high (3).
PO5: Apply (L3)
CO5 Action Verb is greater than PO5 verb by one level; therefore correlation is high (3).
PO6: Using thumb rule CO5 is correlates with PO6 is low (1).

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

Program: B. Tech **Regulation: AK20** **Year/Semester: III / VI**
Branch of Study: EEE

Course Name: NUMERICAL TECHNIQUES USING MATLAB
Course Code: 20ASC0203

L	T	P	Credits
1	0	2	2

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1:- Understand the fundamental computer programming concepts used for numerical analysis in MATLAB.
CO2:- Analyze linear equations, difference equations and differential equations using MATLAB.
CO3:- Evaluate the roots for polynomials.
CO4:- Evaluate the polynomials using Euler, Runge-Kutta and LSC fitting methods.
CO5:- Analyze the time response of an RLC circuit using MATLAB.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	Fundamental Computer Programming Concepts Used For Numerical Analysis.			L2
CO2	Analyze	Linear Equations, Difference Equations And Differential Equations.	Using in MATLAB		L4
CO3	Evaluate	Roots For Polynomials.			L5
CO4	Evaluate	Polynomials Using Euler, Runge-Kutta And LSC Fitting Methods.			L5
CO5	Analyze	Time Response Of An RLC Circuit.	Using in MATLAB		L4

SYLLABUS:

LIST OF EXPERIMENTS:

1. Study of Introduction to numerical techniques. (CO1)
2. Study of basic matrix operations. (CO1)
3. Solve linear equation using MATLAB. (CO2)
4. Solution of Linear equations for Underdetermined and Overdetermined cases. (CO2)
5. Determination of Eigen values and Eigen vectors of a square matrix. (CO2)
6. Solution of Difference Equations. (CO2)
7. Solution of Difference Equations using Euler Method. (CO4)
8. Solution of differential equation using 4th order Runge- Kutta method. (CO4)
9. Determination of roots of a polynomial. (CO3)
10. Determination of polynomial using method of Least Square Curve Fitting. (CO4)
11. Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data. (CO4)
12. Determination of time response of an R-L-C circuit. (CO5)

Text Books:

1. Grewal, B.S., and Grewal, J.S., Numerical Methods in Engineering and Science, Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., Miller and Freundâ Probability and Statistics for Engineers, Pearson Education, Asia, 8th Edition, 2015.

References:

1. Burden, R.L and Faires, J.D, Numerical Analysis, 9th Edition, Cengage Learning, 2016.
2. Gerald. C.F. and Wheatley. P.O. Applied Numerical Analysis Pearson Education, Asia, New Delhi, 7th Edition, 2007.
3. Gupta S.C. and Kapoor V. K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 12th Edition, 2020.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
NUMERICAL TECHNIQUES USING MATLAB	CO1	2			1	2							1	1	
	CO2				3	3							**1**	3	1
	CO3				3	3							**1**	3	2
	CO4				3	3							**1**	3	2
	CO5				3	3							**1**	3	1

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Understand	L2	PO1, PO4, PO5, PO12	PO1:Apply(L3) PO4:Analyze(L4) PO5: Apply(L3) PO12: Thumb Rule	2 1 2 1
2	Analyze	L4	PO4, PO5, PO12	PO4: Analyze(L4) PO5: Apply(L3) PO12: Thumb Rule	3 3 1
3	Evaluate	L5	PO4, PO5, PO12	PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb Rule	3 3 1
4	Evaluate	L5	PO4, PO5,	PO4: Analyze (L4) PO5: Apply(L3)	3 3

			PO12	PO12: Thumb Rule	1
5	Analyze	L4	PO4, PO5, PO12	PO4: Analyze (L4) PO5: Apply(L3) PO12: Thumb Rule	3 3 1

CO1:- Understand the fundamental computer programming concepts used for numerical analysis in MATLAB.

Action Verb: Understand (L2)

PO1: Apply (L3)

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

PO4: Analyze (L4)

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

PO5: Apply (L3)

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

PO12: Using thumb rule CO1 correlates with PO12 is low (1).

CO2:- Analyze linear equations, difference equations and differential equations using MATLAB.

Action Verb: Analyze (L4)

PO4: Analyze (L4)

CO2 Action Verb is same as PO4 verb; therefore correlation is High (3).

PO5: Apply (L3)

CO2 Action Verb is greater than PO5 verb by one level; Therefore correlation is moderate (3).

PO12: Using thumb rule CO2 correlates with PO12 is low (1).

CO3:- Evaluate the roots for polynomials.

Action Verb: Evaluate (L5)

PO4: Analyze (L4)

CO3 Action Verb is greater than PO4 verb by one level; therefore correlation is High (3).

PO5: Apply (L3)

CO3 Action Verb is greater than PO5 verb by two level; Therefore correlation is moderate (3).

PO12: Using thumb rule CO3 correlates with PO12 is low (1).

CO4:- Evaluate the polynomials using Euler, Runge-Kutta and LSC fitting methods.

Action Verb: Evaluate (L5)

PO4: Analyze (L4)

CO4 Action Verb is greater than PO4 verb by one level; therefore correlation is High (3).

PO5: Apply (L3)

CO4 Action Verb is greater than PO5 verb by two level; Therefore correlation is moderate (3).

PO12: Using thumb rule CO4 correlates with PO12 is low (1).

CO5:- Analyze the time response of an RLC circuit using MATLAB.

Action Verb: Analyze (L4)

PO4: Analyze (L4)

CO5 Action Verb is same as PO4; therefore correlation is High (3).

PO5: Apply (L3)

CO5 Action Verb is greater than PO5 verb by one level; Therefore correlation is moderate (3).

PO12: Using thumb rule CO5 correlates with PO12 is low (1).

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

Subject Code	Subject Name	L	T	P	Credits
20AMC9904	**PROFESSIONAL ETHICS AND HUMAN VALUES**	3	0	0	0

Course Outcomes (CO): After studying of the course, Student will be able to

CO1. Understand the sustained happiness through identifying the essentials of human values and skills.

CO2. Understand the importance of Values and Ethics in their personal lives and professional careers.

CO3. Understand the rights and responsibilities as an employee, team member and a global citizen.

CO4. Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.

CO5. Understand appropriate technologies and management patterns to create harmony in professional and personal life.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**Understand**	the sustained happiness	through identifying the essentials of human values and skills		**L2**
2	**Understand**	the importance of Values and Ethics		in their personal lives and professional careers.	**L2**
3	**Understand**	the rights and responsibilities	as an employee, team member and a global citizen.		**L2**
4	**Understand**	the importance of trust, mutually satisfying human behavior and enriching interaction with nature.			**L2**
5	**Understand**	appropriate technologies and management patterns		to create harmony in professional and personal life.	**L2**

Mapping of COs to POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												2
2								2	2			
3						2			2			
4						2		2				
5					1		2					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)**
	Lesson Plan (Hrs)	**%**	**corr**	**Verb**	**BTL**			
1	**8**	27	2	**Understand**	**L2**	PO12	Thumb Rule	2

2	**8**	26	2	**Understand**	**L2**	PO8, PO9	Thumb Rule Thumb Rule	2 2
3	**4**	13	**2**	**Understand**	**L2**	PO6, PO9	Thumb Rule Thumb Rule	2 2
4	**5**	17	**2**	**Understand**	**L2**	PO6, PO8	Thumb Rule Thumb Rule	2 2
5	**5**	17	**2**	**Understand**	**L2**	PO5, PO7, PO12	PO5 : APPLY Thumb Rule Thumb Rule	1 2 2

CO1: Understand sustained happiness through identifying the essentials of human values and skills.
Action Verb: Understand (L2)
CO1 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO2: Understand the importance of Values and Ethics in their personal lives and professional careers.
Action Verb: Understand (L2)
CO2 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO3: Understand the rights and responsibilities as an employee, team member and a global citizen.
Action Verb: Understand (L2)
CO3 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO4: Understand the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
Action Verb: Understand (L2)
CO4 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO5: Understand appropriate technologies and management patterns to create harmony in professional and personal life.
Action Verb: Understand (L2)
CO5 Action Verb is understand of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).
CO5 Action Verb is understand of BTL 2. Using action verb apply, L2 correlates PO5 as low (1).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

Course Name: FLEXIBLE AC TRANSMISSION SYSTEMS
Course Code: 20APE0204

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1: Understand the basic types of FACTS devices.
CO2: Analyze voltage and current sourced converters.
CO3: Analyze the operation of shunt FACTS devices.
CO4: Analyze the operation of series FACTS devices.
CO5: Understand the operation of different power types of flow controllers.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
1	Understand	Basic Types of FACTS devices.			L2
2	Analyze	Voltage and Current Sourced Converters			L4
3	Analyze	Shunt FACTS devices.			L4
4	Analyze	Series FACTS devices.			L4
5	Understand	Different Power Flow Controllers.			L2

SYLLABUS:

UNIT-I: CONCEPTS OF FLEXIBLE AC TRANSMISSIONSYSTEMS

Transmission line Interconnections, Power flow in parallel lines, Mesh systems, Stability considerations, Relative importance of controllable parameters, Basic types of FACTS controllers, Shunt controllers, Series controllers, Combined shunt and series controllers, Benefits of FACTS.

UNIT-II: VOLTAGE AND CURRENT SOURCED CONVERTERS

Single Phase Full Wave Bridge Converter, Three Phase Full Wave Bridge Converter, Transformer Connections for 12-Pulse Operation, 24 and 48-Pulse Operation, Three Level Voltage Sourced Converter, Pulse Width Modulation (PWM) Converter, Converter Rating, Concept of Current Sourced Converters, Thyristor based converters, Current Sourced Converter with Turn off Devices, Comparison of Current Sourced and Voltage Sourced Converters.

UNIT-III: STATIC SHUNT COMPENSATORS

Objectives of Shunt Compensation, Midpoint Voltage Regulation for Line Segmentation, End of Line VoltageSupporttoPreventVoltageInstability,ImprovementofTransientStability, Power Oscillation Damping, Methods of Controllable VAR Generation, Variable Impedance Type Static VAR Generators, Switching Converter Type VAR Generators, Hybrid VAR Generators, SVC and STATCOM, Transient Stability Enhancement and Power Oscillation Damping, Comparison Between STATCOM and SVC, V-I, V-Q Characteristics, Response Time.

UNIT-IV: STATIC SERIES COMPENSATORS

Objectives of Series Compensation, Voltage Stability, Improvement of Transient Stability, Power Oscillation Damping, Sub-synchronous Oscillation Damping, Variable Impedance Type Series Compensators, GTO Thyristor Controlled Type Series Capacitor (GCSC), Thyristor Switched

Series Capacitor (TSSC), Thyristor-Controlled Series Capacitor(TCSC), Basic Operating Control Schemes for GCSC, TSSC, and TCSC, Switching Converter Type Series Compensators, The Static SynchronousSeriesCapacitor(SSSC),TransmittedPowerVersusTransmissionAngleCharacteristic, ControlRange and VA Rating, Capability to Provide Real Power Compensation.

UNIT-V: POWER FLOW CONTROLLERS

The Unified Power Flow Controller-Basic Operating Principles, Conventional Transmission Control Capabilities, Independent Real and Reactive Power Flow Control. Control Structure, Basic Control System for P and Q Control, Dynamic Performance, the Interline Power Flow Controller(IPFC), Basic Operating Principles and Characteristics, Generalized and Multifunctional FACTS Controllers.

TEXTBOOKS:

1. UnderstandingFACTS–
ConceptsandtechnologyofFlexibleACTransmissionsystems,NarainG. Hingorani,
Laszlo Gyugyi, IEEE Press, WILEY, 1st Edition, 2000, Reprint 2015.
2. FACTSControllersinPowerTransmissionandDistribution,PadiyarK.R.,NewAgeInte
rnational Publishers, 1st Edition, 2007.

