DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Periyar Nagar, Vallam, Thanjavur - 613 403, Tamil Nadu, India
Phone: +91 - 4362 - 264600 Fax: +91- 4362 – 264660
Email: headeee@pmu.edu Web: www. pmu.edu

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
PMIST

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

Board of Studies in Electrical and Electronics Engineering (Part Time)

Curriculum (From I – VII Semesters) & Syllabus (From I –IV Semesters)

(For the candidates admitted from 2018-19 onwards
Based on Outcome Based Education)

FOR

B.Tech. Degree Programme
(Electrical and Electronics Engineering)

UNIVERSITY VISION & MISSION

VISION	To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.	
MISSION	**UM1**	Offering well balanced Programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.
	UM2	Providing student - centred education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.
	UM3	Involving progressive and meaningful research with concern for sustainable development.
	UM4	Enabling the students to acquire the skills for global competencies.
	UM5	Inculcating Universal values, Self respect, Gender equality, Dignity and Ethics.

CORE VALUES

- Student – centric vocation
- Academic excellence
- Social Justice, equity, equality, diversity, empowerment, sustainability
- Skills and use of technology for global competency.
- Continual improvement
- Leadership qualities.
- Societal needs
- Learning, a life – long process
- Team work
- Entrepreneurship for men and women
- Rural development
- Basic, Societal, and applied research on Energy, Environment, and Empowerment.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION	To become a leader in providing education, training and research in the field of Electrical and Electronics Engineering to the aspiring graduates to be competent in their profession and render best service to the society.	
MISSION	**DM1**	To provide affordable, quality undergraduate and graduate education in the areas of electrical engineering.
	DM2	To provide service to the profession, the university, the community, and society
	DM3	To conduct scholarly research at the frontiers of electrical engineering.
	DM4	To instill our graduates the need for life-long learning
	DM5	To promote personal and intellectual growth to reinforce a commitment to ethical and professional practices.

TABLE 1: MAPPING OF UNIVERSITY MISSION (UM) AND DEPARTMENT MISSION (DM)

	DM1	DM2	DM3	DM4	DM5
UM1	**3**	**1**	**1**	**0**	**0**
UM2	**1**	**3**	**1**	**0**	**0**
UM3	**0**	**2**	**3**	**2**	**0**
UM4	**0**	**0**	**2**	**3**	**1**
UM5	**0**	**1**	**0**	**1**	**3**

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Based on the mission of the department, the programme educational objectives is formulated as

PEO1	Our Graduates are professionally competent and apply the concept of mathematics, science and engineering to solve problem in Electrical and Electronics Engineering and related fields.
PEO2	Our Graduates stay relevant in their chosen profession through lifelong learning and demonstrate social and ethical responsibility.

TABLE 2: MAPPING OF PROGRAM EDUCATIONAL OBJECTIVES (PEOs) WITH DEPARTMENT MISSION (DM)

	DM 1	DM 2	DM 3	DM 4	DM 5
PEO 1	2	0	1	1	1
PEO 2	1	3	1	3	3
	3	**3**	**2**	**4**	**4**

1- Low 2 – Medium 3-High

GRADUATE ATTRIBUTES (GAs)

1. **Knowledge base for Engineering:** Demonstrate competence in mathematics, natural sciences, engineering fundamentals and specialized engineering knowledge appropriate to the programme.
2. **Analytical Skills:** Identify, formulate, analyze and solve diverse engineering problems.
3. **Design:** Solution for complicated open–ended engineering problems and design the components with appropriate standards to meet specified needs with proper attention to public health, safety, environment and society.
4. **Experimental Investigation:** Technical skills to conduct investigation, interpretation of observed data and provide solution for multifaceted problems.
5. **Modern Engineering tools usage**: Acquire, select, manipulate relevant techniques, resources and advanced engineering ICT tools to operate simple to complex engineering activities.
6. **Impact of engineering on society:** Provide a product / project for use by the public towards their health, welfare, safety and legal issues to serve the society effectively.
7. **Environment and Sustainability:** Design eco-friendly and sustainable products in demonstrating the technology development to meet present and future needs.
8. **High Ethical Standards:** Practice ethical codes and standards endorsed by professional engineers.
9. **Leadership and team work:** Perform as an individual and as a leader in diverse teams and in multi-disciplinary scenarios.

10. **Communication Skills:** Professional communication with the society to comprehend and formulate reports, documentation, effective delivery of presentation and responsible to clear instructions.
11. **Project management and Finance:** Appropriate in incorporating finance and business practices including project, risk and change management in the practice of engineering by understanding their limitations.
12. **Life-long learners:** Update the technical needs in a challenging world in equipping themselves to maintain their competence.

PROGRAMME OUTCOMES (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, to the solution of complex problems in Electrical and Electronics Engineering.

2. Identify, formulate, research literature and analyze complex Electrical and Electronics Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design solutions for complex Electrical and Electronics Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions, related to Electrical and Electronics Engineering.

5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex Electrical and Electronics Engineering activities with an understanding of the limitations.

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

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

8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Ability to design and answer the problems in the field of Power Engineering by applying the knowledge acquired from Electrical Machines, Power Electronics, Electric Circuit Analysis, Power Systems & other related topics.
PSO2	Graduates will be able to develop and support Renewable based systems.

TABLE 3: MAPPING OF PROGRAM EDUCATIONAL OBJECTIVES (PEOs) WITH PROGRAM OUTCOMES (POs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO 1	3	3	3	2	2	1	1	1	1	2	2	1
PEO 2	3	2	1	3	1	3	3	2	3	2	2	3

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

STRUCTURE OF B.TECH.
ELECTRICAL AND ELECTRONICS ENGINEERING PROGRAMME

Sl.No.	Category	Implementation in Curriculum 2018
1.	Humanities and Social Sciences including Management courses	06
2.	Basic Science courses	14
3.	Professional core courses	47
4.	Professional Elective courses relevant to chosen specialization/branch	18
5.	Project work, seminar and internship in industry or elsewhere and minor courses	12
6.	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	06
	Total	**103**

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

SL. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1.		Industrial Economics and Foreign Trade	3:0:0	3	V
2.		E-Waste Management	3:0:0	3	VI
Total				**6**	

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1.		Calculus and Differential Equations	3:1:0	4	I
2.		Applied Physics for Engineers	3:1:0	3	I
3.		Applied Chemistry for Engineers	3:0:0	3	I
4.		Calculus, Ordinary Differential Equations and Complex Variable	3:1:0	4	II
Total				**14**	

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PROFESSIONAL CORE COURSES TRACKS
ELECTRICAL AND ELECTRONICS ENGINEERING [PEC-EE]

Sl. No	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Semester
1		Electrical Circuit Analysis	3:1:0	4	I
2		Electric Circuits Laboratory	0:0:2	1	
3		Electromagnetic Fields	3:1:0	4	II
4		Analog Electronics	3:0:0	3	
5		Electrical Machines-I	3:0:0	3	
6		Electrical Machines-I Laboratory	0:0:2	1	
7		Transmission and Distribution	3:0:0	3	III
8		Signals and System	2:1:0	3	
9		Electrical Machines-II	3:0:0	3	
10		Electrical Machines-II Laboratory	0:0:2	1	
11		Digital Electronics	3:0:0	3	IV
12		Power Electronics	3:0:0	3	
13		Power Electronics Laboratory	0:0:2	1	
14		Power Systems – I (Apparatus and Modelling)	3:0:0	3	V
15		Control Systems	3:0:0	3	
16		Control Systems Laboratory	0:0:2	1	
17		Power Systems –II (Operation and Control)	3:0:0	3	VI
18		Microprocessors and microcontrollers	3:0:0	3	
19		Microprocessors & Microcontrollers Laboratory	0:0:2	1	
Total				**47**	

PROFESSIONAL ELECTIVE COURSE TRACKS-
ELECTRICAL AND ELECTRONICS ENGINEERING [PEC-EE]

Sl. No	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1		Protection Switchgear	3:0:0	3	IV onwards
2		High Voltage Engineering	3:0:0	3	IV onwards
3		Embedded System	3:0:0	3	IV onwards
4		Line Commutated and Active Rectifiers	3:0:0	3	IV onwards
5		Electrical Drives	3:0:0	3	V onwards
6		Electrical Machine Design	3:0:0	3	V onwards
7		Electrical Energy Conservation and Auditing	3:0:0	3	V onwards
8		Industrial Electrical Systems	3:0:0	3	V onwards
9		Digital Control Systems	3:0:0	3	V onwards
10		Digital Signal Processing	3:0:0	3	V onwards
11		Computer Architecture	3:0:0	3	VI onwards
12		Electromagnetic Waves	3:0:0	3	VI onwards
13		Computational Electromagnetics	3:0:0	3	VI onwards
14		Eco Power Generation	3:0:0	3	VI onwards
15		Power System Dynamics and Control	3:0:0	3	VI onwards
16		HVDC Transmission Systems	3:0:0	3	VII onwards
17		Bio Medical Instrumentation	3:0:0	3	VII onwards
18		Wind and Solar Energy Systems	3:0:0	3	VII onwards
19		Power Plant Engineering	3:0:0	3	VII onwards
20		Energy Auditing and Management	3:0:0	3	VII onwards

PROJECT WORK & INTERNSHIP IN INDUSTRY

SL. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1		Main Project	0:0:16	12	VII
Total				**12**	

MANDATORY COURSES

SL. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1		Environmental Sciences	3:0:3	3	III
2		Disaster Management	3:0:3	3	VI
Total				**6**	

SEMESTER-WISE STRUCTURE OF CURRICULUM
REGULATIONS – 2018
(Applicable to the students admitted from the Academic year 2018-19)

CURRICULUM 2018

SEMESTER I

Code No.	Course Title	L	T	P	TCH	C
PMA 101	Calculus and Linear Algebra	3	1	0	4	4
PAP 102	Applied Physics for Engineers	3	1	0	4	4
PAC 103	Applied Chemistry for Engineers	3	1	0	4	4
PEE 104	Electric Circuit Analysis	3	1	1	6	5
		12	**4**	**1**	**16**	**17**

SEMESTER II

Code No.	Course Title	L	T	P	TCH	C
	Calculus, Ordinary Differential Equations and Complex Variable	3	1	0	4	4
	Electromagnetic Fields	3	1	0	4	4
	Analog Electronics	3	0	0	3	3
	Electrical Machines-I	3	0	2	5	4
		12	**2**	**2**	**16**	**15**

SEMESTER III

Code No.	Course Title	L	T	P	TCH	C
	Transmission and Distribution	3	0	0	3	3
	Environmental Science	3	0	0	3	3
	Signals and System	2	1	0	3	3
	Electrical Machines-II	3	0	2	5	4
		11	**1**	**2**	**14**	**13**

SEMESTER IV

Code No.	Course Title	L	T	P	TCH	C
	Digital Electronics	3	0	0	3	3
	Professional Elective-1	3	0	0	3	3
	Professional Elective-2	3	0	0	3	3
	Power Electronics	3	0	2	5	4
		12	**0**	**2**	**14**	**13**

SEMESTER V

Code No.	Course Title	L	T	P	TCH	C
	Power Systems – I (Apparatus and Modeling)	3	0	0	3	3
	Professional Elective-3	3	0	0	3	3
	Industrial Economics and Foreign Trade	3	0	0	3	3
	Control Systems	3	0	2	5	4
		12	**0**	**2**	**14**	**13**

SEMESTER VI

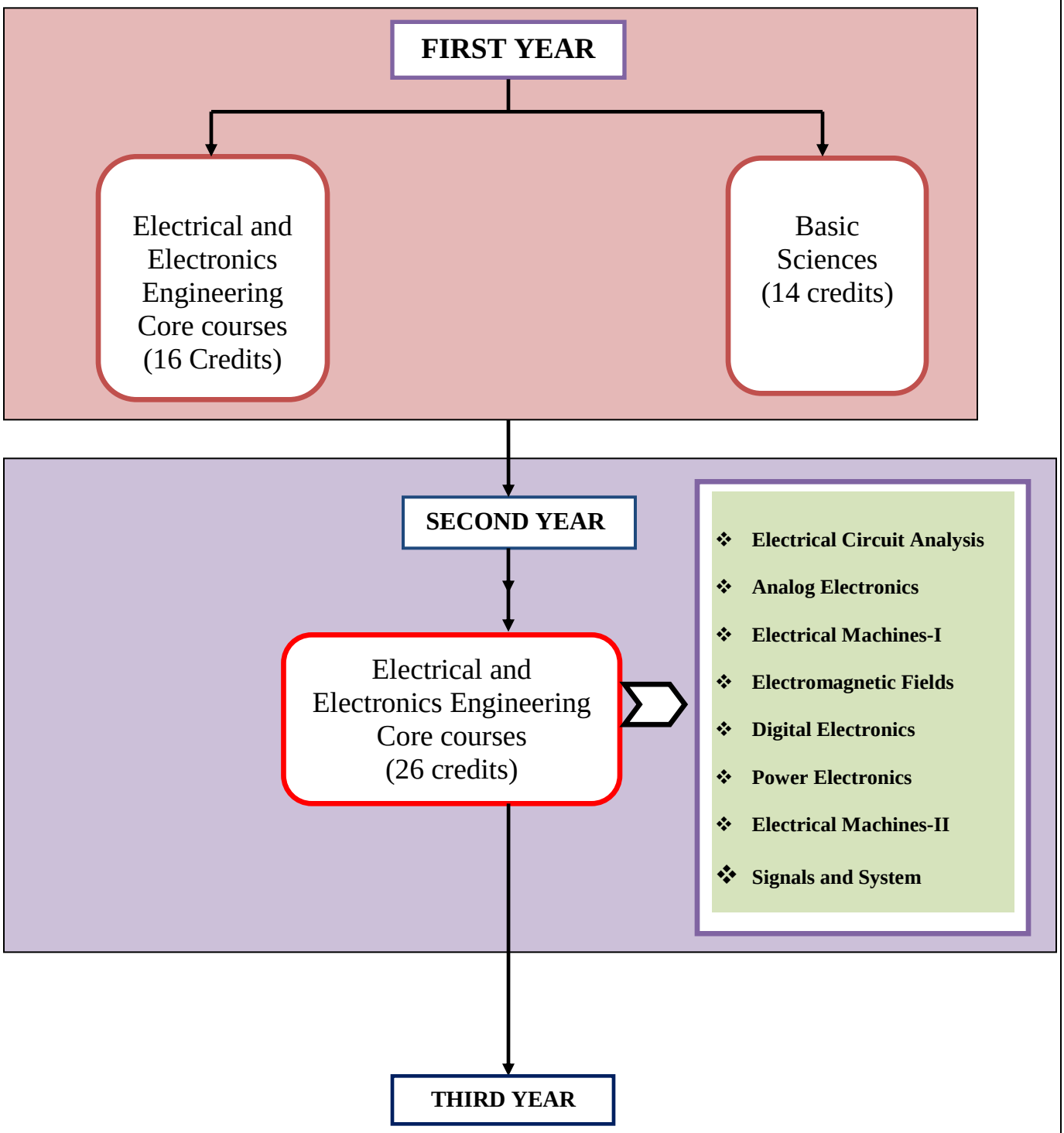
Code No.	Course Title	L	T	P	TCH	C
	Power Systems –II (Operation and Control)	3	0	0	3	3
	E-Waste Management	3	0	0	3	3
	Disaster Management	3	0	0	3	3
	Microprocessors and Microcontrollers	3	0	2	5	4
		12	**0**	**2**	**14**	**13**