REFERENCEBOOKS:

1. Flexible AC Transmission Systems: Modelling and Control, Xiao –Ping Zhang, Christian Rehtanz, Bikash Pal, Springer, 2012, First Indian Reprint, 2015.
2. FACTS–Modelling and Simulation in Power Networks, Enrigue Acha, Claudio R.Fuerte –Esquival, Huge Ambriz – perez, Cesar Angeles – Camacho, WILEY India Private Ltd., 2004, Reprint 2012.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme SpecificOutcomes (PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
FACTS	CO1	2	1							2				1	2
	CO2	3	3							3				3	3
	CO3	3	3							3				3	3
	CO4	3	3							3				3	3
	CO5	2	1							2				1	2

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Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

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	**15**	19.73	2	Understand	**L2**	PO1, PO2, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	2 1 2
2	**18**	23.68	3	Analyze	**L4**	PO1, PO2, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	3 3 3
3	**15**	**19.73**	**2**	Analyze	**L4**	PO1, PO2, PO9	PO1: Apply (L3) PO2: Anlyse(L4) PO9: Thumb Rule	3 **3** **3**
4	**18**	**23.68**	**3**	Analyze	**L4**	PO1, PO2, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	3 **3** **3**
5	**10**	**13.15**	**2**	Understand	**L2**	PO1, PO2, PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	2 1 2
	76							

CO1: Understand the Basic Types of FACTS devices.
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: Analyze (L4)
CO1 Action Verb is less than PO verb by two levels; therefore correlation is low (1).
Student in CLC Activities: CO1 Action Verb is Understand (L2), so based on thumb rule its correlation is moderate (2)

CO2: Analyze Voltage and Current Sourced Converters.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO1 Action Verb is Greater than PO1 verb by one level; Therefore correlation is High (3).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is same PO2 verb; therefore correlation is high (3).
Student in CLC Activities: CO2 Action Verb is Analyze (L4), So based on thumb rule it's correlation is high (3)

CO3: Analyze the Shunt FACTS devices.
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 Verbs: Analyze (L4)

CO3 Action Verb is same PO2 verb; therefore correlation is high (3).
Student in CLC Activities: CO3 Action Verb is Analyze (L4), So based on thumb rule it's correlation is high (3)

CO4: Analyze the Series FACTS devices.
Action Verb: Analyze (L4)
PO1 Verbs: Apply (L3)
CO4 Action Verb is Greater than PO1 verb by one level; Therefore correlation is High (3).
PO2 Verbs: Analyze (L4)
CO4 Action Verb is same PO2 verb; therefore correlation is high (3).
Student in CLC Activities: CO4 Action Verb is Analyze (L4), So based on thumb rule it's correlation is high (3)

CO5: Understand the different power flow controllers.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Analyze (L4)
CO5 Action Verb is less than PO verb by two levels; therefore correlation is low (1).
Student in CLC Activities: CO5 Action Verb is Understand (L2), So based on thumb rule it's correlation is moderate (2)

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb level is less than to PSO1 verb by tow level; Therefore correlation is low (1).

CO2 Action Verb level is greater than to PSO1verb; Therefore correlation is high (3).

CO3 Action Verb level is greater than to PSO1verb; Therefore correlation is high (3).

CO4 Action Verb level is greater than to PSO1verb; Therefore correlation is high (3).

CO5 Action Verb level is less than to PSO1 verb by tow level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb level is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO2 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO3 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO5 Action Verb level is less than to PSO2 verb by one level; Therefore correlation is moderate (2).

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Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: IV / VII**
Branch of Study: EEE

Course Name: ADVANCED CONTROL SYSTEMS
Course Code: 20APE0207

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1: Analyze system stability using sate variable analysis.
CO2: Design state observers and servo systems with integral control.
CO3: Apply Z transforms for stability analysis of systems.
CO4: Understand the fundamental analysis of nonlinear systems.
CO5: Understand the optimal estimator including Kalman filter.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	System stability using sate variable analysis.			L4
CO2	Design	State observers and servo systems with integral control.			L6
CO3	Apply	Z transforms for stability analysis of systems.			L3
CO4	Understand	The fundamental analysis of nonlinear systems.			L2
CO5	Understand	The optimal estimator including kalman filter.			L2

SYLLABUS:

UNIT I STATE VARIABLE ANALYSIS
Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations- Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN
Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS
Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS

Introduction, common physical nonlinearities, The phase plane method: concepts, singular points, stability of non-linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL

Introduction: Classical control and optimization, formulation of optimal control problem, typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

TEXT BOOKS:

1. M.Gopal, "Digital Control and State Variable Methods", 4th edition, Mc Graw Hill India, 2012
2. K. Ogata, 'Modern Control Engineering', 5th Edition, Pearson, 2012.
3. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.

REFERENCES:

1. M.Gopal, Modern Control System Theory, 3rd edition, New Age International Publishers, 2014.
2. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
3. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
4. T. Glad and L. Ljung,, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis,
2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

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	PO12	PSO1	PSO2
ADVANCE CONTROL SYSTEMS	CO1	3	3	1		3							3	3	1
	CO2	3	3	3		3							3	3	1
	CO3	3	3	1		3							3	3	1
	CO4	2	1	2		1							1	1	
	CO5	2	1											1	

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Branch of Study: EEE

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO2 , PO3, PO5, PO12	PO1:Apply(L3) PO2:Analyze(L4) PO3: Design (L6) PO5: Apply (L3) PO12:Thumb Rule	3 3 1 3 3
2	Design	L6	PO1, PO2 , PO3, PO5, PO12	PO1:Apply(L3) PO2:Analyze(L4) PO3: Design (L6) PO5: Apply (L3) PO12:Thumb Rule	3 3 3 3 3
3	Apply	L3	PO1, PO2 , PO3, PO5, PO12	PO1:Apply(L3) PO2:Analyze(L4) PO3: Design (L6) PO5: Apply (L3) PO12:Thumb Rule	3 3 1 3 3
4	Understand	L2	PO1, PO2, PO5, PO12	PO1:Apply(L3) PO2:Analyze(L4) PO5: Apply (L3) PO12: Thumb Rule	2 1 2 1
5	Understand	L2	PO1, PO2	PO1:Apply(L3) PO2:Analyze(L4)	2 1

CO1: Analyze system stability using sate variable analysis.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2: Analyze (L4)

CO1 Action Verb is same as PO2 verb; therefore correlation is high (3).

PO3: Design (L6)

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

PO5: Apply (L3)

CO1 Action Verb is greater than PO5 verb by one level; Therefore correlation is high (3).

PO12: Using Thumb Rule, CO1 Correlated to PO12 as high(3).

CO2: Design state observers and servo systems with integral control.

Action Verb: Design (L6)

PO1: Apply (L3)

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

PO2: Analyze (L4)

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

PO3: Design (L6)

CO2 Action Verb is same as PO3 verb; therefore correlation is high (3).

PO5: Apply (L3)

CO2 Action Verb is greater than PO5 verb by three level; Therefore correlation is high (3).
PO12: Using Thumb Rule, CO1 Correlated to PO12 as high(3).

CO3: Apply Z transforms for stability analysis of systems.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO3 Action Verb is same as PO1 verb; therefore correlation is high (3).
PO2: Analyze (L4)
CO3 Action Verb is less than PO2 verb by one level; Therefore correlation is moderate (2).
PO3: Design (L6)
CO3 Action Verb is same as PO3 verb; therefore correlation is high (3).
PO5: Apply (L3)
CO3 Action Verb is same as PO5 verb; therefore correlation is high (3).
PO12: Using Thumb Rule, CO1 Correlated to PO12 as high (3).

CO4: Understand the fundamental analysis of nonlinear systems.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO4 Action Verb is less than PO1 verb by one level; therefore correlation is moderate (2).
PO2: Analyze (L4)
CO4 Action Verb is less than PO2 verb by two level; therefore correlation is low (1).
PO5: Apply (3)
CO4 Action Verb is less than PO5 verb by one level; therefore correlation is moderate (2).
PO12: Using Thumb Rule, CO1 Correlated to PO12 as low (1).

CO5: Understand the optimal estimator including Kalman filter.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; therefore correlation is moderate (2).
PO2: Analyze (L4)
CO5 Action Verb is less than PO2 verb by two level; therefore correlation is low (1).

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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

Course Name: POWER SYSTEM OPERATION AND CONTROL
Course Code: 20APE0208

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1: Understand the concept of economic scheduling of power systems.
CO2: Analyze the coordination in hydro-thermal system and optimal power flow.
CO3: Understand automatic generation control of power plants of a power system.
CO4: Apply the compensation methods to control the reactive power.
CO5: Develop the techniques to find market power and transfer capabilities in power system deregulation.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	The concept of economic scheduling of power systems.			L2
CO2	Analyze	Co-ordination of hydro thermal power plants and optimal power flow problem			L4
CO3	Understand	Automatic generation control of power plants of a power system			L2
CO4	Apply	The compensation methods to control the reactive power.			L3
CO5	Develop	The techniques to find market power and transfer capabilities in power system deregulation.			L6

SYLLABUS:

UNIT-I: ECONOMIC OPERATION OF POWER SYSTEMS
Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems.

UNIT-II: HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW
Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling. Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems.

UNIT-III: AUTOMATIC GENERATION CONTROL
Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control

area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples.

UNIT-IV: REACTIVE POWER CONTROL

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems.

UNIT-V: OPERATION OF MODERN POWER SYSTEMS

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems..

TEXT BOOKS:

1. Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation and Control", 2nd edition,
John Wiley & Sons, Inc., New York, 1996.
2. D P Kothari and I J Nagrath, "Power System Engineering", McGraw
Hill Education India Pvt. Limited, Chennai, 3e, 2019.

REFERENCES:

1. Olle I. Elgerd, "Electric Energy Systems Theory: An Introduction", TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.
2. T J E Miller, "Reactive Power Control in Electric Systems", John Wiley & Sons, New York, 1982.

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes(POs) & Programme Specific Outcomes(PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
POWER SYSTEM OPERATION AND CONTROL	CO1	2	1					1						3	
	CO2	3	3					1						3	
	CO3	2	1					1						3	
	CO4	3	2					1						3	
	CO5	3	3					1						3	1

Justification Table:

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

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

					(0-3)
	Verb	**BTL**			
1	Understand	L2	PO1, PO2 , PO7	PO1:Apply(L3) PO2:Analyze(L4) PO7: Thumb Rule	2 1 1
2	Analyze	L4	PO1, PO2 , PO7	PO1:Apply(L3) PO2:Analyze(L4) PO7: Thumb Rule	3 3 1
3	Understand	L2	PO1, PO2 , PO7	PO1:Apply(L3) PO2:Analyze(L4) PO7: Thumb Rule	2 1 1
4	Apply	L3	PO1, PO2 , PO7	PO1:Apply(L3) PO2:Analyze(L4) PO7: Thumb Rule	3 2 1
5	Develop	L6	PO1, PO2 , PO7	PO1:Apply(L3) PO2:Analyze(L4) PO7: Thumb Rule	3 3 1

CO1: Understand the concept of economic scheduling of power systems.

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 levels; therefore correlation is low (1).

PO7: Using thumb rule CO1 is correlates with PO7 is low (1).

CO2: Analyze the coordination in hydro-thermal system and optimal power flow.

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 equal to PO2 verb; therefore correlation is high (3).

PO7: Using thumb rule CO2 is correlates with PO7 is low (1).

CO3: Understand automatic generation control of power plants of a power system.

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 levels; therefore correlation is low (1).

PO7: Using thumb rule CO3 is correlates with PO7 is low (1).

CO4: Apply the compensation methods to control the reactive power.

Action Verb: Apply (L3)

PO1: Apply (L3)
CO4 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2: Analyze (L4)
CO4 Action Verb is less than PO2 verb by one level; therefore correlation is moderate (2).
PO7: Using thumb rule CO4 is correlates with PO7 is low (1).

CO5: Develop the techniques to find market power and transfer capabilities in power system deregulation.

Action Verb: Develop (L6)
PO1: Apply (L3)
CO5 Action Verb is greater than PO1 verb by three levels; Therefore correlation is high (3).
PO2: Analyze (L4)
CO5 Action Verb is greater than PO2 verb by two levels; therefore correlation is high (3).
PO7: Using thumb rule CO5 is correlates with PO7 is low (1).