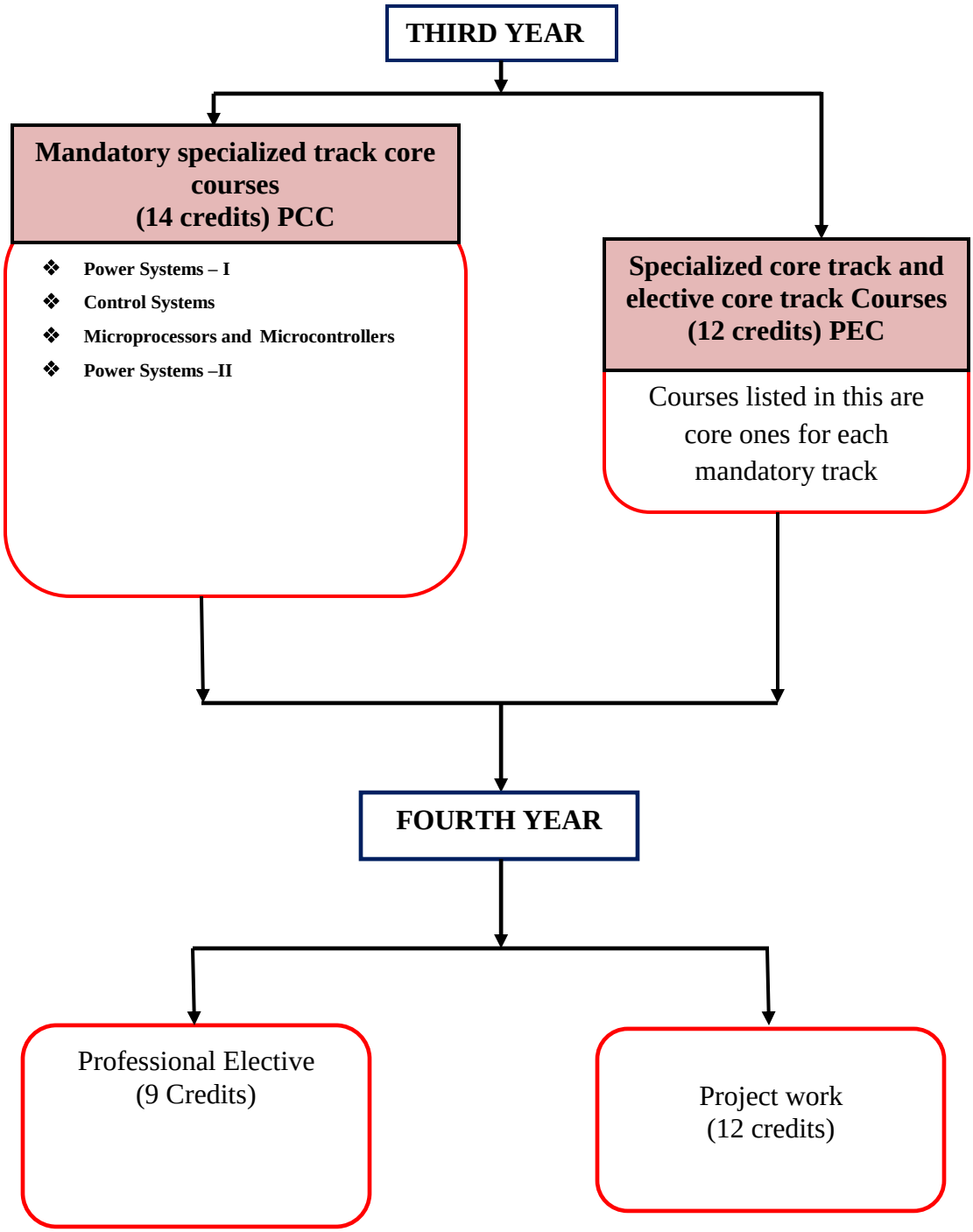
SEMESTER VII

Code No.	Course Title	L	T	P	TCH	C
	Professional Elective-4	3	0	0	3	3
	Professional Elective-5	3	0	0	3	3
	Professional Elective-6	3	0	0	3	3
	Main Project	0	0	16	16	12
		9	**0**	**16**	**25**	**21**

OVER ALL CREDITS = 103CREDITS

FLOW CHART FOR THE ENTIRE PROGRAMME




THIRD YEAR
Mandatory specialized track core courses
(14 credits) PCC
Power Systems – I
Control Systems
Microprocessors and Microcontrollers
Power Systems –II
Specialized core track and elective core track Courses
(12 credits) PEC
Courses listed in this are core ones for each mandatory track
FOURTH YEAR
Professional Elective
(9 Credits)
Project work
(12 credits)

SYLLABUS 2018

REGULATION 2018

SEMESTER I

COMMON TO ALL BRANCHES

COURSE CODE			COURSE NAME	L	T	P	C
PMA 101			CALCULUS AND LINEAR ALGEBRA	3	1	0	4
C	P	A		L	T	P	H
3	0.5	0.5		3	1	0	4

PREREQUISITE: Differentiation and Integration

COURSE OUTCOMES:

COURSE OUTCOMES	DOMAIN	LEVEL
CO1: Apply orthogonal transformation to reduce quadratic form to canonical forms.	Cognitive	Remembering Applying
CO2: Apply power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series.	Cognitive Psychomotor	Applying Remembering Guided Response
CO3: Find the derivative of composite functions and implicit functions. Euler's theorem and Jacobian	Cognitive Psychomotor	Remembering Guided Response
CO4: Explain the functions of two variables by Taylors expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence.	Cognitive Affective	Remembering Understanding Receiving
CO5: Apply Differential and Integral calculus to notions of Curvature and to improper integrals.	Cognitive	Applying

UNIT I MATRICES	**12**
Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only).	
UNIT II SEQUENCES AND SERIES	**12**
Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test-. Fourier series: Half range sine and cosine series- Parseval's Theorem.	
UNIT III MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION	**12**
Limit and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian.	

UNIT IV MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND	**12**

VECTOR CALCULUS	
Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables: with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl.	
UNIT V DIFFERENTIAL AND INTEGRAL CALCULUS	**12**
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

Text Books:

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit I, Unit III and Unit IV).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit II).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit V).**

Reference Books:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

COs Versus GAs mapping

Table 1: Mapping of Cos with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2			2					1		2
CO 2	3	2								1		1
CO 3	3	2								1		1
CO 4	3	2								1		1
CO 5	3	2			1					1		2
	15	10	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

APPLIED PHYSICS FOR ENGINEERS

COURSE CODE	COURSE NAME	L	T	P	C
PAP 102	APPLIED PHYSICS FOR ENGINEERS	3	1	0	4
C:P:A	3:1:0	L	T	P	H
PREREQUISITE:	Basic Physics in HSC level	3	1	0	4

COURSE OUTCOMES		Domain	Level
CO1	**Identify** the basics of mechanics, **explain** the principles of elasticity and **determine** its significance in engineering systems and technological advances.	Cognitive	Remember Understand
CO2	**Illustrate** the laws of electrostatics, magneto-statics and electromagnetic induction; **use** and **locate** basic applications of electromagnetic induction to technology.	Cognitive	Remember Analyze
CO3	**Understand** the fundamental phenomena in optics by measurement and **describe** the working principle and application of various lasers and fibre optics.	Cognitive	Understand Apply
CO4	**Analyse** energy bands in solids, **discuss** and **use** physics principles of latest technology using semiconductor devices.	Cognitive	Understand Analyze
CO5	**Develop** Knowledge on particle duality and **solve** Schrodinger equation for simple potential.	Cognitive	Understand Apply

UNIT I MECHANICS OF SOLIDS **9+3**

Mechanics: Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.

Elasticity: Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending.

UNIT II ELECTROMAGNETIC THEORY **9+3**

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarisation, Dielectric constant, internal field - Clausius Mossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for plane, circularly and elliptically polarized light - quarter and half wave plates - production and detection of plane, circularly and elliptically polarized light.

UNIT III OPTICS, LASERS AND FIBRE OPTICS **9+3**

Optics: Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating.

LASER: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - CO_2 laser - Applications

Fibre Optics: Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system (Block diagram).

UNIT IV SEMICONDUCTOR PHYSICS	9+3

Semiconductors: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.

Diodes and Transistors: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

UNIT V QUANTUM PHYSICS	9+3

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.
2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010.

REFERENCE BOOKS

1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.

E RESOURCES

NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

REFERENCE BOOKS

1. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd, 2008.
2. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	0	60

COURSE CODE	COURSE NAME	L	T	P	C
PAC 103	APPLIED CHEMISTRY FOR ENGINEERS	3	1	0	4
PREREQUISITES	Nil	L	T	P	H
C:P:A	3:1:0	3	1	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Identify** the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. **Describe** the various water quality parameters like hardness and alkalinity.	Cognitive	Remember
CO2	**Explain** and **Measure** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive	Understand
CO3	**Interpret** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive	Apply
CO4	**Describe, Illustrate** and **Discuss** the chemical reactions that are used in the synthesis of molecules.	Cognitive	Remember Analyze
CO5	**Apply, Measure** and **Distinguish** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive	Remember Apply

UNIT I	PERIODIC PROPERTIES AND WATER CHEMISTRY	9+3

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity.

UNIT II	USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA	9+3

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion-Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB).

UNIT III	ATOMIC AND MOLECULAR STRUCTURE	9+3

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles.. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Intermolecular forces and potential energy surfaces

Ionic, dipolar and Vander waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

UNIT IV	SPECTROSCOPIC TECHNIQUES AND APPLICATIONS	9+3

Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering.

UNIT V	STEREOCHEMISTRY AND ORGANIC REACTIONS	9+3

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization reactions and ring opening reactions. Synthesis of a commonly used drug molecule-Aspirin and paracetamol.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
Hours	45	15	0	60

TEXT BOOKS

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.
3. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
7. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd. New Delhi, 1977.
8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

REFERENCE BOOKS

1. Puri B R Sharma L R and Madan S Pathania, " Principles of Physical Chemistry", Vishal publishing Co., Edition 2004
2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

E Resources - MOOCs:

1. http://www.mooc-list.com/course/chemistry-minor-saylororg
2. https://www.canvas.net/courses/exploring-chemistry
3. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
4. http://freevideolectures.com/Course/3001/Chemistry-I
5. http://freevideolectures.com/Course/3167/Chemistry-II
6. http://ocw.mit.edu/courses/chemistry/

REFERENCE BOOKS

1. Mendham, Denney R.C,. Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.

2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. “Experiments in Physical Chemistry”, 8th Ed.; McGraw-Hill: New York, 2003.

E Resources - MOOCs:

1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques

2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011

3.http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

ELECTRICAL CIRCUIT ANALYSIS

Course Outcomes		Domain	Level
CO1	Cog (app.): Apply network theorems for the analysis of electrical circuits. Psy (GR): Respond network theorems for the analysis of electrical circuits.	Cognitive Psychomotor	Apply Guided Response
CO2	Cog (U): Comparing the transient and steady-state response of R, RL and RLC electrical circuits. Psy (P): Describe the transient and steady-state response of RL and RC electrical circuits.	Cognitive Psychomotor	Understand Perception
CO3	Cog (Anl.): Analyze circuits in the sinusoidal steady-state (single-phase and three-phase). Psy (M.): Construct and analyze of Single-phase transformer for its Sinusoidal response	Cognitive Psychomotor	Analyze Mechanism
CO4	Cog (Anl.): Laplace transforms analysis of ac circuits. Psy (M.): Construct and analyze of RLC Series and parallel resonance circuits.	Cognitive Psychomotor	Analyze Mechanism
CO5	Cog (U): To Understand the concept of one port and two port network functions.	Cognitive	Understanding

SUBCODE	SUB NAME	L	T	P	C
	ELECTRICAL CIRCUIT ANALYSIS	**3**	**1**	**1**	**5**
C:P:A = 3:1:0		**L**	**T**	**P**	**H**
		3	**1**	**2**	**6**

UNIT I NETWORK THEOREMS **9+3+3**

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

LIST OF EXPERIMENTS

1.Verification of KVL and KCL using hardware and Digital simulation
2.Verification of Thevenin theorem by hardware and Digital simulation
3.Verification of Norton theorem by hardware and Digital simulation
4.Verification of Maximum power transfer theorem by hardware and Digital simulation

UNIT II SOLUTION OF FIRST AND SECOND ORDER NETWORKS **9+3+3**

Solution of first and second order differential equations for Series and parallel R-L, R-C, RL-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

LIST OF EXPERIMENTS

5.Transient analysis of Series RL, RC circuits by hardware and Digital simulation
6.Sinusoidal analysis of Series RL, RC circuits by hardware and Digital simulation

UNIT III SINUSOIDAL STEADY STATE ANALYSIS **9+3+3**

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

LIST OF EXPERIMENTS

7.Measurement of active power for star and delta connected balanced loads

8.Verification of self , mutual inductance and coefficient of coupling by using hard ware and Digital simulation

UNIT IV ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS	**9+3+3**

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

LIST OF EXPERIMENTS

9. RLC Series and parallel Resonance by hardware and Digital simulation

UNIT V NETWORK FUNCTIONS AND TWO PORT NETWORK	**9+3+3**

Concepts of complex frequency, Transform impedance, Networks function of one port and two port network, concepts of poles and zeros, property of driving point and transfer function. Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**15**	**15**	**75**

TEXTBOOKS

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.