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Branch of Study: EEE

Course Name: NEURAL NETWORKS AND FUZZY LOGIC
Course Code: 20APE0203

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1: Understand the evolution and basic architecture of artificial neural networks.
CO2: Analyze various learning process of Artificial Neural Networks.
CO3: Analyze various learning rules used to train neural networks to produce desired results.
CO4: Understand basic fuzzy logic operations and properties.
CO5: Apply fuzzy logic control operations to real world applications.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Understand	the evolution and basic architecture of artificial neural networks			L2
CO2	Analyze	various learning process of Artificial Neural Networks			L4
CO3	Analyze	various learning rules used to train neural networks to produce desired results			L4
CO4	Understand	Basic Fuzzy Logic Operations and properties			L2
CO5	Apply	fuzzy logic control operations	to real world applications		L3

SYLLABUS:

UNIT–IARTIFICIALNEURAL NETWORKS
Approaches to AI – Architectures of AI – Symbolic Reasoning System – Rule based Systems–Knowledge Representation–Expert Systems. Introduction and motivation: Neural Network, Human Brain, Structure of biological neuron, Memory, Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies, Artificial Intelligence and Neural Networks.

UNIT–II LEARNING PROCESS
Layers, activation functions, learning methods: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Memory, Adaption, Back Propagation and Differentiation, Supervised Learning, unsupervised learning.

UNIT–III NETWORKS
Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules – ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks –

Associative Memories - Self-Organization Map – Hopfield models – ART networks.

UNIT–IV UNIT–IV FUZZY LOGIC

ClassicalSets–FuzzySets–FuzzyPropertiesandOperations–FuzzyLogicSystem – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT–V FUZZY LOGIC APPLICATIONS

Fuzzy pattern recognition – Fuzzy control system – Aircraft landing control problem - Statistical process control- Fuzzy cognitive mapping – Probability measures – Possibility and necessity measures.

TEXT BOOKS:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Neural Networks using MATLAB", McGraw Hill Edition, 2006.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY india Edition, 2012.

REFERENCEBOOKS:

1. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using
2. MATLAB", Springer International Edition, 2013.
3. Laurene V. Fausett "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" United States Edition.
4. Yung C. Shin and Chengying Xu, "Intelligent System – Modeling, Optimization & Control, CRC Press, 2009.

Mappingofcourseoutcomeswithprogramoutcomes

CourseTitle	COs	ProgrammeOutcomes(POs)&ProgrammeSpecificOutcomes(PSOs)												
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
NEURAL NETWORKS AND FUZZY LOGIC	CO1	2	1							2				1	2
	CO2	3	3	3		3				3				3	3
	CO3	3	3	3		3				3				3	3
	CO4	2	1							2				1	2
	CO5	3	2	3		3				2				2	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	**12**	18.18	2	**Understand**	**L2**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Identify(L3) PO9: Thumb Rule	2 2 2
2	**12**	18.18	2	**Analyze**	**L4**	PO1, PO2,PO3, PO5,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO3: Develop(L3) PO5: Apply(L3) PO9: Thumb Rule	3 3 3 3 3
3	**11**	**16.66**	**2**	**Analyze**	**L4**	PO1, PO2,PO3, PO5,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO3: Develop(L3) PO5: Apply(L3) PO9: Thumb Rule	3 3 3 3 3
4	**11**	**16.66**	**2**	**Understand**	**L2**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Identify (L3) PO9: Thumb Rule	2 1 2
5	**10**	**15.15**	**2**	**Apply**	**L3**	PO1, PO2,PO3, PO5,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO3: Develop(L3) PO5: Apply(L3) PO9: Thumb Rule	3 2 3 3 2
	66							

CO1: Understand the evolution, basic architecture of artificial neural networks.
Action Verb: Understand (L2)
PO1 Verbs: Apply (L3)
CO1 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO2 Verbs: Analyze (L4)
CO1 Action Verb is less than PO verb by one level; therefore correlation is moderate (1).
Based on thumb rule, Students' participate in CLC Activities, CO Action verb is 2. So, its moderate (2)

CO2: Analyze various learning process of Artificial Neural Networks
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: Analyze (L4)
CO2 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO3 Verbs: Develop (L3)
CO2 Action Verb is greater than PO3 verb by one level; Therefore correlation is moderate high(3).
PO5 Verbs: Apply (L3)
CO2 Action Verb is one level greater than to PO2 verb; Therefore correlation is high (3).
Based on thumb rule, Students' participate in CLC Activities, CO Action verb is 4. So, its high (3)

CO3: Analyze various learning rules used to train neural networks to produce desired results.

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 Verbs: Analyze (L4)
CO3 Action Verb is equal to PO2 verb; Therefore correlation is high (3).
PO3 Verbs: Develop (L3)
CO3 Action Verb is greater than PO3 verb by one level; Therefore correlation is moderate high(3).
PO5 Verbs: Apply (L3)
CO3 Action Verb is one level greater than to PO2 verb; Therefore correlation is high (3).
Based on thumb rule, Students' participate in CLC Activities, CO Action verb is 4. So, its high (3)

CO4: Understand basic fuzzy logic operations.

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: Analyze (L4)
CO4 Action Verb is less than PO verb by two level; therefore correlation is low (1).
Based on thumb rule, Students' participate in CLC Activities, CO Action verb is 2. So, its moderate (2)

CO 5: Apply fuzzy logic control operations to real world applications.

Action Verb: Apply (L3)
PO1 Verbs: Apply (L3)
CO5 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO2 Verbs: Analyze (L4)
CO5 Action Verb is less than PO2 verb by one level; therefore correlation is moderate (2).
PO3 Verbs: Develop (L3)
CO5 Action Verb is equal to PO3 verb; Therefore correlation is moderate high(3).
PO5 Verbs: Apply (L3)
CO5 Action Verb is equal to PO5 verb; therefore correlation is high (3).
Based on thumb rule, Students' participate in CLC Activities, CO Action verb is 3. So, its moderate (2)

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb level is less than to PSO1 verb by two level; Therefore correlation is low (1).

CO2 Action Verb level equal to PSO1verb; Therefore correlation is high (3).

CO3 Action Verb level is equal to PSO1verb; Therefore correlation is high (3).

CO4 Action Verb level is less than to PSO1 verb by two level; Therefore correlation is low (1).

CO5 Action Verb level is less than to PSO1 verb by one level; Therefore correlation is moderate(2).

PSO2 Verb: Develop (L3)

CO1 Action Verb level is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO2 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO3 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb level is less than PSO2 verb by one level; Therefore correlation is moderate (2).

CO5 Action Verb level is equal to PSO2 verb; Therefore correlation is high (3).

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ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)

Course Code	Year & Sem	Digital Signal processing	L	T	P	C
20APC0419	III-II		3	0	0	3

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

CO1: Analyze the discrete time signals and systems in time and frequency domains.

CO2. Apply the Fast Fourier Transform algorithms for efficient computation of DFT.

CO3. Analyze the steps in the design of analog and digital filters for the given specifications

CO4.Evaluate the realizations of digital IIR and FIR filters by using various structures.

CO5. Analyze the interpolation and decimation in multirate digital signal processing and applications

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Analyze	the discrete time signals and systems	in time and frequency domains		L4
CO2	Apply	the Fast Fourier Transform algorithms	for efficient computation of DFT		L3
CO3	Analyze	the steps in the design of analog and digital filters		for the given specifications	L4
CO4	Evaluate	the realizations of digital IIR and FIR filters	by using various structures		L5
CO5	Analyze	the interpolation and decimation		in multirate digital signal processing	L4

UNIT - I

Introduction to DSP

Review of discrete-time signals and systems – Time domain analysis of discrete-time signals & systems, Frequency domain analysis of discrete-time signals and systems.

Discrete Fourier Transform: Frequency-domain sampling and reconstruction of discrete- time signals, Discrete Fourier Transform (DFT), The DFT as a linear transformation, Relationship of the DFT to other transforms, Properties of DFT, Frequency analysis of signals using the DFT.

UNIT - II

Fast Fourier Transform

Efficient computation of the DFT – Direct computation of DFT, Divide and conquer approach to computation of DFT, Radix-2, Radix-4, and Split radix FFT algorithms, Implementation of FFT algorithms, Applications of FFT algorithms – Efficient computation of the DFT of two real sequences, 2N point real sequences, Use of the FFT algorithm in linear filtering and correlation, Quantization errors in the computation of DFT.

UNIT - III

Analog & Digital Filters

General considerations – Causality and its implications, Characteristics of practical Frequency Selective Filters, Design of Finite Impulse Response (FIR) filters – Symmetric and asymmetric FIR filters, Design of linear phase FIR filters using windows, Design of linear phase FIR filters by the frequency sampling method, Comparison of design methods for linear phase FIR filters, Design of Impulse Invariance Response (IIR) filters from analog filters – IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Characteristics of commonly used analog filters, Design examples of both FIR and IIR filters, Frequency transformation in the analog and digital domains, Illustrative problems..

UNIT - IV

Realization of Filters

Structures for the realization of discrete-time systems, Structures for FIR systems - Direct form, Cascade form, Linear Phase Realization and Lattice structures, Structures for IIR systems – Direct form, Signal flow graphs & Transposed, Cascade form, Parallel form and Lattice structures, lattice – Ladder structure.

UNIT - V

Multirate DSP

Introduction, Decimation, and interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate onversion, Multistage implementation of sampling rate conversion, Sampling rate conversion of band pass signals, Sampling rate conversion by arbitrary factor, Applications of multirate signal processing.

Textbooks:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles,Algorithms and applications," Pearson Education/PHI, 4th ed., 2007.

2. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3rd edition, 2009.

Reference Books:

1.Carl Hamacher, ZvonksVranesic, SafwatZaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.
2.Andrew S.Tanenbaum, "Structured Computer Organization",4th Edition PHI/Pearson
3.John L.Hennessy and David A.Patterson, "Computer Architecture a quantitative approach", Fourth Edition Elsevier

Online Learning Resources:

nptel videos

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	21	28%	2	Analyze	L4	PO1, PO2, PO4 PO6	PO1: Apply (L3) PO2: Review(L2) PO4:Identitify (L5) PO6:Thumb rule	3 3 2 2
2	12	16%	2	Apply	L3	PO1, PO2, PO3 PO12	PO1: Apply (L3) PO2:Identify(L3) PO3:Develop(L3) PO12: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	Evaluate	L5	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, PO12	PO1: Apply(L3) PO2:Identify(L3) PO5: Create (L6) PO6:Thumb rule PO12:Thumb rule	3 3 1 2 2
	75	100%						

Justification Statements:

CO1: Analyze the discrete time signals and systems in time and frequency 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).
PO12: CO2 using Thumb rule, correlates PO12 as medium (2).

CO3: Analyze the steps in the design of analog and digital filters for the given specifications.

Action Verb: Analyze (L4)

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: Evaluate the realizations of digital IIR and FIR filters by using various structures.
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).
PO6: CO4 using Thumb rule, correlates PO6 as medium (2).
CO5: Analyze the interpolation and decimation in multirate digital signal processing and applications.
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).
PO12: CO5 using Thumb rule, correlates PO12 as medium (2).

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

Subject Code	Subject Name	L	T	P	Credits
20APE0306	Renewable Energy Technologies	3	0	0	3

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

CO1. Understand the necessity of different energy sources.
CO2. Apply the solar energy concepts for generation of electricity
CO3. Analyze the anaerobic digestion for bio-gas production and the wind energy for generation of electricity
CO4. Apply the ocean thermal energy conversion and geothermal energy conversion for generation of electricity
CO5. Analyze the properties of hydrogen as fuel, production and storage process of hydrogen energy

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the necessity of different energy sources			L2
CO2	Apply	the solar energy concepts		for generation of electricity	L3
CO3	Analyze	the anaerobic digestion and wind energy		for bio-gas production for generation of electricity	L3
CO4	Apply	ocean thermal energy conversion and geothermal energy conversion		for generation of electricity	L3
CO5	Analyze	the properties of hydrogen as fuel, production and storage proces	of hydrogen energy		L4

UNIT I

Classification of Energy:

Energy chain and common forms of usable energy- Present energy scenario- World energy status- Energy scenario in India- Introduction to renewable energy resources- Introduction to solar Energy- Energy from sun- Spectral distribution of Solar radiation- Instruments for measurement of solar radiation.

UNIT II

Solar Energy

Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors, Solar Direct Thermal Applications, Solar Thermal Power Generation, Fundamentals of Solar Photo Voltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV Applications.

UNIT III

Bio Energy Sources:

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gasdigesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.

Wind Energy:

Wind Energy Estimation, Types of Wind Energy Systems, Performance, Site Selection, Details of Wind Turbine Generator.

UNIT IV

Ocean Energy:

Ocean Thermal Energy Conversion (OTEC), Principle of operation, development of OTEC plants, Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants.

Geothermal Energy:

Resources, types of wells, methods of harnessing the energy, scope in India.

Unit – V:

Hydrogen Energy:

Properties of hydrogen as fuel, Hydrogen pathways introduction-current uses, general introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and hydrogen production plants.

Textbooks:

1. Non-Conventional Energy Sources /G.D. Rai.
2. Reneweble energy resources: Tiwari and ghosal, Narosa publication.
3. Non-conventional Energy Sources, Khanna Publication.

References:

1. Non-Conventional Energy Resources, B.H. Khan, McGrawHIll, 2015.
2. Principles of Solar Energy/ Frank Krieth & John F Kreider.
3. Fang Lin You, Hong ye (2012), Renewable Energy Systems, Advanced conversion technologies and applications, CRC Press
4. John.A.Duffie, William A.Beckman (2013), Solar Engineering of Thermal processes, Wiley
5. Godfrey Boyle (2012), Renewable Energy, power for a sustainable future, Oxford University Press.

Articulation matrix

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Renewable Energy Technologies	CO1	**2**	**3**					**2**						**2**	**2**
	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 Outcomes (PO)	PO(s): Action Verb and BTL (for PO1 to PO5)	Level of Correlation
	Verb	BTL			
1	Understand	**L2**	**PO1** **PO2** **PO7** **PSO1** **PSO2**	**Apply-l3** **Reviev-l2** **Thumb Rule** **Thumb Rule** **Thumb Rule**	**2** **3** **2** **2** **2**
2	Apply	**L3**	**PO1** **PO2** **PO7** **PSO1** **PSO2**	**Apply-l3** **Reviev-l2** **Thumb Rule** **Thumb Rule** **Thumb Rule**	**3** **3** **3** **3** **3**
3	Analyze	**L3**	**PO1** **PO2** **PO7** **PSO1** **PSO2**	**Apply-l3** **Reviev-l2** **Thumb Rule** **Thumb Rule** **Thumb Rule**	**3** **3** **3** **2** **2**
4	Apply	**L3**	**PO1** **PO2** **PO7** **PSO1** **PSO2**	**Apply-l3** **Reviev-l2** **Thumb Rule** **Thumb Rule** **Thumb Rule**	**3** **3** **3** **3** **3**
5	Analyze	**L4**	**PO1** **PO2** **PO7** **PSO1** **PSO2**	**Apply-l3** **Reviev-l2** **Thumb Rule** **Thumb Rule** **Thumb Rule**	**3** **3** **3** **3** **3**

Justification Statements:

CO1: Understand the necessity of different energy sources**.**
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: **Understand (L2)**
CO1 Action verb is same level as PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: using thumb rule CO1 correlates PO6 as moderate (2).
CO2: Apply the solar energy concepts for generation of electricity
Action Verb: Apply (L3)
PO1 Verb: **Apply (L3)**
CO2 Action verb is same level as PO1 verb. Therefore, the correlation is High (3)
PO2 Verb: **Review (L2)**
CO2 Action verb is greater than PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: PO7 Verb: using thumb rule CO2 correlates PO6 as high (3).

CO3: Apply the anaerobic digestion for bio-gas production and the wind energy for generation of electricity
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 greater than PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: PO7 Verb: using thumb rule CO3 correlates PO6 as high (3).

CO4: Apply the ocean thermal energy conversion and geothermal energy conversion for generation of electricity
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 greater than PO2 verb. Therefore, the correlation is high (3)
PO7 Verb: PO7 Verb: using thumb rule CO4 correlates PO6 as high (3).

CO5: Analyze the properties of hydrogen as fuel, production and storage process of hydrogen energy
Action Verb: Analyse (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)
PO7 Verb: using thumb rule CO5 correlates PO6 as high (3).

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

Course Code	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
20AHSMB02		3	0	0	3

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

CO1. Understand the concept and process of Entrepreneurship to develop entrepreneurial skills
CO2. Analyze the different feasibility studies to start a new enterprise.
CO3. Analyze the various sources of finance to entrepreneurs.
CO4. Analyze the role of central government and state government in promoting women Entrepreneurship.
CO5. Analyze the role of incubations in fostering startups.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	the concept and process of Entrepreneurship		to develop entrepreneurial skills	L2
CO2	Analyze	the different feasibility studies		to start a new enterprise	L4
CO3	Analyze	the various sources of finance to entrepreneurs			L4
CO4	Analyze	the role of central government and state government		in promoting women Entrepreneurship	L4
CO5	Analyze	the role of incubations		in fostering startups	L4

Unit-1 Introduction to Entrepreneurship

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

Unit-II Formulation of Business Idea

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

Unit-III Financial Aspects of Promotion

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development.

Unit-IV Women Entrepreneurship

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

Unit-V Startups and Incubation

Startups – Definition, Role of startups in India, Governmental initiatives to foster entrepreneurship across sectors. Funding opportunities for startups.Business Incubation and its benefits, Pre-Incubation and Post - Incubation process.

Textbooks:

1. D F Kuratko and T V Rao, "Entrepreneurship" - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, " Fundamentals of Entrepreneurship", PHI, 2013.

References:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", Himalaya Publishing 2012.
2. Rajeev Roy "Entrepreneurship", 2nd Edition, Oxford, 2012.
3. B.Janakiram and M.Rizwana‖ "Entrepreneurship Development: Text & Cases", Excel Books, 2011.
4. Stuart Read, Effectual "Entrepreneurship", Routledge, 2013.

OnlineLearningResources:

1. Entrepreneurship-Through-the-Lens-of-ventureCapital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurship/50

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	PO12	PSO1	PSO2
ENTREPRENEURSHIP DEVELOPMENT	CO1	2													
	CO2			3	3						3				
	CO3	3										3			
	CO4	3													
	CO5	3													

Course Outcome (CO)	Percentage of contact hours over the total planned contact hours	CO: Action verb and BTL	Program Outcome(PO)	PO: Action verb and BTL	Level of correlation (0-3)
CO1	18.86	Understand	PO1	Apply (L3)	2
CO2	18.86	Analyze	PO3 PO4 PO10	Apply (L3) Apply (L3) Thumb Rule	3 3 3
CO3	20.75	Analyze	PO1 PO11	Apply (L3) Thumb Rule	3 3
CO4	18.86	Analyze	PO1	Apply (L3)	3
CO5	22.64	Analyze	PO1	Apply (L3)	3

Justification Statements:

CO1: Understand the concept and process of Entrepreneurship to develop entrepreneurial skills

Action Verb: Understand (L2)

PO1Verb : Apply(L3)

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

CO2: Analyzethedifferent feasibility studies to start a new enterprise.

Action Verb: Analyze(L4)

PO3: Apply (L3)

CO2 Action verb is more than PO3 verb. Therefore the correlation is High (3)

PO4: Apply (L3)

CO2 Action verb is more than PO4 verb. Therefore the correlation is High (3)

PO10: Thumb Rule

As using thumb rule CO2 correlates with PO10. Therefore the correlation is High (3)

CO3: Analyze the various sources of finance to entrepreneurs.

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO3 Action verb is more than PO1 verb by one level. Therefore the correlation is High (3)

PO11: Thumb Rule

CO3 Action verb blooms level 4 correlates with PO11. Therefore the correlation is High (3)

CO4: Analyze the role of central government and state government in promoting women Entrepreneurship**.**

Action Verb: Analyze (L4)

PO1: Apply (L3)

CO4 Action verb is more than PO1 verb by one level. Therefore the correlation is High (3)

CO5: Analyze the role of incubations in fostering startups**.**

Action Verb: Analyze (L4)

PO1: Apply (L3)
CO5 Action verb is more than PO1 verb. Therefore the correlation is High (3)

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(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)

Course Code	Year & Sem	EMBEDDED SYSTEMS	L	T	P	C
20APE0411	IV-I		3	0	0	3

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

CO1: **Understand** the fundamental concepts of embedded systems, programming languages and tools.

CO2: **Analyze** the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

CO3: **Analyze** the microprocessor interfacing concepts and the design cycle for embedded systems

CO4: **Analyze the** microcontroller internal blocks for basic programming of embedded system

CO5: **Apply** the real-world embedded communication protocols enabling microcontrollers to interact with external sensors and actuators external sensors and actuators.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	**Understand**	The fundamental concepts of Embedded systems.			L2
CO2	**Analyze**	The architecture of TM4C, instruction set, and its addressing modes	.	For Developing embedded systems	L4
CO3	**Analyze**	The microprocessor interfacing concepts and the design cycle			L4
CO4	**Analyze**	The microcontroller internal blocks	For basic programming of embedded system		L4
CO5	**Apply**	The real-world embedded communication protocols	Enabling Microcontrollers to interact with external sensors and actuators.		L3

UNIT - I	**INTRODUCTION TO EMBEDDED SYSTEMS**	
Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design		
UNIT - II	**EMBEDDED PROCESSOR ARCHITECTURE**	
CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, addressing modes and instruction set basics.		
UNIT - III	**OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS**	
Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O Devices and I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System Design metrics of embedded systems - low power, high performance, engineering cost, time-to-market.		
UNIT - IV	**MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING**	
I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).		
UNIT - V	**EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS**	
Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C.Case Study: Tiva based embedded system application using the interface protocols for communication with external devices “Sensor Hub Booster Pack” Embedded Networking fundamentals, IoT overview and architecture, Overview of		

wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API. Case Study: Tiva based Embedded Networking Application: "Smart Plug with Remote Disconnect and Wi-Fi Connectivity"

Textbooks:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, 2014, Create space publications ISBN: 978-1463590154.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition Jonathan W Valvano, Create space publications ISBN-13: 978-1477508992
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011 ISBN-0070667640, 9780070667648

Reference Books:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html
4. CC3100/CC3200 SimpleLink™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015

Mapping of course outcomes with program outcomes

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

Correlation matrix

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1				CO1: Understand	L2	PO2 PO3	PO1: Apply(L3) PO3: Develop (L3)	2 2
2				CO2: Analyze	L4	PO1 PO3 PO4	PO1: Apply(L3) PO 3: Develop (L3) PO4: Interpret (L2)	3 3 3
3				CO3: Analyze	L2	PO1 PO2 PO3 PO4 PO5	PO1: Apply(L3) PO2: Identify (L3) PO 3: Develop (L3) PO4: Interpret (L2) PO5: Apply(L3)	3 3 3 3 3
4				CO4: Analyze	L4	PO1 PO3 PO4	PO1: Apply(L3) PO3: Develop (L3) PO4: Interpret (L2)	3 3 3
5				CO5: Apply	L3	PO1 PO3 PO4 PO5	PO1: Apply(L3) PO 3: Develop(L3) PO4: Interpret (L2) PO5: Apply(L3)	3 3 3 3

Justification Statements:

CO1: Understand the fundamental concepts of embedded systems, programming languages and tools.

Action Verb: Understand(L2)

PO1 Verb: Apply(L3)

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

PO3 Verb: Develop (L3)

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

CO2: Analyze the architecture of TM4C, instruction set, and its addressing modes for developing embedded systems.

Action Verb: Analyze(L4)

PO1: Apply(L3)

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

PO 3 Verbs: Develop (L3)

CO1 Action Verb is greater than PO 3 verb; therefore, correlation is high (3).