REFERENCES

1. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.

E REFERENCES

1. NPTEL :http://nptel.ac.in/courses/108102042/
2. MOODLE : http://moodle.cecs.pdx.edu/course/view.php?id=16

REFERENCES

1. Department Lab Manual
2. Sudhakar.A and ShyamMohan.S.P, "Circuits and Networks Analysis and Synthesis", Fourth edition, Tata McGraw Hill Publishing Company Ltd., NewDelhi, 2010.

COs VERSUS POs MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PEO1**	**PEO2**
CO 1	3									1		1	1	1
CO 2	3									1		1	2	1
CO 3	3	2								1	1	2	3	1
CO 4	3	2			1					1	1	1	3	3
CO 5	3	2			1					1	1	1	2	2
	15	6	0	0	2	0	0	0	0	5	3	6	11	8

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

SEMESTER II

CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE

COURSE CODE			COURSE NAME	L	T	P	C
XMA201			CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE	3	1	0	4
C	P	A		L	T	P	H
4	0	0		3	1	0	4

PREREQUISITE: Mathematics I (Calculus and Linear Algebra)

COURSE OUTCOMES:	DOMAIN	LEVEL
CO1: Find double and triple integrals and to find line, surface and volume of an integral by **Applying** Greens, Gauss divergence and Stokes theorem.	Cognitive	Applying Remembering
CO2: Solve first order differential equations of different types which are solvable for p, y, x and Clairaut's type.	Cognitive	Applying
CO3: Solve Second order ordinary differential equations with variable coefficients using various methods.	Cognitive	Remembering
CO4: Use CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation.	Cognitive Psychomotor	Understanding Remembering Guided Response
CO5: Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series.	Cognitive Affective	Applying Receiving

UNIT I MULTIVARIABLE CALCULUS (INTEGRATION)	12
Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes.	
UNIT II FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	**12**
Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equations solvable for p - equations solvable for y- equations solvable for x and Clairaut's type.	
UNIT III ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS	**12**
Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties.	
UNIT IV COMPLEX VARIABLE – DIFFERENTIATION	**12**
Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and their properties.	
UNIT V COMPLEX VARIABLE – INTEGRATION	**12**

Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)-Liouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

Text Book:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40thth Edition, 2008.

Reference Books:

1.G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3.W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn. Wiley India, 2009.
4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.
5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

Text Book:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40thth Edition, 2008.

Reference Books:

1.G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3.W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn. Wiley India, 2009.
4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.
5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

COs Versus GAs mapping

Table 1: Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2			2					1		2
CO 2	3	1								1		1
CO 3	3	1								1		1
CO 4	3	2								1		1
CO 5	3	2			1					1		2
	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

ELECTROMAGNETIC FIELDS

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Cog(R) Cog(U): To understand the basics of vector and outline different coordinate system.	Cognitive	Remembering Understanding
CO2	Cog(U) :To understand the concept of static electric field for simple configuration using gauss and Coulombs law.	Cognitive	Understanding
CO3	Cog(R): Define the knowledge of electrostatics using, boundary conditions, Poissons and Laplace equation.	Cognitive	Understanding
CO4	Cog(R) Cog(U) : Recall the magnetic field configuration using Different laws and outline time varying electric and magnetic fields using Maxwell's equation .	Cognitive	Remembering Understanding
CO5	Cog(U) : Recall the concept of magnetization and magnetic field configuration using boundary condition.	Cognitive	Understanding

SUB. CODE	SUB NAME	L	T	P	C
	ELECTROMAGNETIC FIELDS	3	1	0	4
C:P:A = 3:0:0		L	T	P	H
		3	1	0	4

UNIT I REVIEW OF VECTOR CALCULUS **9+3**

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

UNIT II STATIC ELECTRIC FIELD **9+3**

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT III CONDUCTORS, DIELECTRICS AND CAPACITANCE **9+3**

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

UNIT IV STATIC MAGNETIC FIELDS,TIME VARYING FIELDS AND MAXWELL'S EQUATIONS **9+3**

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Condit ions. Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic circuits, inductances and mutual inductances.

UNIT V ELECTROMAGNETIC WAVES **9+3**

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation

in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXTBOOKS

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.

REFERENCES

1. W. J. Duffin, " Electricity and Magnetism" , McGraw Hill Publication, 1980.
2. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
3. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press,1966.
4. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
5. W. Hayt, "Engineering Electromagnetics" , McGraw Hill Education, 2012.

REFERENCES

1. NPTEL :http://nptel.ac.in/courses

COs VERSUS POs MAPPING

	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
CO1	2	2	-	1	-	-	-	-	-	1	-	1	1	1
CO2	1	2	-	1	-	-	-	-	-	-	1	-	2	1
CO3	1	2	-	-	-	-	-	-	-	-	-	1	1	2
CO4	1	3	-	-	-	-	-	-	-	-	-	-	2	2
CO5	1	2	1	-	-	-	-		-	-	-	1	1	1
Total	6	11	1	3	0	0	0	0	0	1	1	3	7	7
Scaling	2	3	1	1	0	0	0	0	0	1	1	1	2	2

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

ANALOG ELECTRONICS

Course Outcomes		Domain	Level
CO1	Understand the characteristics of diode and analyze the rectifier circuits.	Cognitive Psychomotor	Understand Analyse Guided Response
CO2	Understand the characteristics of transistor.	Cognitive Psychomotor	Understand Mechanism
CO3	Understand the concept of MOSFET and analyze the circuits and its characteristics	Cognitive Psychomotor	Understand Analyse Mechanism
CO4	Classify and explain different types of amplifier	Cognitive Psychomotor	Understand Mechanism
CO5	Recall and explain linear and non-linear application of OP-Amp	Cognitive Psychomotor	Understand Mechanism

SUBCODE	SUB NAME	L	T	P	C
	ANALOG ELECTRONICS	3	0	0	3
C:P:A = 3:0:0		L	T	P	H
		3	0	0	3

UNIT I DIODE CIRCUITS	**6**
P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, Special diodes, clamping and clipping circuits.	
UNIT II BJT CIRCUITS	**8**
Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.	
UNIT III MOSFET CIRCUITS	**8**
MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.	
UNIT IV DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS	**8**
Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)	
UNIT V LINEAR AND NONLINEAR APPLICATIONS OF OP-AMP	**15**
Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wien bridge and phase shift). Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector, Monoshot.	

	LECTURE	TUTORIAL	TOTAL
	45	0	45

TEXTBOOKS

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.

REFERENCES

1. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
2. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
3. Department Lab Manual.

E REFERENCES

1. www.nptel.ac.in.