PO4: Interpret (L2)

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

CO3: Analyze the microprocessor interfacing concepts and the design cycle for embedded systems

Action Verb: Analyze(L4)
PO1: 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).
PO 3 Verbs: Develop (L3)
CO3 Action verb is greater than PO3 verb, Therefore, the correlation is high(3).
PO4: Interpret (L2)
CO3 Action verb is greater than PO4 verb, Therefore, the correlation is high(3).
PO5: Apply(L3)
CO3 Action verb is greater than PO5 verb, Therefore, the correlation is high(3).
CO4: Analyze microcontroller internal blocks for basic programming of embedded system
Action Verb: Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb, Therefore, the correlation is high(3).
PO 3 Verbs: Develop (L3)
CO4 Action verb is greater than PO3 verb, Therefore, the correlation is high(3).
PO4: Interpret (L2)
CO4 Action verb is greater than PO4 verb, Therefore, the correlation is high(3).
CO5:Apply real-world embedded communication protocols enabling microcontrollers to interact with external sensors
Action Verb :Apply (L3)
PO1: Apply(L3)
CO5 Action verb is equal to PO1 verb . Therefore the correlation is high (3)
PO 3 Verbs: Develop (L3)
CO5 Action verb is equal to PO1 verb . Therefore the correlation is high (3)
PO4: Interpret (L2)
CO5 Action verb is greater than PO4 verb by one level. Therefore the correlation is moderate (2)
PO5: Apply(L3)
CO5 Action verb is equal to PO5 verb . Therefore the correlation is high (3)

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

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

Subject Code: 20AHSMB03	**Subject Name: PRINCIPLES OF MANAGEMENT**	**L** 3	**T** -	**P** -	**Credits** 03

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

CO1: Understand the fundamental concepts of management and schools of thought.
CO2: Analyze various types of plans and decision making techniques.
CO3: Understand the types of organizational structures and related concepts.
CO4: Analyze various motivational and leadership theories to direct employees.
CO5: Analyze the various techniques of controlling and reporting methods in organizations.

CO	**Action Verb**	**Knowledge Statement**	**Condition**	**Criteria**	**Blooms level**
CO1	Understand	the fundamental concepts of management and schools of thought			L2
CO2	Analyze	various types of plans and decision making techniques			L4
CO3	Understand	the types of organizational structures and related concepts			L2
CO4	Analyze	various motivational and leadership theories		to direct employees	L4
CO5	Analyze	the various techniques of controlling and reporting methods in organizations			L4

UNIT I : Introduction to Management: Definition – Science or Art – Types of Management – Functions of Management - Roles and Skills of Manager – Evolution of Management – Schools of Management Thought: Scientific Management – Administrative Management – Human relations, Systems and Contingency Approaches.

UNIT II: Planning: Nature and Purpose–Process-Types of Plans, Management by Objectives. **Decision Making:** Process--Types of Decisions--Decision making Techniques.

UNIT III: Organizing: Nature and Purpose – Formal and Informal Organizations - Process – Organizational Structure–Line and Staff Authority–Departmentalization–delegation of Authority – Centralization and Decentralization - Span of Control.

UNIT IV: Directing: Meaning–Need–Motivation: Motivation Theories– Leadership: Leadership Theories–Types of leadership– Communication: Types- Process–Barriers to communication – Effective Communication.

UNIT V: Controlling: Meaning, Control Process, Characteristics of an Effective Control System, Types of Controlling – Techniques of controlling – Reporting.

Text Books:

- Organizational Behavior, Stephen P. Robbins, Pearson Education.
- Management and Organizational Behavior, Subbarao P, Himalaya Publishing House
- Principles of Management, Koonz, Weihrich and Aryasri, Tata McGraw Hill.
- Principles of Management, PC Tripathi and PN Reddy, Tata McGraw Hill.

References:

- Management and Organizational behavior, Pierce Gordner, Cengage.
- Principles of Management, Murugesan, Laxmi Publications

Course Title	Course Outcomes (COs)	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	P O3	P O4	P O5	P O6	P O7	PO 8	PO 9	P O10	P O11	P O12	**PSO 1**	**PSO 2**
PRINCIPLES OF MANAGEMENT	CO1	**1**													
	CO2	**3**													
	CO3	**2**													
	CO4									2	**2**				
	CO5	3													

Course Outcome (CO)	**Percentage of contact hours over the total planned contact hours**	**CO: Action verb and BTL**	**Program Outcome(PO)**	**PO: Action verb and BTL**	**Level of correlation (0-3)**
CO1	15.5%	Understand	PO1	Apply	1
CO2	14.1%	Analyze	PO1	Apply	3
CO3	19.7%	Understand	PO1	Apply	2
CO4	31%	Analyze	PO9 PO10	Thumb Rule	2 2
CO5	19.7%	Analyze	PO1	Apply	3

Justification Statements:

CO1: Understand the fundamental concepts of management and schools of thought.
Action Verb: Understand (L2)
PO1 Verb: Apply (L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is low (1)

CO2: Analyze various types of plans and decision making techniques.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO2 Action verb is more than PO1 verb by one level. Therefore the correlation is High (3)

CO3: Understand the types of organizational structures and related concepts.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO3 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)

CO4: Analyze various motivational and leadership theories to direct employees.
Action Verb: Analyze (L4)
PO9: Thumb Rule
PO10: Thumb Rule
CO4 Blooms level (4) correlates with PO9, PO10. Therefore the correlation is medium (2)

CO5: Analyze the various techniques of controlling and reporting methods in organizations.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO5 Action verb is more than PO1 verb by one level. Therefore the correlation is high (3)

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

Course Code	Year & Sem	Database Management Systems	L	T	P	C
20APC0502	II-I	**(common to CSE,CIC,AIDS,AIML,CSE(DS),EEE)**	**3**	**0**	**0**	**3**

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

CO1: Understand the fundamentals of databases to design relational models.
CO2: Apply the SQL and PL/SQL concepts to formulate queries.
CO3: Apply the E-R model for data base design of real world applications.
CO4: Analyze the query processing and optimization for data manipulation.
CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	Understand	The fundamentals of databases		To design relational models.	L2
CO2	Apply	the SQL and PL/SQL concepts		To formulate queries.	L3
CO3	Apply	the E-R model		for data base design of real world applications	L3
CO4	Analyze	the query processing and optimization		For data manipulation.	L4
CO5	Analyze	the concurrent transactions and recover systems		to prevent data loss in system crash.	L4

UNIT - I	**Introduction, Introduction to Relational Model**	
Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators, Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations		
UNIT - II	**Introduction to SQL, Advanced SQL**	
Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL: Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization. Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.		
UNIT - III	**Database Design and the E-R Model, Relational Database Design**	
Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues. Relational Database Design:Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms.		
UNIT - IV	**Query Processing, Query optimization**	
Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions. Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.		
UNIT - V	**Transaction Management, Concurrency control and Recovery System**	
Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements. Concurrency Control: Lock-based Protocols, Deadlock Handling, Multiple granularity, Timestamp-based Protocols, and Validation-based Protocols. Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer		

Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations.
Textbooks:
1. A. Silberschatz, H.F.Korth, S.Sudarshan, "Database System Concepts",6/e, TMH 2019
Reference Books:
1. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA 2. Database Principles Fundamentals of Design Implementation and Management, Carlos Coronel, StevenMorris, Peter Robb, Cengage Learning. 3. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke,TMH
Online Learning Resources:
https://onlinecourses.nptel.ac.in/noc21_cs04/preview

Mapping of course outcomes with program outcomes

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

Correlation matrix

Justification Statements :

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	13	14%	2	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Review(L2)	2 3
2	19	20%	2	CO2 :Apply	L3	PO1 PO2 PO12	PO1: Apply(L3) PO2: Review(L2) PO12: Thumb rule	3 3 2
3	18	19%	2	CO3 :Apply	L3	PO1 PO2 PO3 PO4 PO5 PO8 PO9 PO12	PO1: Apply(L3) PO2: Review(L2) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule	3 3 3 2 3 2 2 2
4	18	19%	2	CO4 :Analyze	L4	PO1 PO2 PO3 PO4 PO5 PO8	PO1: Apply(L3) PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule	3 3 3 3 3 3
5	25	27%	3	CO5 :Analyze	L4	PO2 PO3 PO4 PO5 PO8 PO9 PO12	PO2: Analyze(L4) PO3: Develop (L3) PO4: Analyze (L4) PO5: Apply(L3) PO8: Thumb rule PO9: Thumb rule PO12: Thumb rule	3 3 3 3 2 2 2
	93	100 %						

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

Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Review(L2)
CO1 Action verb is same level as PO2 verb. Therefore the correlation is high (3)

CO2: Apply the SQL and PL/SQL concepts to formulate queries.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)

PO2: Review (L2)
CO2 Action verb is greater than PO2 verb. Therefore the correlation is high (3)
PO12: Thumb rule
For some of DB applications, PL/SQL concepts are used to formulate queries. Therefore the correlation is medium (2)

CO3: Apply the E-R model for data base design of real world applications.
Action Verb : Apply(L3)
PO1: Apply(L3)
CO3 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2:Review (L2)
CO3 Action verb is higher level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO3 Action verb is same level as PO3 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb is less than PO4 verb by one level. Therefore the correlation is medium (2)
PO5: Apply(L3)
CO3 Action verb is same level as PO5 verb. Therefore the correlation is high (3)
PO8 : Thumb rule
Since ethical principles should be followed to create a database. Therefore the correlation is medium(2)
PO9 : Thumb rule
Team work is required between DBA and Database designer to create a database. Hence the correlation is medium (2)
PO12: Thumb rule
For some of DB applications, ER model concepts are used to create designs. Therefore the correlation is medium(2)

CO4: Analyze the query processing and optimization for data manipulation.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2: Analyze (L4)
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO4 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO4 Action verb is same as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO8: Thumb rule
Since ethical principles shall be followed in data manipulation. Therefore the correlation is high(3)

CO5: Analyze the concurrent transactions and recover systems to prevent data loss in system crash.
Action Verb : Analyze (L4)
PO2: Analyze (L4)
CO5 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO3: Develop (L3)
CO5 Action verb is greater than PO3 verb. Therefore the correlation is high (3)
PO4: Analyze (L4)
CO5 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO5 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO8 : Thumb rule
Since ethical principles should be followed for transaction management. Therefore the correlation is medium(2)
PO9 : Thumb rule
Team work is required for transaction management and recovery of failure transactions. Hence the correlation is medium (2)
PO12: Thumb rule
In real time transaction management is continuously updating. Therefore the correlation is medium (2)

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

Course Code	Year & Sem	Computer Networks	L	T	P	C
20APC0516	III-I		3	0	0	3

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

CO1: **Understand** the basics of data communications and networking by using OSI model.
CO2: **Apply** the Data link Layer functionalities to solve real world problems.
CO3: **Analyze** the various routing algorithms and protocols.
CO4: **Analyze** the Transport Layer services by using TCP and UDP protocols.
CO5: **Understand** the various services protocols offered by application layer.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
CO1	understand	the basics of data communications and networking by using OSI model.			L2
CO2	Apply	The Data link Layer functionalities		to solve real world problems.	L3
CO3	Analyze	the various routing algorithms and protocols.			L4
CO4	Analyze	the Transport Layer services	by using TCP and UDP protocols		L4
CO5	understand	The various services protocols offered by application layer			L2

UNIT - I		
Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration. **Network Models:** Protocol Layering, TCP/IP Protocol Suite, The OSI Model **Introduction to Physical Layer**: Data and Signals, Transmission Impairment, Data Rate Limits, Performance. Transmission Media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet Switching		
UNIT - II		
The Data Link Layer: Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol. **Media Access control**: Random Access, Controlled Access, Channelization, Connecting devices and virtual LANs: Connecting Devices.		
UNIT - III		
The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking. **The network layer in the Internet:** IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.		
UNIT - IV		
The Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control, The internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.		
UNIT - V		
The Application Layer: Introduction, Client-Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.		
Textbooks:		
1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012. 2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.		
Reference Books:		

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. "Internetworking with TCP/IP – Principles, protocols, and architecture - Volume 1, Douglas E. Comer, 5th edition, PHI
3. "Computer Networks", 5E, Peterson, Davie, Elsevier.
4. "Introduction to Computer Networks and Cyber Security", Chawan- Hwa Wu, Irwin, CRC Publications.
5. "Computer Networks and Internets with Internet Applications", Comer.