COs VERSUS POs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PEO1	PEO2
CO 1	3									1		1		
CO 2	3									1		1		
CO 3	3	2								1	1	2		
CO 4	2	2			1					1	1	1		

ELECTRICAL MACHINES-I

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Understand the operation of dc machines.	Cognitive Psychomotor	Understand Perception
CO2	Understand the winding concepts of DC machine.	Cognitive Psychomotor	Understand Complex Overt Response
CO3	Understand the motoring and generating concepts of dc machine.	Cognitive Psychomotor	Understand Set
CO4	Analyse single phase and three phase transformers circuits.	Cognitive Psychomotor	Analyse Set
CO5	Understand the various loss in magnetic circuits	Cognitive Psychomotor	Understand Set

SUB. CODE	SUB NAME	L	T	P	C
PCC EE303	**ELECTRICAL MACHINES - I**	**3**	**0**	**2**	**4**
C:P:A = 3:0:0		**L**	**T**	**P**	**H**
		3	**0**	**2**	**5**

UNIT I DC MACHINES - INTRODUCTION **9+3**

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.

LIST OF EXPERIMENTS

1. Study of D.C. Motor Starters

UNIT II DC MACHINES – ARMATURE AND WINDING **9+3**

Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

UNIT III DC MACHINE - MOTORING AND GENERATION **8+3**

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

LIST OF EXPERIMENTS

2. Open Circuit Characteristics (OCC) and load Characteristics of D.C self-excited generator.
3. Load characteristics of D.C. shunt generator
4. Load characteristics of D.C. shunt motor
5. Load characteristics of D.C. series motor
6. Speed control of D.C. shunt motor

UNIT IV TRANSFORMERS AND TEST **11+3**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers. losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test- separation of hysteresis and eddy current

losses

LIST OF EXPERIMENTS

7. Load test on single-phase transformer.

8. Open circuit and short circuit tests on single phase transformer.

UNIT V AUTOTRANSFORMERS	**8+3**

Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**0**	**15**	**60**

TEXTBOOKS

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

REFERENCES

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

COs VERSUS POs MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PEO 1**	**PEO 2**
CO 1	3	2	2	2	1				1			1	1	0
CO 2	3	-	2	1				1				1		1
CO 3	3			1				1			1			1
CO 4	3	2	2	2	1		1			1		1		1
CO 5	3			1						1				1
	15	4	6	7	2		1	2	1	2	1	3	1	4

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

SEMESTER III

TRANSMISSION AND DISTRIBUTION

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Explain** the major components of Transmission and Distribution Systems (TDS). **Classify** different types of single and three phase transmission line parameters.	Cognitive	Understanding Understanding
CO2	**Outline** the types of transmission line efficiency calculations and its performance	Cognitive	Understanding
CO3	**Explain** the different types of insulators and **solve** for stress and sag in overhead lines.	Cognitive	Understanding Applying
CO4	**Interpret** different type's underground cables.	Cognitive	Understanding
CO5	**Summarize** the latest technologies in the field of distribution systems.	Cognitive	Understanding

SUBCODE	SUB NAME	L	T	P	C
	TRANSMISSION AND DISTRIBUTION	**3**	**0**	**0**	**3**
C:P:A = 3:0:0		**L**	**T**	**P**	**H**
		3	**0**	**0**	**3**

UNIT I TRANSMISSION LINE PARAMETERS	**9**
Structure of electric power system: Various levels such as generation, transmission and distribution; – Resistance, Inductance and Capacitance calculations – Single-phase and three-phase lines – double circuit lines – effect of earth on transmission line capacitance.	
UNIT II PERFORMANCE OF TRANSMISSION LINES	**9**
Regulation and efficiency – Tuned power lines, Power flow through a transmission line – Power circle diagrams, Introduction to Transmission loss and Formation of corona – critical voltages – effect on line performance – travelling waveform phenomena.	
UNIT III MECHANICAL DESIGN OF OVERHEAD LINES	**9**
Line supports – Insulators, Voltage distribution in suspension insulators – Testing of insulators – string efficiency – Stress and sag calculation – effects of wind and ice loading.	
UNIT IV UNDERGROUND CABLES	**9**
Comparison with overhead line – Types of cables – insulation resistance – potential gradient – capacitance of single-core and three-core cables.	
UNIT V DISTRIBUTION SYSTEM	**9**
General aspects – Kelvin's Law – A.C. distribution – Single-phase and three phase – Techniques of voltage control and power factor improvement – Introduction to Distribution loss – Recent trends in transmission and distribution systems	

	LECTURE	TUTORIAL	TOTAL
	45	**0**	**45**

TEXTBOOKS

1. D.P.Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw–Hill, 2 nd Edition, 2008.
2. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall India Pvt. Ltd, 2002.

REFERENCES

1. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadisaddak, 'Power System Analysis,' Tata McGraw Hill Publishing Company',2003
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi
4. Tamil Nadu Electricity Board Handbook', 2012.

E REFERENCES

1. NPTEL, Power System Generation, Transmission and Distribution Prof. D. P. Kothari Center for Energy Studies Indian Institute of Technology, Delhi.

COs VERSUS GAs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	3								1		2	2	1
CO2	1	3	1		1							1	3	1
CO3	1			1	1					1			2	1
CO4	1	2									1	1	2	1
CO5	1	2										1	2	1
Total	**5**	**10**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**3**	**1**	**5**	**11**	**5**
Scaling	**2**	**3**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**3**	**2**

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

ENVIRONMENTAL SCIENCE

COURSE CODE	COURSE NAME	L	T	SS	P	C
XES102	ENVIRONMENTAL SCIENCES	3	0	0	0	3
C:P:A		L	T	SS	P	H
1.4: 0.3 : 0.3		3	0	0	0	3

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Describe** the significance of natural resources and **explain** anthropogenic impacts.	Cognitive	Remember Understand
CO2	**Illustrate** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	**Identify** the facts, consequences, preventive measures of major pollutions and **recognize** the disaster phenomenon	Cognitive Affective	Remember Receive
CO4	**Explain** the socio-economic, policy dynamics and **practice** the control measures of global issues for sustainable development.	Cognitive	Understand Apply
CO5	**Recognize** the impact of population and the concept of various welfare programs, and **apply** the modern technology towards environmental protection.	Cognitive	Understand Analysis

SUBCODE	SUB NAME	L	T	P	C
	ENVIRONMENTAL SCIENCE	0	0	0	0
C:P:A = 1:0:0		L	T	P	H
		2	0	0	2

UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY — **12**

Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource, land degradation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT – II EYSTEMS AND BIODIVERSITY — **7**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III ENVIRONMENTAL POLLUTION — **10**

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

UNIT –IV SOCIAL ISSUES AND THE ENVIRONMENT — **10**

Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – 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	**6**

Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**SELF STUDY**	**TOTAL**
	45	**0**	**0**	**0**	**45**

TEXT BOOKS

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
1. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
2. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
3. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
4. Introduction to International disaster management, Butterworth Heinemann, 2006.
5. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.

REFERENCE BOOKS

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, 2007.
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.