Online Learning Resources:

https://www.youtube.com/watch?v=O--rkQNKqls&list=PLbRMhDVUMngf-peFloB7kyiA40EptH1up

Mapping of course outcomes with program outcomes

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

Unit No.	CO					Program Outcome (PO)	PO(s) :Action Verb and BTL(for PO1 to PO12)	Level of Correlation (0-3)
	Lesson plan(Hrs)	%	Correlation	Co's Action verb	BTL			
1	15	23%	3	CO1 :Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
2	10	15%	2	CO2 : Apply	L3	PO1 PO2 PO6	PO1: Apply(L3) PO2: Analyze (L4) PO6:Thumb rule	3 2 1
3	15	23%	3	CO3 : Analyze	L4	PO1 PO2 PO4 PO5 PO6	PO1: Apply(L3) PO2: Analyze L4) PO4: Analyze (L4) PO5:Apply(L3) PO6:Thumb rule	3 3 3 3 1
4	11	17%	2	CO4 :Analyze	L4	PO1 PO2 PO4 PO5	PO1: Apply(L3) PO2: Analyze (L4) PO4: Analyze (L4) PO5:Apply(L3)	3 3 3 3
5	15	23%	3	CO5 : Understand	L2	PO1 PO2	PO1: Apply(L3) PO2: Analyze (L4)	2 1
	66	100%						

Correlation matrix

Justification Statements :

CO1: understand the basics of data communications and networking by using OSI model.
Action Verb : Understand(L2)
PO1 Verb : Apply(L3)
CO1 Action verb is less than PO1 verb by one level. Therefore the correlation is medium (2)
PO2 Verb : Analyze(L4)
CO1 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

CO2: Apply Data link Layer functionalities to solve real world problems.
Action Verb : Apply (L3)
PO1: Apply(L3)
CO2 Action verb is same level as PO1 verb. Therefore the correlation is high (3)
PO2: Analyze(L4)
CO2 Action verb is less than PO2 verb by One levels. Therefore the correlation is medium (2)
PO6: Thumb rule
Data link Layer functionalities are useful for realtime applications.Therefore the correlation is (1)

CO3: Analyze various routing algorithms and protocols.
Action Verb : Analyze(L4)

PO1: Apply(L3)
CO3 Action verb is greater than PO1 verb. Therefore the correlation is high (3)
PO2: Analyze(L4)
CO3 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO3 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO3 Action verb is greater than PO5 verb. Therefore the correlation is high (3)
PO6 : Thumb rule
Various routing algorithms are useful for finding distance between routers in real life.Therefore the correlation is (1)

CO4: Analyze the Transport Layer services by using TCP and UDP protocols.
Action Verb : Analyze(L4)
PO1: Apply(L3)
CO4 Action verb is greater than PO1 verb by one level. Therefore the correlation is high (3)
PO2: Analyze(L4)
CO4 Action verb is same level as PO2 verb. Therefore the correlation is high (3)
PO4: Analyze(L4)
CO4 Action verb is same level as PO4 verb. Therefore the correlation is high (3)
PO5: Apply(L3)
CO4 Action verb is greater than PO5 verb by one level. Therefore the correlation is high (3)

CO5: Understand various services protocols offered by application layer.
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)
PO2 Verb : Analyze(L4)
CO5 Action verb is less than PO2 verb by two levels. Therefore the correlation is low (1)

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

Course name: ELECTRICAL DISTRIBUTION SYSTEM & AUTOMATION
Course code: 20APE0206

L	T	P	Credits
3	0	0	3

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

CO1: Understand the concepts of distribution systems fundamentals.
CO2: **Analyze** the distribution system substations and loads.
CO 3: Analyze **the** load flow solutions in the distribution system
CO4: Evaluate voltage drop and power loss **calculations**.
CO5: Understand the concepts of SCADA, automation distribution system and management.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Understand	Distribution systems fundamentals.			L2
2	**Analyze**	Substations and modelling of various loads			L4
3	Analyze	Load flow solutions in distribution system			L4
4	Evaluate	Voltage drops and power loss **calculations**			L5
5	Understand	SCADA, Automation distribution system and management.			L2

SYLLABUS:

UNIT–I: DISTRIBUTION SYSTEM FUNDAMENTALS

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

UNIT–II: DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS

Substations: Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, radial feeder with uniformly and non-uniformly distributed loading. Benefits derived through optimal location of substations.

Classification of substations: Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

Loads: Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, modeling of star and delta connected loads, two-phase and single-phase loads shunt capacitors.

UNIT–III: DISTRIBUTION SYSTEM LOAD FLOW

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

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UNIT–IV: VOLTAGE DROP AND POWER LOSS CALCULATION

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems

UNIT–V: DISTRIBUTION AUTOMATION

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces. Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE.

TEXT BOOKS:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, Turan Gonen, McGraw-HillInc., New Delhi, 1986

REFERENCEBOOKS:

1. Control and automation of electrical power distribution systems, James North cote - Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.
2. Biswarup Das, Power distribution Automation, IET publication, 2016.
3. Dr. M. K. Khedkar, Dr. G. M. Dhole, Electric Power Distribution Automation, Laxmi Publications, First edition, 2017

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	PO 11	PO 12	PSO 1	PSO 2
EDSA	CO1	2	1							2				1	2
	CO2	3	3							3				3	3
	CO3	3	3							3				3	3
	CO4	3	3							3				3	3
	CO5	2	1							2				1	2

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			

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1	**10**	16.66	2	**Understand**	**L2**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	2 1 2
2	**16**	26.66	3	**Analyze**	**L4**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	3 **3** **3**
3	**8**	**13.33**	**2**	**Analyze**	**L4**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	3 **3** **3**
4	**12**	**20.00**	**2**	**Analyze**	**L4**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze (L4) PO9: Thumb Rule	3 **3** **3**
5	**14**	**23.33**	**3**	**Understand**	**L2**	PO1, PO2,PO9	PO1: Apply (L3) PO2: Analyze(L4) PO9: Thumb Rule	2 1 2
total	**60**							

CO1: Understand basics of distribution systems fundamentals

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: Analyze (L4)

CO1 Action Verb is less than PO2 verb by two levels; therefore correlation is low (1).

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

CO2: Analyze the distribution system substations and loads.

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: Analyze (L4)

CO2 Action Verb is equal to PO2 verb; therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO2 level is 4, Using Thumb Rule its correlation is high (3).

CO3: Analyze of load flow solutions in distribution system

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Analyze (L3)

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

CO4: Evaluate voltage drops, line loss and feeder cost.
Action Verb: Evaluate (L5)

PO1 Verbs: Apply (L3)

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

PO2 Verb: Identify (L3)

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

PO3 Verb: Develop (L3)

CO4 Action Verb level is greater to PO3 verb; Therefore correlation is high (3).

CO5: Understand the concepts of SCADA, automation distribution system and management.
Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Analyze (L4)

CO5 Action Verb is less than PO2 verb by two levels; therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO5 level is 2, Using Thumb Rule its correlation is moderate (2).

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is less than PSO1 verb by two level; Therefore correlation is moderate (1).

CO2 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

CO3 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

CO4 Action Verb level is greater to PSO1verb; Therefore correlation is high (3).

CO5 Action Verb is less than PSO1 verb by two level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

CO2 Action Verb level is greater than PSO2 verb; Therefore correlation is high (3).

CO3 Action Verb level is greater than PSO2 verb; Therefore correlation is high (3).

CO4 Action Verb level is greater than to PSO2 verb; Therefore correlation is high (3).

CO5 Action Verb level is one level less than PSO2 verb; Therefore correlation is moderate (2).

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Department of Electrical and Electronics Engineering
Program: B. Tech Regulation: AK20 Year/Semester: IV / VII
Branch of Study: EEE

Course Name: HIGHVOLTAGEENGINEERING
Course code: 20APE0209

L	T	P	Credits
3	0	0	3

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

CO1: Analyze the levels of high voltages in electrical system and electric stress.
CO2: Analyze the conduction and breakdown process in gases.
CO 3: Analyze the mechanisms of conduction and breakdown in liquid and solid dielectrics.
CO4: Understand the generation and measurement of high voltages and high currents.
CO 5: Understand the over voltage and insulation coordination in electric power system.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	Analyze	Electrical stress control techniques in gas and vacuum insulation systems.			L4
2	Analyze	Conduction and breakdown process in gases.			L4
3	Analyze	Various mechanisms of breakdown in liquid and solid dielectrics breakdown			L4
4	Understand	Generation and measurement of high voltage and high current.			L2
5	Understand	Over voltage and insulation coordination in electric power system.			L2

SYLLABUS:

UNIT-I High voltages in electrical systems and electric stress

Levels of High voltage – Electrical insulation and Dielectrics – importance of electric field intensity in the dielectrics – Electric field stresses – gas / vacuum as insulator - estimation and control of electric stress – Surge voltage their distribution and control.

UNIT-II Conduction and breakdown in gases

Gases as insulating media - Collision Processes – Ionization Processes – Townsend's current growth equation – Current growth in the presence of secondary processes - Townsend's criterion for breakdown - the experimental determination of coefficients α and γ – breakdown in electro negative gases.

UNIT-III Conduction and breakdown in Liquid, solid dielectrics

Liquids as insulator – conduction and breakdown in pure liquids – conduction and breakdown in commercial liquids – testing of insulating oils – breakdown in solid dielectrics –intrinsic, electromechanical and thermal - breakdown in composite dielectrics.

UNIT-IV Generations and measurements of high voltages and currents

Generations of high direct current and alternating voltages – generation of impulse voltages and currents – Measurement of high Voltage and current: direct, alternating and impulse – measurement of dielectric constant and loss factor - partial discharge measurement.

UNIT-V Overvoltage and insulation coordination in electric power system

Natural causes for over voltages – lightning switching and temporary over voltage – Protection against over voltage – Bewley's lattice diagram – principles of insulation coordination on high voltage and extra high voltage power system.

TEXTBOOKS:

1. High Voltage Engineering by M.S.Naidu and V.Kamaraju–TMH Publications, 5th Edition,2013.
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition, 2000.

REFERENCEBOOKS:

1. Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre, New Age International(P) Ltd., New Delhi – 2007.
2. High Voltage Engineering by C.L. Wadhwa, New Age Internationals(P) Limited,2010.
3. High Voltage Engineering:, E.Kuffel, W.S.Zaengl, J.Kuffel, Cbs Publishers New Delhi, 2nd Edition, 2005

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	PO 11	PO 12	PSO 1	PSO 2
HVE	CO1	3	3							3				3	3
	CO2	3	3							3				3	3
	CO3	3	3							3				3	3
	CO4	2	1							2				1	2
	CO5	2	1							2				1	2

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

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CO1: Analyze the levels of high voltages in electrical system and electric stress.

Action Verb: Analyze (L4)

PO1 Verbs: Apply (L3)

CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).

PO2 Verbs: Analyze (L4)

CO1 Action Verb is equal to PO verb; therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO1 level is 4, Using Thumb Rule its correlation is high (3)

CO2: Analyze the conduction and breakdown process in gases.

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: Analyze (L4)

CO2 Action Verb is equal to PO verb; therefore correlation is high (3).

Based on students' participate in CLC activities. From this: CO2 level is 4, Using Thumb Rule its correlation is high (3)

CO3: Analyze the mechanisms of conduction and breakdown in liquid and solid dielectrics.

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 Verbs: Analyze (L4)

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

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

CO4: Understand the generation and measurement of high voltages and high currents.

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: Analyze(L4)

CO1 Action Verb is less than PO2 verb by teo level; Therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO4 level is 2, Using Thumb Rule its correlation is moderate (2)

CO5: Understand the over voltage and insulation coordination in electric power system.

Action Verb: Understand (L2)

PO1 Verbs: Apply (L3)

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

PO2 Verbs: Analyze(L4)

CO5 Action Verb is less than PO2 verb by teo level; Therefore correlation is low (1).

Based on students' participate in CLC activities. From this: CO5 level is 2, Using Thumb Rule its correlation is moderate (2)

Program Specific Outcomes:

PSO1 Verb: Analyze (L4)

CO1 Action Verb is equal to PSO1 verb; Therefore correlation is high (3).

CO2 Action Verb is equal to PSO1verb; Therefore correlation is high (3).

CO3 Action Verb is equal to PSO1verb; Therefore correlation is high (3).).

CO4 Action Verb level is less than to PSO1 verb by tow level; Therefore correlation is low (1).

CO5 Action Verb level is less than to PSO1 verb by tow level; Therefore correlation is low (1).

PSO2 Verb: Develop (L3)

CO1 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO2 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO3 Action Verb level is one greater than PSO2 verb by one level; Therefore correlation is high (3).

CO4 Action Verb level is less than to PSO2 verb by one level; Therefore correlation is moderate (2).

CO5 Action Verb level is less than to PSO2 verb by one level; Therefore correlation is moderate (2).

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Program: B. Tech **Regulation: AK20** **Year/Semester: IV / VII**
Branch of Study: EEE

Course Name: ELECTRIC VEHICLE TECHNOLOGIES
Course Code: 20APE0210

L	T	P	Credits
3	0	0	3

COURSE OUTCOMES: After studying of the course, Student will be able to:

CO1: Analyze the basic concepts of electric vehicles, and their impact on environment.
CO2: Understand the hybrid electric vehicles classification, operating principle and architectures.
CO 3: Analyze the drive-train topologies and advanced propulsion techniques.
CO4: Analyze the hybrid energy storage methodologies.
CO 5: Understand the suitable power converter topologies for motor control and hybrid energy storage.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	Basic Concepts Of Electric Vehicles and their impact on environment			L4
CO2	Understand	The hybrid electric vehicles classification, operating principle and architectures.			L2
CO3	Analyze	The drive-train topologies and advanced propulsion techniques.			L4
CO4	Analyze	The hybrid energy storage methodologies.			L4
CO5	Understand	The suitable power converter topologies for motor control and hybrid energy storage.			L2

SYLLABUS:

UNIT I INTRODUCTION

Conventional vehicle, basics of vehicle performance, History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC VEHICLES

Micro hybrid vehicles, mild hybrid vehicles, full hybrid vehicles, Parallel hybrid vehicles, series Hybrid Vehicles, Series-Parallel Hybrid vehicles, plug-in hybrid vehicles, power flow diagrams for various operating modes. Plug-in Hybrid Vehicles: Operating principle, architectures: series-parallel-series-parallel, challenges related to grid connection. Range-extended Electric Vehicles: Classification and configurations, Fuel Cell Electric Vehicles, Solar electric Vehicles, Electric Bicycles and their propulsion systems, Vehicle-to-grid, vehicle to-home concepts, Concept of Hybrid Electric Vehicles.

UNIT III ELECTRIC DRIVE-TRAINS & PROPULSION UNIT

Electric drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis Electric

propulsion unit: Electric components used in electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, Drive system efficiency.

UNIT IV ENERGY STORAGE

Storage requirements for Electric Vehicles, Battery based energy storage, Fuel Cell based energy storage, and Super Capacitor based energy storage and their analysis. Power pack management systems, Cell balancing techniques, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices, compressed air storage systems, super conducting magnetic storage systems and Energy management systems.

UNIT V CONVERTERS FOR HYBRID ENERGY STORAGE SYSTEMS

Converter configurations for hybrid energy systems based on Battery and Ultra Capacitors-cascaded converter, multiple parallel-connected converter, dual-active-bridge converter, multiple-input converter,- multiple modes single converter, interleaved converter, switched capacitor converter, converters for coupled inductor based hybridization. Fundamentals of Chargers: Charger classifications and standards, selection of AC charging systems, DC charging systems, Converter topologies for charging, wireless chargers.Measurement of Earth Resistance by Megger.

TEXTBOOKS:

1. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, Taylor & Francis Group 2015.
2. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press, 2003, 2nd Edition.

REFERENCE BOOKS:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2005.
2. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003. Online **Learning Resources:**

1. https://nptel.ac.in/courses/108/106/108106170/
2. https://nptel.ac.in/courses/108/102/108102121/

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
ELECTRIC VEHICAL TECHNOLOGIES	CO1	3				3		3						1	
	CO2	2				2		1						1	
	CO3	3				3		3						3	1
	CO4	3				3		3						3	1
	CO5	2				2		3						1	

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Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	**BTL**			
1	Analyze	L4	PO1, PO5, PO7	PO1:Apply(L3) PO5:Apply(L3) PO7: Thumb Rule	3 3 3
2	Understand	L2	PO1, PO5, PO7	PO1:Apply(L3) PO5:Apply(L3) PO7: Thumb Rule	2 2 1
3	Analyze	L4	PO1, PO5, PO7	PO1:Apply(L3) PO5:Apply(L3) PO7: Thumb Rule	3 3 3
4	Analyze	L4	PO1, PO5, PO7	PO1:Apply(L3) PO5:Apply(L3) PO7: Thumb Rule	3 3 3
5	Understand	L2	PO1, PO5, PO7	PO1:Apply(L3) PO5:Apply(L3) PO7: Thumb Rule	2 2 1

CO1: Analyze the basic concepts of electric vehicles, and their impact on environment.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is Greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply (L3)
CO1 Action Verb is Greater than PO2 verb by one level; Therefore correlation is high (3).
PO7: Using Thumb Rule, CO1 Correlated to PO7 as high (3)

CO2: Understand the hybrid electric vehicles classification, operating principle and architectures.
Action Verb: Understand (L2)
PO1: Apply (L3)
CO2 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO5: Apply (L3)
CO2 Action Verb is less than PO5 verb by one level; Therefore correlation is moderate (2).
PO7: Using Thumb Rule, CO2 Correlated to PO7 as low (1)

CO 3: Analyze the drive-train topologies and advanced propulsion techniques.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is greater than PO1 verb by one level; therefore correlation is High (3).
PO5: Apply (L3)
CO3 Action Verb is greater than PO5 verb by one level; therefore correlation is High (3).
PO7: Using Thumb Rule, CO3 Correlated to PO7 as high (3)

CO4: Analyze the hybrid energy storage methodologies.
Action Verb: Analyze (L4)
PO1: Apply (L3)
CO4 Action Verb is greater than PO1 verb by one level; therefore correlation is High (3).

PO5: Apply (L3)
CO4 Action Verb is greater than PO5 verb by one level; therefore correlation is High (3).
PO7: Using Thumb Rule, CO4 Correlated to PO7 as high (3)

CO 5: Understand the suitable power converter topologies for motor control and hybrid energy storage.

Action Verb: Understand (L2)
PO1: Apply (L3)
CO5 Action Verb is less than PO1 verb by one level; Therefore correlation is moderate (2).
PO5: Apply (L3)
CO5 Action Verb is less than PO5 verb by one level; Therefore correlation is moderate (2).
PO7: Using Thumb Rule, CO2 Correlated to PO7 as low (1)

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

Subject Code	Subject Name	L	T	P	Credits
20AHE9903	**Professional Communication**	3	0	0	3

Course Outcomes (CO): After studying of the course, Student will be able to:

CO1. Understand the communication skills effectively for professional success.
CO2. Analyze the communication skills clearly and concisely in formal and informal conversations.
CO3. Apply the information through drafting, editing and presentation.
CO4. Apply the interpersonal skills in appropriate manner towards the growth of best career.
CO5. Apply the sentence structures using correct vocabulary and without any grammatical errors.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Blooms level
1	**UNDERSTAND**	the communication skills effectively		for professional success	**L2**
2	**ANALYZE**	the communication skills clearly and concisely	in formal and informal conversations		**L4**
3	**APPLY**	the information	through drafting, editing and presentation		**L3**
4	**APPLY**	the interpersonal skills		in appropriate manner towards the growth of best career	**L3**
5	**APPLY**	the sentence structures	using correct vocabulary and without any grammatical errors		**L3**

Syllabus:

Unit: 1- Grammar & Vocabulary

Parts of Speech
Articles
The Prepositions
Subject-Verb agreement
Tenses
Active and Passive Voice
Direct & Indirect Speech
Degrees of Comparison
Punctuation
Vocabulary

Unit: 2 - Communication Skills:

Importance of Communication

Non-verbal Communication

- Introduction
- Kinesics
- Proxemics
- Chronemics

Basics of Technical Communication

- Group Discussion

Interviews

Conversations

Unit:3 – Telephone Skills:

Understanding Telephone Communication

Types of calls

Handling calls

Leaving a message

Making requests

Asking for and giving information

Giving Instructions

Making or changing appointments

Unit:4 – Interpersonal Skills

Team management

Problem solving and Decision Making

Managing Time and Stress

Technology @ work

Etiquette

Unit:5 – Written Communication

Email

Professional Letters

- (a) Letters of application
- (b) Business letters
- (c) Using Salutations
- (d) Routine letters
- (e) Request letters
- (f) Persuasive letters

Report writing

Note making

Meetings, Agenda, Notice

Suggested books for reading:

1. Meenakshi Raman, Sangeeta Sharma, Technical Communication – Principles and Practice, 3rd Edition, Oxford University Press, 2015.

2.Professional Communication Skills, Er A.K. Jain, Dr. Pravin S.R. Bhatia, Dr. A.M. Sheikh, S.Chand & Company Ltd, New Delhi, 2011.

3. Soft Skills for everyone, Jeff Butterfield, Cengage Learning India Private Ltd, New Delhi, 2014.

4. Basic communication Skills P. Kiranmai Dutt, Geetha Rajeevan, Cambridge University Press India Pvt. Ltd, New Delhi, 2010.

5. A Course in Communication Skils, P.Kiranmai Dutt, Geetha Rajeevan, CLN Prakash, Cambridge University Press India Pvt Ltd, New Delhi, 2013

Correlation of COs with the POs & PSOs

Course Title	Course Outcomes COs	Programme Outcomes(POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Professional Communication	CO1						2				2		2
	CO2									2	2		2
	CO3									2	2		2
	CO4									2	2		2
	CO5										2		

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

CO-PO mapping justification:

CO	Percentage of contact hours over the total planned contact hours			CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Lesson Plan (Hrs)	%	corr	Verb	BTL			
1	16	25	2,2.2	UNDERSTAND	L2	PO10, PO12, PO6	Thumb Rule Thumb Rule Thumb Rule	2, 2. 2
2	12	19	2,2,2	ANALYSE	L4	PO9, PO10, PO12	Thumb Rule Thumb Rule Thumb Rule	3, 3, 3
3	10	15	2,2,2	APPLY	L3	PO9, PO10, PO12	Thumb Rule Thumb Rule Thumb Rule	2, 2, 2
4	10	15	2,2,2	APPLY	L3	PO9, PO10, PO12	Thumb Rule Thumb Rule Thumb Rule	2, 2, 2
5	17	26	2	APPLY	L3	PO10	Thumb Rule	2

CO1: Understand the communication skills effectively for professional success.

Action Verb: Undersatand-L2

CO1 Action Verb Understand is of BTL 2. Using Thumb rule, L2 correlates PO6 to PO12 as moderate (2).

CO2: Analyze communication skills clearly and concisely in formal and informal conversations.

Action Verb: Analyze (L4)
CO2 Action Verb Analyze is of BTL 4. Using Thumb rule, L4 correlates PO6 to PO12 as high (3)

CO3: Apply and communicate the information through drafting, editing and presentation .
Action Verb: Apply (L3)
CO3 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

CO4: Apply interpersonal skills in appropriate manner towards the growth of best career.
Action Verb: Apply (L3)
CO4 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

CO5: Apply sentence structures using correct vocabulary and without any grammatical errors.
Action Verb: Apply (L3)
CO5 Action Verb Apply is of BTL 3. Using Thumb rule, L3 correlates PO6 to PO12 as moderate (2).

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES::TIRUPATI
(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: IV / VII**
Branch of Study: EEE

Course Name: FUNDAMENTALS OF USING AI TOOLS
Course Code: 20ASC0204

L	T	P	Credits
1	0	2	2

COURSE OUTCOMES: After studying of the course, Student will be able to:
CO1: Analyze AI powered features for MS Office tools.
CO2: Apply the required procedures and installation AI tools in desktop/laptop.
CO3: Analyze the operation of Chat GPT tools for documentation applications.
CO4: Apply AI Tools for research article drafting and generate an article.
CO5: Apply AI tools to generate Python and MATLAB codes.

CO	Action Verb	Knowledge Statement	Condition	Criteria	Bloom's level
CO1	Analyze	AI powered features for MS Office tools.			L4
CO2	Apply	The required procedures and installation AI tools in desktop/laptop.			L3
CO3	Analyze	The operation of Chat GPT tools for documentation applications.			L4
CO4	Apply	AI Tools for research article drafting and generate an article.			L3
CO5	Apply	AI tools to generate Python and MATLAB codes.			L3

SYLLABUS:

List of Experiments

Introduction to the use AI tools for MS Office applications. (CO1)

Installation of ChatGPT and Monica plugins and activate accounts. (CO2)

Generate 2 pages curriculum vitae using ChatGPT. (CO3)

Generate a research article for any one experiment of Machines-1 lab course. (CO4)

Draft a research article using a base paper to suit the needs for Project work of next semester. (CO4)

Generate python codes for Fibonacci series. (CO5)

Generate MATLAB program for speed control of Induction motor. (CO5)

REFERENCES:

1. Microsoft Office AI: This online training program by Microsoft covers a range of AI topics such as data analytics, machine learning, and natural language processing. The program is free to access and offers a self-paced curriculum that allows individuals to learn at their

own pace.

2. Office 365 AI: This LinkedIn Learning Course focuses on how to utilize AI tools within the Microsoft Office Suite, such as Excel's Power Query add-in or PowerPoint's Designer tool. The course is designed for beginners and helps individuals learn how to leverage important AI-powered features in MS Office applications.
3. AI in Office Hours: This is a YouTube playlist by Microsoft Office that features short videos demonstrating how to use AI-powered features in Microsoft Office for business, education, and personal use. It is a great resource for individuals who want to see practical examples of how AI tools work in Microsoft Office.
4. Office Insiders: This community-based program is for dedicated Microsoft Office users that offers early access to new features, priority support and the ability to provide feedback to the Office team, among other benefits. Members of the program can access AI-powered features before they are made available to the general public and can provide valuable feedback to improve these tools.
5. MS Office AI Blog: The official Microsoft Office blog shares updates on AI development tools, as well as real-world examples showing how its AI services are making an impact. This is a useful resource for staying up-to-date on the latest developments in AI for Microsoft Office.
6. Microsoft AI School: This is an online resource that provides learning materials about AI, including modules specifically designed for MS Office. The modules cover a range of AI topics and are designed to be accessible for individuals with different backgrounds.
7. AI4AXLS: This YouTube channel features practical applications of Excel and other Office tools combined with AI. The channel shares tutorials and examples of how individuals can use AI to enhance their Excel experience.
8. Neural Networks Demystified (Python version): A YouTube series that teaches the of neural networks and deep learning using Python. The videos are beginner-friendly and cover topics such as gradient descent, backpropagation, and convolutional neural networks.
9. Python for Data Science Handbook: This book by Jake Vanderplas covers the basics of Python programming and its application in data science. The book includes examples and exercises and covers important topics such as NumPy, Pandas, and machine learning libraries such as Scikit-learn.
10. Basics of MATLAB and Beyond: This LinkedIn Learning course provides an introduction to MATLAB and its application in engineering and sciences. The course covers topics such as data analysis, visualization, and control design.
11. MATLAB Onramp: This is a free interactive course offered by MathWorks that teaches the basics of MATLAB. The course covers the basics of MATLAB syntax, visualization, and programming. It is a great starting point for anyone looking to learn MATLAB.
12. Hands-On Machine Learning with Scikit-learn and TensorFlow: This book by Aurélien Géron provides a practical guide to machine learning using Python. The book includes examples and exercises and covers important topics such as clustering, classification, and regression.
13. Applied Data Science with Python Specialization: A Coursera course offered by the University of Michigan that covers the application of Python in data science. The course covers topics such as data visualization, machine learning, and text analysis.

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Program: B. Tech **Regulation: AK20** **Year/Semester: IV / VII**
Branch of Study: EEE

Mapping of course outcomes with program outcomes

Course Title	COs	Programme Outcomes (POs) & Programme Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
FUNDAMENTALS OF USING AI TOOLS	CO1	3				3							1		1
	CO2	3				3							1		1
	CO3	3				3							1		1
	CO4	3				3							1		1
	CO5	3				3							1		1

Justification Table:

CO	CO		Program Outcome (PO)	PO(s): Action verb and BTL (for PO1 to PO5)	Level of Correlation (0-3)
	Verb	BTL			
1	Analyze	L4	PO1, PO5, PO12	PO1:Apply(L3) PO5:Apply(L3) PO12: Thumb Rule	3 3 1
2	Apply	L3	PO1, PO5, PO12	PO1:Apply(L3) PO5:Apply(L3) PO12: Thumb Rule	3 3 1
3	Analyze	L4	PO1, PO5, PO12	PO1:Apply(L3) PO5:Apply(L3) PO12: Thumb Rule	3 3 1
4	Apply	L3	PO1, PO5, PO12	PO1:Apply(L3) PO5:Apply(L3) PO12: Thumb Rule	3 3 1
5	Apply	L3	PO1, PO5, PO12	PO1:Apply(L3) PO5:Apply(L3) PO12: Thumb Rule	3 3 1

CO1:- Analyze AI powered features for MS Office tools.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO1 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply (L3)
CO1 Action Verb is greater than PO5 verb by one level; Therefore correlation is high (3).
PO12: Using thumb rule CO1 correlates with PO12 is low (1).

CO2: Apply the required procedures and installation AI tools in desktop/laptop.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO2 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO5: Apply (L3)
CO2 Action Verb is equal to PO5 verb; Therefore correlation is high (3).
PO12: Using thumb rule CO2 correlates with PO12 is low (1).

CO3: Analyze the operation of Chat GPT tools for documentation applications.

Action Verb: Analyze (L4)
PO1: Apply (L3)
CO3 Action Verb is greater than PO1 verb by one level; Therefore correlation is high (3).
PO5: Apply (L3)
CO3 Action Verb is greater than PO5 verb by one level; Therefore correlation is high (3).
PO12: Using thumb rule CO3 correlates with PO12 is low (1).

CO4: Apply AI Tools for research article drafting and generate an article.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO4 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO5: Apply (L3)
CO4 Action Verb is equal to PO5 verb; Therefore correlation is high (3).
PO12: Using thumb rule CO4 correlates with PO12 is low (1).

CO5: Apply AI tools to generate Python and MATLAB codes.

Action Verb: Apply (L3)
PO1: Apply (L3)
CO5 Action Verb is equal to PO1 verb; Therefore correlation is high (3).
PO5: Apply (L3)
CO5 Action Verb is equal to PO5 verb; Therefore correlation is high (3).
PO12: Using thumb rule CO5 correlates with PO12 is low (1).

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(AUTONOMOUS)
Department of Electrical and Electronics Engineering
Program: B. Tech **Regulation: AK20** **Year/Semester: IV / VIII**
Branch of Study: EEE

Course Name: Project Work
Course Code: 20APR0203

L	T	P	Credits
0	0	0	9

1. Introduction

The B. Tech Electrical and Electronics Engineering project work is a critical component of the curriculum designed to provide students with hands-on experience in solving real-world engineering problems. This policy document outlines the objectives, guidelines, procedures, and assessment criteria for the project work.

2. Objectives:

To apply theoretical knowledge to practical problems.
To develop skills in research, design, and implementation.
To enhance teamwork and project management abilities.
To foster innovation and creativity in engineering solutions.
To prepare students for professional engineering practice.

3. Course Outcomes:

After completion of the course, students must be able to,
CO1: Apply theoretical and practical knowledge in Electrical & Electronics engineering to design and develop innovative project.
CO2: Analyze complex engineering problems, identify feasible solutions and implement the best possible approach using modern engineering tools and techniques.
CO3: Create an effective plan, manage and execute project activities, ensuring adherence to timelines, resource constraints and project specifications.
CO4: Develop strong communication skills by preparing detailed project reports, deliver concise presentation.
CO5: Identify sustainable and eco-friendly engineering solutions, following ethical standards to deploy the project.

4. Project Work Structure

Duration: Final semester of the course.
Credits: Allocated as per the academic regulations of the institution.
Types of Projects: Research-based, design-oriented, industry-sponsored or interdisciplinary.

5. Project Selection

Topics: Students can select topics based on their interests, industry trends or faculty suggestions.
Batch: Project batches are allotted as per the percentage of marks obtained till III B. Tech – II Semester and also ensuring that at least one fast learner is present in each batch. Recommended Project batch/team size is maximum of four (4) students (allowed up to 5 if necessary).
Approval: HOD constitutes an Internal Department committee (IDC). All project topics must be approved by the Internal Department committee (IDC).

6. Supervisor Allocation

- Each project will be supervised by a faculty member from the EEE department.
- Project guides will guide students throughout the project, providing technical and academic support.
- IDC will approve the allocation of Faculty as supervisor / guide to the project batches.

7. Project Execution

Regular Meetings: Students must meet with their Project guides regularly to discuss progress and receive feedback.
Documentation: Maintain detailed records of project activities, including design documents, experimental data and progress reports.
Milestones: Projects must adhere to defined milestones and timelines as published in the Academic calendar of the Institution.

8. Report: A comprehensive final report must be submitted, documenting the entire project work.
Presentation: Students must present their work to a panel of faculty members and external examiners, if applicable.

11. Assessment Criteria

Technical Content: Originality, complexity, and depth of the project.
Methodology: Appropriateness and rigor of the research/design methodology.
Implementation: Quality of the design, implementation, and testing.
Documentation: Clarity, organization, and thoroughness of the project report.
Presentation: Effectiveness of the oral presentation and response to questions.
Teamwork: Collaboration and contribution of each team member.

12. Assessment method:

- Total marks for the project evaluation is 200.
- External Marks are completely awarded by the External Examiner during project Viva-Voce (140 marks).
- Internal Marks are awarded by the IDC (60 Marks).
- IDC schedules the project review and evaluation dates.
- The evaluation is conducted through conduct of two reviews.
- Review – 1 is conducted for assessing Abstract, Analysis and problem identification.
- In review-1 students of the Project batch have to deliver Introduction, Statement of the problem, Objectives, Scope, Literature survey, Rival Methods, Software and Hardware Requirements, Physical Model, Mathematical Model, Network Model (If necessary),
- Review-2 will be conducted after two months from the day/date of Review-1.
- Assessment during reviews takes into account the grading of students through various parameters (Rubrics) that are mapped to COs, POs and PSOs.

13. Submission Deadlines

- Adherence to submission deadlines for proposals, interim reports, final reports, and presentations is mandatory.
- Extensions may be granted only under exceptional circumstances with proper justification.

14. Feedback and Evaluation

- Students will receive constructive feedback from Project guides and review committees.
- Final grades will be assigned based on the overall performance throughout the project duration as advised in point 12.

15. Conclusion

The B. Tech EEE project work is an opportunity for students to integrate their knowledge and skills in a practical setting. This policy document ensures a structured and fair approach to managing and assessing project work, thereby enhancing the educational experience and preparing students for their professional careers.

Mapping of course outcomes with program outcomes

Course Title	COs	Program Outcomes(POs) & Program Specific Outcomes (PSOs)													
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
Project Work	CO1	3	3	3	3	3	0	1	0	0	0	0	1	3	3
	CO2	3	3	3	3	3	2	1	0	0	0	0	2	3	3
	CO3	2	2	2	2	1	2	1	1	3	2	3	2	2	2
	CO4	2	1	1	1	1	1	1	1	2	3	0	3	1	0
	CO5	1	1	1	1	1	3	3	3	1	0	0	2	0	0