E RESOURCES

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4
5. http://bookboon.com/en/pollution-prevention-and-control-ebook
6. http://www.e-booksdirectory.com/details.php?ebook=8557
7. http://www.e-booksdirectory.com/details.php?ebook=6804
8. http://bookboon.com/en/atmospheric-pollution-ebook
9. http://www.e-booksdirectory.com/details.php?ebook=3749
10. http://www.e-booksdirectory.com/details.php?ebook=2604
11. http://www.e-booksdirectory.com/details.php?ebook=2116
12. http://www.e-booksdirectory.com/details.php?ebook=1026
13. http://www.faadooengineers.com/threads/7894-Environmental-Science

SIGNALS AND SYSTEMS

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Understand the concepts of continuous time and discrete time systems.	Cognitive	Understand
CO2	Analyse systems in complex frequency domain.	Cognitive	Analyse
CO3	Learn about Fourier transformation techniques	Cognitive	Remembering
CO4	Learn about Laplace transformation techniques	Cognitive	Remembering
CO5	Learn about Z- transformation techniques	Cognitive	Remembering

SUBCODE	SUB NAME	L	T	P	C
	SIGNALS AND SYSTEMS	**2**	**1**	**0**	**3**
C:P:A = 2:1:0		**L**	**T**	**P**	**H**
		2	**1**	**0**	**3**

UNIT I INTRODUCTION TO SIGNALS AND SYSTEMS	**9**
Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples.	
UNIT II BEHAVIOUR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS	**9**
Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	
UNIT III FOURIER TRANSFORMS	**9**
Fourier series representation of periodic signals, Waveform Symmetries, Fourier Coefficients, harmonic spectrum and THD. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Application to simple circuits.	
UNIT IV LAPLACE TRANSFORMS	**6**
Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour. Application to simple circuits.	
UNIT V Z- TRANSFORMS AND SAMPLING RECONSTRUCTION	**12**
The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	

	LECTURE	TUTORIAL	TOTAL
	30	15	45

TEXTBOOKS

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

REFERENCES

1. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
2. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education,2007.
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

COs VERSUS GAs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PEO1	PEO2
CO 1	3	2	2	2	1				1			1	1	0
CO 2	3	3	2	1		3		1				2		1
CO 3	3			1		3		1			1			1
CO 4	3	2	2	2	1		1			2		2		1
CO 5	3			1						2				1
	15	7	6	7	2	6	1	2	1	4	1	5	1	4

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

ELECTRICAL MACHINES – II

Course Outcomes		Domain	Level
CO1	To Understand the fundamentals of different types of slots and windings used for AC machines.	Cognitive Psychomotor	Understanding Mechanism
CO2	To Understand the concepts of pulsating and revolving magnetic fields.	Cognitive Psychomotor	Understanding Mechanism
CO3	To Understand the operation of induction machines, ttorque slip characteristics, equivalent circuit and its phasor diagram.	Cognitive Psychomotor	Understanding Mechanism
CO4	To Understand the different typesof starting, braking and speed control for induction motors. React the generator operation, self-excitation and doubly-fed Induction machines.	Cognitive Psychomotor	Understanding Response
CO5	To Understand the operation of single phase induction motors and its performance parameters.	Cognitive Psychomotor	Understanding Perception

SUB.CODE	SUB. NAME	L	T	P	C
	ELECTRICAL MACHINES – II	3	0	2	4
C:P:A = 3:0:0		L	T	P	H
		3	0	2	5

UNIT I FUNDAMENTALS OF AC MACHINE WINDINGS **9+3**

Physical arrangement of windings in stator and cylindrical rotor–Slots for windings –Single-turn coil –Active portion and overhang –Full-pitch coils–Types of windings– 3D visualization of the above winding types– Air-gap MMF distribution with fixed current through winding –Winding distribution factor.

LIST OF EXPERIMENTS

1. Load test on three phase squirrel cage induction motor.
2. Load test on three phase slip ring induction motor.
3. Load test of a three phase alternator.
4. Load test on single-phase induction motor.

UNIT II PULSATING AND REVOLVING MAGNETIC FIELDS **9+3**

Types of magnetic fields –Alternating current in windings with spatial displacement – Magnetic field produced by a single winding – Fixed current and alternating current. Pulsating fields produced by spatially displaced windings– Windings spatially shifted by 90° – Three windings spatially shifted by 120° (carrying three-phase balanced currents) – Revolving magnetic field.

LIST OF EXPERIMENTS

5. No load and blocked rotor test on single phase induction motor.
6. No load and blocked rotor test on three phase induction motor.

UNIT III INDUCTION MACHINES **9+3**

Constructional details –Types of rotors (squirrel cage and slip-ring) – Torque Slip Characteristics – Equivalent circuit – Phasor Diagram– Effect of parameter variation on torque speed characteristics – Methods of starting, braking and speed control for induction motors–Generator operation –Self-excitation– Doubly-Fed Induction Machines.

LIST OF EXPERIMENTS

7. Regulation of three phase alternator by EMF /MMF methods.
8. V and inverted V curves of three phase synchronous motor.

UNIT IV SINGLE PHASE INDUCTION MOTORS	**9+3**

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – Determination of parameters – Split-phase starting methods and applications.

LIST OF EXPERIMENTS

9. OCC and load characteristics of three phase alternator.

UNIT V SYNCHRONOUS MACHINES	**9+3**

Constructional details – Cylindrical rotor synchronous machine– EMF equation –Equivalent circuit – Phasor diagram–Armature reaction–Voltage regulation– V-curves. Salient pole machine – Two reaction theory –Phasor diagram –Power angle characteristics. Synchronizing and parallel operation. (Basic operation of synchronous motors)

LIST OF EXPERIMENTS

10. Study of induction motor starters.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**0**	**15**	**60**

TEXTBOOKS:

1. I. J. Nagrath and D. P. Kothari, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2010.
2. M. G. Say, 'Performance and Design of AC Machines', CBS Publishers, 2002.
3. P. S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2011.
4. B.L.Theraja, 'A Textbook of Electrical Technology', Vol. I & II, M/s S.Chand, Delhi, 2013.

REFERENCES:

1. A. E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2013.
2. A. S. Langsdorf, 'Alternating Current Machines', Tata McGraw Hill publishing Company Ltd, 1984.
3. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
4. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.
5. DeshPande M.V., 'Electrical Machines', PHI Learning Pvt Ltd., New Delhi – 2011.
6. A. G. Warren, 'Problems in Electrical Engineering', Parker and Smith Solutions, Newyork, 1940.
7. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt Ltd, 2002.
8. Department Laboratory Manual.

E REFERENCES:

1. http://freevideolectures.com/Course/2335/Basic-Electrical-Technology35-38, Prof. L. Umanand, IISc Bangalore.

COs VERSUS GAs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	2	1	0	0	0	0	0	0	2	2	1
CO 2	3	2	2	2	1	0	0	0	0	0	0	1	2	1
CO 3	3	2	2	2	1	0	0	0	0	0	0	1	1	1
CO 4	2	2	1	3	2	0	0	0	0	0	0	1	1	1
CO 5	3	0	0	0	1	0	0	0	0	0	0	1	1	1
Total	14	8	7	9	6	0	0	0	0	0	0	6	7	5

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

SEMESTER IV

DIGITAL ELECTRONICS

Course Outcomes		Domain	Level
CO1	Cog (U): To Understand numerical values in various number systems and show number conversions between different number Systems.	Cognitive	Understanding
CO2	Cog (Anl): To Analyze Boolean functions and minimization techniques using k –maps and postulates and theorems of Boolean Algebra, minimization of Boolean functions using basic laws.	Cognitive	Analyze
CO3	Cog (App.): TO Apply Logic gates and their applications and construct the simple adders and sub tractors using logic gates.	Cognitive	Apply
CO4	Cog (U) : To Understand the process of Analog to Digital conversion and its applications.	Cognitive	Understanding
CO5	Cog (U) : To Understand the process of Digital to Analog conversion and its applications.	Cognitive	Understanding

SUBCODE	SUB NAME	L	T	P	C
	DIGITAL ELECTRONICS	**3**	**0**	**0**	**3**
C:P:A = 3:0:0		**L**	**T**	**P**	**CH**
		3	**0**	**0**	**3**

UNIT I FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES	**9**
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families.	
UNIT II COMBINATIONAL DIGITAL CIRCUITS	**9**
Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders Q-M method of function realization.	
UNIT III SEQUENTIAL CIRCUITS AND SYSTEMS	**9**
A 1-bit memory, the circuit properties of Bistable latch, JK, SR, D and T types flip-flops, applications of flip-flops, shift registers, applications of shift registers, Asynchronous counters, synchronous counters design using flip flops, special counter IC's, applications of counters.	
UNIT IV A/D AND D/A CONVERTERS	**9**
Digital to analog converters: weighted resistor/converter, R-2R Ladder DAC, specifications for D/A converters, examples of DAC lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator ADC, ,successive approximation ADC, specifications of ADC, example of ADC ICs.	
UNIT V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES	**9**
Memory organization and operation, expanding memory size, classification and characteristics of	

memories, sequential memory, ROM, RAM, content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, PLA, PAL, CPLDS, and FPGA.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	0	45

TEXTBOOKS

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

REFERENCES

1. Taub and Schilling, 'Digital Integrated Circuits', McGraw Hill, 2002.
2. Samuel C. Lee “Digital Circuits and Logic Designs” Prentice Hall of India; 2000.
3. Fletcher, W.I., 'An Engineering Approach to Digital Design', Prentice Hall of India, 2002.
4. Anand Kumar, Fundamental of Digital circuits, PHI 2003.

E REFERENCES

1. NPTEL, Digital Logic Circuits, Prof. S.Srinivasan, IIT Madras.
2. NPTEL, Digital Logic Circuits, Prof. D. Roychoudhury, IIT Kharagpur.

COs VERSUS GAs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PEO1	PEO2
CO1	2	1	3	-	-	1	1	1	-	1	-	2	2	1
CO2	3	2	1	-	-	2	0	2	1	-	-	2	1	2
CO3	2	2	1	-	-	1	2	2	1	1	-	1	2	2
CO4	2	2	3	-	-	1	1	1	-	-	1	1	1	2
CO5	3	2	2	-	-	0	1	1	1	1	1	2	2	2
	12	9	10	-	-	4	5	7	3	3	2	8	8	9

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

POWER ELECTRONICS

Course Outcomes		Domain	Level
CO1	To Understand the structure, operation and characteristics of power switching devices.	Cognitive Psychomotor	Understanding
CO2	Determine the operation, characteristics and performance parameters of controlled rectifiers.	Cognitive Psychomotor	Understanding Response
CO3	Analysis the operation of DC - DC choppers.	Cognitive Psychomotor	Analyzing Mechanism
CO4	Analysis the operation of various inverters and infer the suitable PWM techniques.	Cognitive Psychomotor	Analyzing Mechanism
CO5	To Understand the concept of various types of AC voltage controllers.	Cognitive Psychomotor	Understanding Mechanism

SUB.CODE	SUB. NAME	L	T	P	C
	POWER ELECTRONICS	3	0	2	4
C:P:A = 3:0:0		L	T	P	H
		3	0	2	5

UNIT I POWER SWITCHING DEVICES **9+3**

Review on Semiconductor devices – I-V characteristics and Switching Characteristics of power Diodes, SCR, TRIAC, power BJT, power MOSFET and IGBT. Triggering and Commutation Circuits.

LIST OF EXPERIMENTS

1. Characteristics of SCR.
2. Characteristics of MOSFET.
3. Characteristics of IGBT.

UNIT II THYRISTOR RECTIFIERS **9+3**

Single phase half-wave and full-wave thyristor rectifiers – Single phase full-bridge thyristor rectifier with R-load and highly inductive load – Three phase full-bridge thyristor rectifier with R-load and highly inductive load.

LIST OF EXPERIMENTS

4. Single phase fully controlled rectifier with R, RL load.

UNIT III DC TO DC CHOPPERS **9+3**

Types of Choppers, Class A to E, step-up and step-down choppers – Analysis of Voltage, Current and Load commutated choppers –Introduction to Resonant converters

LIST OF EXPERIMENTS

5. BUCK- BOOST converter using MOSFET.
6. IGBT based choppers.

UNIT IV INVERTERS **9+3**

Single phase, Three phase voltage source inverters (Both 120º and 180º mode of conductions) – Bipolar sinusoidal modulation and unipolar sinusoidal modulation, Modulation Index - PWM Techniques- Current Source Inverters.

LIST OF EXPERIMENTS

7. Single phase IGBT PWM inverter.

8. Series Inverter/ Parallel Inverter.

UNIT V AC VOLTAGE CONTROLLERS	**9+3**

Single-phase and three phase AC voltage controllers -. Multi-stage sequence control – step-up and step-down cycloconverter – Single phase to single phase and Single phase to Three phase cycloconverters.

LIST OF EXPERIMENTS

9. Single phase AC voltage controller using SCR / TRIAC.
10. Single phase cycloconverter.
11. Mini project: Design of basic power converter circuits.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**0**	**15**	**60**

TEXTBOOKS:

1. Rashid, M.H., 'Power Electronics: Circuits, Devices and Applications', Pearson Education India, 2009.
2. Singh, M.D and Kanchandani, 'Power Electronics',Tata McGraw Hill & Hill publication Company Ltd New Delhi, 2009.
3. Bimbhra, P.S ,'Power Electronics', Khanna Publishers, 2007.
4. Ned Mohan, Tore M. Undeland and William P.Robbins, 'Power Electronics:Converters,Applications and Design', New Jersey, John Wiley and Sons, 2007.

REFERENCES:

1. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., 'Thyristorised Power Controllers', Wiley Eastern Limited, 1986.
2. Lander,W., 'Power Electronics', McGraw Hill and Company, Third Edition, 2009.
3. Sen.P.C., 'Power Electronics', Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2005.
4. Joseph Vithayathil,'Power Electronics', McGraw-Hill New York, 1996.
5. Erickson, R.W and Maksimovic, D., 'Fundamentals of Power Electronics', Springer Science & Business Media, 2007.
6. Umanand, L., 'Power Electronics: Essentials and Applications', Wiley India, 2009.
7. Department Laboratory Manual.

E REFERENCES:

1. ***Lecture*** Series on ***Power Electronics*** by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.
2. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf

COs VERSUS GAs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	0	0	1	3	0	0	0	0	1	3	1
CO 2	2	1	2	1	0	0	1	0	0	0	0	0	2	2
CO 3	3	1	1	0	0	0	0	0	0	0	0	0	1	2
CO 4	1	3	2	0	0	1	0	0	0	0	0	0	2	1
CO 5	1	2	3	1	3	0	1	1	0	0	0	0	3	2
Total	10	9	9	2	3	2	5	1	0	0	0	1	11	8

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation