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
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 (Full Time)

Curriculum (From I – VIII 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

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	DM3	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	Suggested by AICTE Breakup of Credits	Implementation in Curriculum 2018
1	Humanities and Social Sciences including Management courses	12	12
2	Basic Science courses	26	23
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	20	16
4	Professional core courses	53	57
5	Professional Elective courses relevant to chosen specialization/branch	18	19
6	Open subjects – Electives from other technical and /or emerging subjects	18	18
7	Project work, seminar and internship in industry or elsewhere and minor courses	11	13
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)	(non-credit)
	Total	**158**	**158**

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1		English	2:0:1	3	II
2		Industrial Economics and Foreign Trade	3:0:0	3	V
3		E-Waste Management	3:0:0	3	VI
4		Professional Ethics and Human Values	3:0:0	3	VII
Total				**12**	

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1	XMA101	Calculus And Linear Algebra	3:1:0	4	I
2	XAP104	Applied Physics for Engineers	3:1:2	6	I
3.	XMA201	Calculus, Ordinary Differential Equations and Complex Variable	3:1:0	4	II
4.	XAC204	Applied Chemistry for Engineers	3:1:1	5	II
5.		Mathematics – III (Probability and Statistics)	3:1:0	4	IV
			Total	**23**	

ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1	XCP202	Programming for Problem Solving	3:0:4	5	II
2	XBE103	Electrical and Electronics Engineering Systems	3:1:1	5	I
3	XWP205	Workshop Practices	1:0:2	3	II
4	XEG105	Engineering Graphics	2:0:1	3	I
			Total	**16**	

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	III
2		Analog Electronics	3:0:0	3	
3		Electrical Machines-I	3:0:0	3	
4		Electromagnetic Fields	3:1:0	4	
5		Transmission and Distribution	3:0:0	3	
6		Electric Circuits Laboratory	0:0:2	1	
7		Analog Electronics Laboratory	0:0:2	1	
8		Electrical Machines-I Laboratory	0:0:2	1	
9		Digital Electronics	3:0:0	3	IV
10		Power Electronics	3:0:0	3	
11		Electrical Machines-II	3:0:0	3	
12		Signals and System	2:1:0	3	
13		Digital Electronics Laboratory	0:0:2	1	
14		Power Electronics Laboratory	0:0:2	1	
15		Electrical Machines-II Laboratory	0:0:2	1	
16		Power Systems – I (Apparatus and Modelling)	3:0:0	3	V
17		Control Systems	3:0:0	3	
18		Microprocessors and microcontrollers	3:0:0	3	
19		Power Systems – I Laboratory	0:0:2	1	
20		Control Systems Laboratory	0:0:2	1	
21		Microprocessors & Microcontrollers Laboratory	0:0:2	1	
22		Power Systems –II (Operation and Control)	3:0:0	3	VI
23		Power Systems – II Laboratory	0:0:2	1	
24		Measurements and Instrumentation Laboratory	2:0:2	3	
25		Electronics Design Laboratory	1:0:4	3	
Total				**57**	

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	V onwards
2		Electrical Machine Design	3:0:0	3	V onwards
3		Embedded System	3:0:0	3	V onwards
4		Electrical safety, operations and Regulations	3:0:0	3	V onwards
5		Industrial Automation	3:0:0	3	V onwards
6		Power system Restructuring	3:0:0	3	V onwards
7		Line Commutated and Active Rectifiers	3:0:0	3	VI onwards
8		Electrical Drives	3:0:0	3	VI onwards
9		High Voltage Engineering	3:0:0	3	VI onwards
10		Electrical Energy Conservation and Auditing	3:0:0	3	VI onwards
11		Industrial Electrical Systems	3:0:0	3	VI onwards
12		Digital Control Systems	3:0:0	3	VI onwards
13		Digital Signal Processing	3:0:0	3	VI onwards
14		Computer Architecture	3:0:0	3	VI onwards
15		Electromagnetic Waves	3:0:0	3	VI onwards
16		Computational Electromagnetics	3:0:0	3	VI onwards
17		Control Systems Design	3:0:0	3	VI onwards
18		Power System Dynamics and Control	3:0:0	3	VII onwards
19		HVDC Transmission Systems	3:0:0	3	VII onwards
20		Power Quality and FACTS	3:0:0	3	VII onwards
21		Wind and Solar Energy Systems	3:0:0	3	VII onwards
22		Electrical and Hybrid Vehicles	3:0:0	3	VII onwards
23		Power System Protection	3:0:0	3	VII onwards
24		Minor Course	3:0:0	1	VII onwards
25		Advanced Electric Drives	3:0:0	3	VIII onwards

OPEN ELECTIVE COURSES TRACKS-
ELECTRICAL AND ELECTRONICS ENGINEERING [OEC-EE]

Sl. No	Course Code	Course Title	Credits
01		Electronic Devices	3
02		Bio Medical Instrumentation	3
03		Analog and Digital Communication	3
04		Computer Networks	3
05		Eco Power Generation	3
07		Energy Auditing and Management	3
08		Wavelet Transforms	3
09		Power Plant Engineering	3
10		Communication Engineering	3
11		Strength of Materials	3
12		Fluid Machinery	3
13		Automobile Engineering	3
14		Electrical Materials	3
15		Modern Manufacturing Processes	3
16		Internet of Things	3
17		Big Data Analysis	3

PROJECT WORK & INTERNSHIP IN INDUSTRY

Sl. No.	Course Code	Course Title	Hrs. /Week L: T: P	Credits	Preferred Semester
1		In-plant Training	0:0:0	1	V
2		Project Phase-I	0:0:6	3	VII
3		Summer Internship (45 to 60 days duration during summer vacation of III year)	0:0:0	1	VII
4		Project Phase-II	0:0:16	8	VIII
Total				**13**	

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
XMA101	Calculus And Linear Algebra	3	1	0	4	4
XES102	Environmental Science	3	0	0	3	0
XBE103	Electrical And Electronics Engineering Systems	3	1	1	7	5
XAP104	Applied Physics For Engineers	3	1	2	7	6
XEG105	Engineering Graphics	2	0	1	4	3
		14	**3**	**4**	**25**	**18**

SEMESTER II

Code No.	Course Title	L	T	P	TCH	C
XMA201	Calculus, Ordinary Differential Equations and Complex Variable	3	1	0	5	4
XCP202	Programming for Problem Solving	3	0	2	7	5
XGS203	English	2	0	1	4	3
XAC204	Applied Chemistry for Engineers	3	1	1	7	5
XWP205	Workshop Practices	1	0	2	6	3
		12	**2**	**8**	**29**	**20**

SEMESTER III

Code No.	Course Title	L	T	P	TCH	C
	Electrical Circuit Analysis	3	1	2	6	5
	Analog Electronics	3	0	2	5	4
	Electrical Machines-I	3	0	2	5	4
	Electromagnetic Fields	3	1	0	4	4
	Transmission and Distribution	3	0	0	3	3
		15	**2**	**6**	**23**	**20**

*Pass / Fail course

SEMESTER IV

Code No.	Course title	L	T	P	TCH	C
	Mathematics – III (Probability and Statistics)	3	1	0	4	4
	Digital Electronics	3	0	2	5	4
	Power Electronics	3	0	2	5	4
	Electrical Machines-II	3	0	2	5	4
	Signals and System	2	1	0	3	3
	Mandatory Course (Extracurricular activities - NCC/NSS/YRC/RRC/Sports)	-	-	-	-	0
		14	**2**	**6**	**22**	**19**

SEMESTER V

Code No.	Course Title	L	T	P	TCH	C
	Power Systems – I (Apparatus and Modelling)	3	0	2	5	4
	Control Systems	3	0	2	5	4
	Microprocessors and microcontrollers	3	0	2	5	4
	Professional Elective-1	3	0	0	3	3
	Open Elective -1	3	0	0	3	3
	Slot for Humanities or Management Course (Industrial Economics and Foreign Trade)	3	0	0	3	3
	In-plant Training	-	-	-	-	1
		18	**0**	**6**	**24**	**22**

SEMESTER VI

Code No.	Course title	L	T	P	TCH	C
	Power Systems –II (Operation and Control)	3	0	2	5	4
	Professional Elective-2	3	0	0	3	3
	Professional Elective-3	3	0	0	3	3
	Open Elective -2	3	0	0	3	3
	Slot for Humanities or Management Course (E-Waste Management)	3	0	0	3	3
	Disaster Management	-	-	-	-	P/F
	Measurements and Instrumentation Laboratory	2	0	2	3	3
	Electronics Design Laboratory	1	0	4	5	3
		18	**0**	**8**	**25**	**22**

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
	Open Elective -3	3	0	0	3	3
	Open Elective -4	3	0	0	3	3
	Professional Ethics and Human Values	3	0	0	3	3
	Minor Course	1	0	0	1	1
	Project Phase-I	0	0	6	6	3
	Summer Internship (45 to 60 days duration during summer vacation of III year)	-	-	-	-	1
		15	**0**	**6**	**21**	**20**

SEMESTER VIII

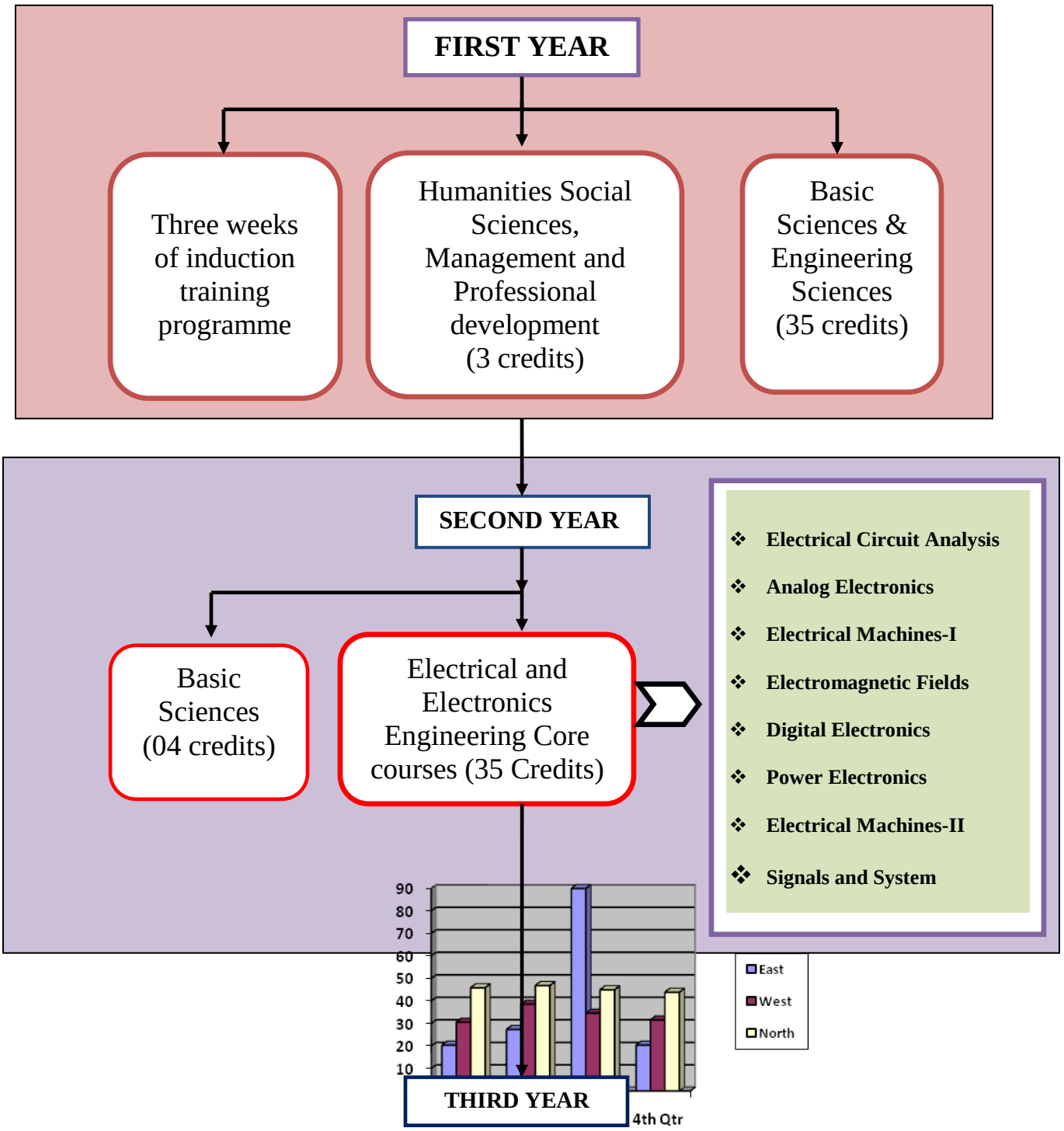
Code No.	Course title	L	T	P	TCH	C
	Professional Elective-6	3	0	0	3	3
	Open Elective -5	3	0	0	3	3
	Open Elective -6	3	0	0	3	3
	Cyber security	-	-	-	-	P/F
	Project Phase-II	0	0	16	16	8
		9	**0**	**16**	**25**	**17**

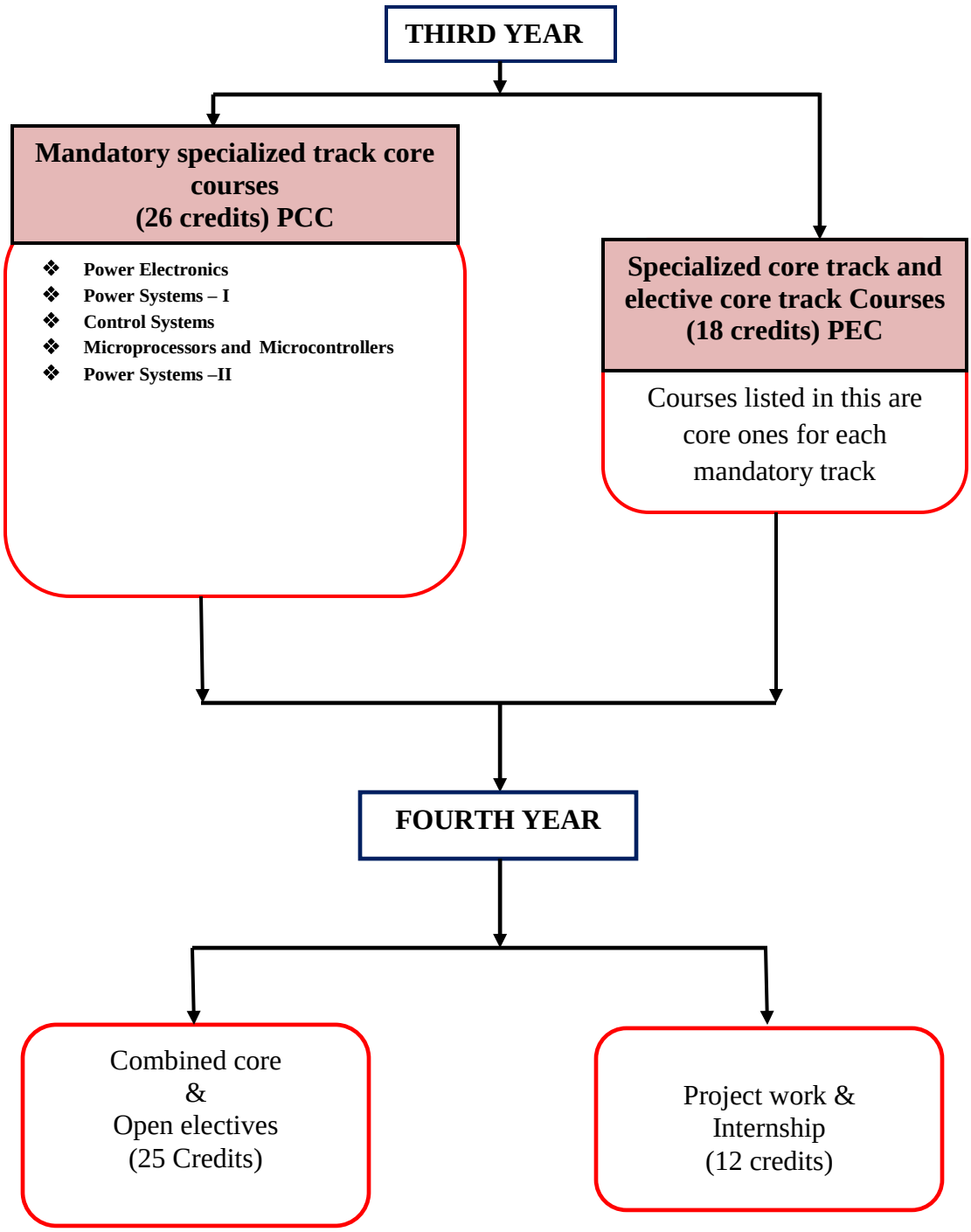
MINOR (ONE CREDIT) COURSES:

Code No.	Course Title	L	T	P	C
	Electrical Safety	1	0	0	1
	Microgrid	1	0	0	1
	PLC Programming	1	0	0	1
	Energy Auditing	1	0	0	1
	Programming with Arduino	1	0	0	1
	Online MOOC Course	1	0	0	1

OVER ALL CREDITS = 158 CREDITS

FLOW CHART FOR THE ENTIRE PROGRAMME




THIRD YEAR
Mandatory specialized track core courses (26 credits) PCC
Power Electronics
Power Systems – I
Control Systems
Microprocessors and Microcontrollers
Power Systems –II
Specialized core track and elective core track Courses (18 credits) PEC
Courses listed in this are core ones for each mandatory track
FOURTH YEAR
Combined core & Open electives (25 Credits)
Project work & Internship (12 credits)

SYLLABUS 2018

SEMESTER I

COURSE CODE			COURSE NAME	L	T	P	C
XMA101			CALCULUS AND LINEAR ALGEBRA	3	1	0	4
C	P	A		L	T	P	H
3	0.5	0.5		4	1	0	5

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 1: MATRICES	**15**
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 2: SEQUENCES AND SERIES	**15**
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 ine series- Parseval's Theorem.	
UNIT 3: MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION	**15**
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 4: MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS	**15**
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 5: DIFFERENTIAL AND INTEGRAL CALCULUS	**15**
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**

	60	**15**	**75**

Text Books:

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit-1, Unit-3 and Unit-4).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit-2).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit-5).**

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 with :

	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		

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 30$ - No Relation,
1 - Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE	COURSE NAME	L	T	SS	P	C
XES102	ENVIRONMENTAL SCIENCES	3	0	0	0	0
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

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
HOURS	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

COURSE CODE	COURSE NAME	L	T	P	C
XBE 103	ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS	3	1	1	5
PREREQUISITES	PHYSICS	L	T	P	H
C:P:A		3	2	2	7
3:1:0					

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Define and Relate** the fundamentals of electrical parameters and **build** and **explain** AC, DC circuits by Using measuring devices	Cognitive Psychomotor	Remember Understand Mechanism set
CO2	**Define and Explain** the operation of DC and AC machines.	Cognitive	Remember Understand
CO3	**Recall and Illustrate** various semiconductor devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive Psychomotor	Remember Understand Mechanism
CO4	**Relate and Explain the** number systems and logic gates. **Construc**t the different digital circuit.	Cognitive Psychomotor	Remember Understand Origination
CO5	**Label and Outline the** different types of microprocessors and their applications.	Cognitive	Remember Understand

UNIT I- FUNDAMENTALS OF DC AND AC CIRCUITS, MEASUREMENTS	9+9+12
Fundamentals of DC– Ohm's Law – Kirchoff's Laws - Sources - Voltage and Current relations – Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter). **LIST OF EXPERIMENTS** 1. Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies. 2. Study of Active and Passive elements – Resistors, Inductors and Capacitors, Bread Board. 3. Verification of AC Voltage, Current and Power in Series and Parallel connection. 4. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter. 5. Fluorescent lamp connection with choke. 6. Staircase Wiring.	
UNIT II – ELECTRICAL MACHINES	**9 + 6+0**
Construction, Principle of Operation, Basic Equations, Types and Application of DC Generators, DC motors - Basics of Single Phase Induction Motor and Three Phase Induction Motor- Construction, Principle of Operation of Single Phase Transformer, Three phase transformers, Auto transformer.	
UNIT III – SEMICONDUCTOR DEVICES	**9 + 3+8**
Classification of Semiconductors, Construction, Operation and Characteristics: PN Junction Diode – Zener Diode, PNP, NPN Transistors, Field Effect Transistors and Silicon Controlled Rectifier – Applications. **LIST OF EXPERIMENTS** 5. Forward and Reverse bias characteristics of PN junction diode. 6. Forward and Reverse bias characteristics of zener diode. 7. Input and Output Characteristics of NPN transistor.	
UNIT IV – DIGITAL ELECTRONICS	**9 + 6+10**
Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers. 8. Construction and verification of simple logic gates. 9. Construction and verification of adders. 10. Construction and verification of subtractor.	
UNIT V – MICROPROCESSORS	**9+ 6+0**
Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts – Simple Programming concepts	

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	30	30	105

TEXT BOOKS

1. Metha V.K., 2008. Principles of Electronics. Chand and Company.
2. Malvino, A. P., 2006. Electronics Principles. 7th ed. New Delhi: Tata McGraw-Hill.
3. Rajakamal, 2007. Digital System-Principle & Design. 2nd ed. Pearson education.
4. Morris Mano, 1999. Digital Design. Prentice Hall of India.
5. Ramesh, S. Gaonkar, 2000. Microprocessor Architecture, Programming and its Applications with the 8085. 4th ed. India: Penram International Publications.

REFERENCE BOOKS:

1. Corton,H.,2004. Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967. Electronics Devices.New Delhi: McGraw-Hill.
4. Millman, J. andHalkias, C. C., 1972. Integrated Electronics: Analog and Digital Circuits and Systems. Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. Microprocessors - Theory and Applications: Intel and Motorola. Prentice Hall International.

E-REFERENCES:

1. NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya and Prof. G.D. Roy, IIT Kharagpur.
2. Prof.L.Umanand, http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, IISc Bangalore.
3. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. Nagendra Krishnapura , IIT Madras.
4. Dr.LUmanand , http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISC Bangalore.

COURSE CODE	COURSE NAME	L	T	P	C
XAP104	APPLIED PHYSICS FOR ENGINEERS	3	1	2	6
C:P:A	2.8:0.8:0.4	L	T	P	H
PREREQUISITE:	Basic Physics in HSC level	3	1	3	7

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 Psychomotor	Remember, Understand Mechanism
CO2	**Illustrate** the laws of electrostatics, magneto-statics and electromagnetic induction; **use** and **locate** basic applications of electromagnetic induction to technology.	Cognitive Psychomotor Affective	Remember, Analyze, Mechanism Respond
CO3	**Understand** the fundamental phenomena in optics by measurement and **describe** the working principle and application of various lasers and fibre optics.	Cognitive Psychomotor Affective	Understand, Apply Mechanism Receive
CO4	**Analyse** energy bands in solids, **discuss** and **use** physics principles of latest technology using semiconductor devices.	Cognitive Psychomotor Affective	Understand, Analyze Mechanism Receive
CO5	**Develop** Knowledge on particle duality and **solve** Schrodinger equation for simple potential.	Cognitive	Understand, Apply

UNIT - I MECHANICS OF SOLIDS	9+3+9
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+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+12**
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+6

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+0

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.

LABORATORY

1.	Torsional Pendulum - determination of moment of inertia and rigidity modulus of the given material of the wire.
2.	Uniform Bending - Determination of the Young's Modulus of the material of the beam.
3.	Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam.
4.	Meter Bridge - Determination of specific resistance of the material of the wire.
5.	Spectrometer - Determination of dispersive power of the give prism.
6.	Spectrometer - Determination of wavelength of various colours in Hg source using grating.
7.	Air wedge - Determination of thickness of a given thin wire.
8.	Laser - Determination of wavelength of given laser source and size of the given micro particle using Laser grating.
9.	Post office Box - Determination of band gap of a given semiconductor.
10.	PN Junction Diode - Determination of V-I characteristics of the given diode.

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**	**30**	**90**

SUB CODE			SUB NAME	L	T	P	C
XEG105			ENGINEERING GRAPHICS	2	0	1	3
C	P	A		L	T	P	H
1.75	1	0.25		2	0	2	4

PREREQUISITE: NIL

COURSE OUTCOMES:

	Course outcomes:	Domain	Level
CO1	Apply the national and international standards, construct and practice various curves	Cognitive, Psychomotor and Affective	Applying, Guided response and Responds to Phenomena
CO2	Interpret, construct and practice orthographic projections of points, straight lines and planes.	Cognitive Psychomotor and Affective	Understanding, Mechanism and Responds to Phenomena
CO3	Construct Sketch and Practice projection of solids in various positions and true shape of sectioned solids.	Cognitive Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena
CO4	Interpret, Sketch and Practice the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive Psychomotor and Affective	Understanding, Complex Overt Response and Responds to Phenomena
CO5	Construct sketch and practice isometric and perspective views of simple and truncated solids.	Cognitive Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena

UNIT-I	**INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE**	**6+6**

Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003.Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects. Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves.

UNIT –II	**PROJECTION OF POINTS, LINES AND PLANE SURFACES**	**6+6**

General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection.

UNIT-III	**PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS**	**6+6**

Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids

in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections.		
UNIT –IV	**DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS**	**6+6**
Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset		
UNIT V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**6+6**
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods.		
THEORY 30	**PRACTICAL 30**	**TOTAL HRS 60**

TEXT BOOKS

1. Bhatt,N.D, "Engineering Drawing", Charotar Publishing House, 46th Edition-2003.
2. Natarajan,K.V, " A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006 .
3. Dr. P.K. Srividhya, P. Pandiyaraj, "Engineering Graphics", PMU Publications, Vallam, 2013

REFERENCES

1. Luzadder and Duff, "Fundamentals of Engineering Drawing" Prentice Hall of India PvtLtd, XI Edition - 2001.
2. Venugopal,K. and Prabhu Raja, V., "Engineering Graphics", New Age International(P) Ltd., 2008.
3. Gopalakrishnan.K.R,. "Engineering Drawing I & II", Subhas Publications, 1998.
4. Shah,M.B and Rana,B.C.,"Engineering Drawing", Pearson Education,2005.

E RESOURCES

1. http://periyarnet/Econtent
2. http://nptel.ac.in/courses/112103019/

SEMESTER II

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		4	1	0	5

PREREQUISITE: Mathematics I (Calculus and Linear Algebra)

COURSE OUTCOMES:

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)	**15**
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	**15**
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	**15**
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	**15**
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	**15**
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**

	60	**15**	**75**

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.

PROGRAMMING FOR PROBLEM SOLVING

COURSE CODE	XCP 202	L	T	P	C
COURSE NAME	PROGRAMMING FOR PROBLEM SOLVING	3	0	2	5
PREREQUISITES		L	T	P	H
C:P:A		3	1	3	7

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Define** programming fundamentals and **Solve** simple programs using I/O statements	Cognitive Psychomotor	Remember Understand Apply
CO2	**Define** syntax and **write simple programs** using control structures and arrays	Cognitive Psychomotor	Remember Understand Apply
CO3	**Explain** and **write simple programs** using functions and pointers	Cognitive Psychomotor	Understand Apply
CO4	**Explain** and **write simple programs** using structures and unions	Cognitive Psychomotor	Understand Apply Analyze
CO5	**Explain** and **write simple programs** using files and **Build** simple projects	Cognitive Psychomotor	Remember Understand Create

UNIT I PROGRAMMING FUNDAMENTALS AND INPUT/OUTPUT STATEMENTS	9+6
Theory Introduction to components of a computer system, Program – Flowchart – Pseudo code – Software – Introduction to C language – Character set – Tokens: Identifiers, Keywords, Constants, and Operators – sample program structure -Header files – Data Types-Variables - Output statements – Input statements. **Practical** 1. Program to display a simple picture using dots. 2. Program for addition of two numbers 3. Program to swap two numbers 4. Program to solve any mathematical formula.	
UNIT II CONTROL STRUCTURE AND ARRAYS	**9+6**
Theory Control Structures – Conditional Control statements: Branching, Looping - Unconditional control structures: switch, break, continue, goto statements – Arrays: One Dimensional Array – Declaration – Initialization – Accessing Array Elements – Searching – Sorting – Two Dimensional arrays - Declaration – Initialization – Matrix Operations – Multi Dimensional Arrays - Declaration – Initialization. Storage classes: auto – extern – static. Strings: Basic operations on strings. **Practical** 1. Program to find greatest of 3 numbers using Branching Statements 2. Program to display divisible numbers between n1 and n2 using looping Statement 3. Program to remove duplicate element in an array. 4. Program to perform string operations.	

5. Performing basic sorting algorithms	
UNIT III FUNCTIONS AND POINTERS	**9+6**
Theory Functions: Built in functions – User Defined Functions - Parameter passing methods - Passing arrays to functions – Recursion - Programs using arrays and functions.Pointers - Pointer declaration - Address operator - Pointer expressions & pointer arithmetic - Pointers and function - Call by value - Call by Reference - Pointer to arrays - Use of Pointers in self-referential structures-Notion of linked list(no implementation). **Practical** 1. Program to find factorial of a given number using four function types. 2. Programs using Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort 3. Programs using Pointers	
UNIT IV STRUCTURES AND UNIONS	**9+6**
Theory Structures and Unions - Giving values to members - Initializing structure -Functions and structures - Passing structure to elements to functions - Passing entire function to functions - Arrays of structure - Structure within a structure and Union. **Practical** 1. Program to read and display student mark sheet Structures with variables 2. Program to read and display student marks of a class using Structures with arrays 3. Program to create linked list using Structures with pointers	
UNIT V FILES	**9+6**
Theory File management in C - File operation functions in C - Defining and opening a file - Closing a file - The getw and putw functions - The fprintf & fscanf functions - fseek function – Files and Structures. **Practical** 1. Program for copying contents of one file to another file. 2. Program using files using structure with pointer	

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
HOURS	**45**	**0**	**30**	**75**

TEXT BOOKS/ REFERENCES

1. Byron Gottfried, "Programming with C", III Edition, (Indian Adapted Edition), TMH publications, 2010
2. Yeshwant Kanethker, “Let us C”, BPB Publications, 2008
3. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Pearson Education Inc. 2005
4. Behrouz A. Forouzan and Richard. F. Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks–Cole Thomson Learning Publications, 2001
5. Johnson baugh R. and Kalin M., “Applications Programming in ANSI C”, III Edition, Pearson Education India, 2003
6. E. Balaguruswamy, “Programming in ANSI C”, Tata McGraw-Hill

COs VERSUS POs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PE O1	PE O2
CO 1	2	2	2	2	1								1	0
CO 2	2	-	2	1								1		1
CO 3	2							1						1
CO 4	2	2	2		1	1	1			1				
CO 5	2							1		1				
	10	4	6	3	2	1	1	2		2		1	1	2

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

COURSE CODE	COURSE NAME	L	T	P	SS	C
XGS203	ENGLISH	2	0	1	0	3
		L	T	P	SS	H
C: P: A	2.6:0.4:0	2	0	2	0	4

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Ability** to recall the meaning for proper usage	Cognitive	Remember
CO2	**Apply** the techniques in sentence patterns	Cognitive	Apply
CO3	**Identify** the common errors in sentences	Cognitive	Remember
CO4	**Construct** the Nature and Style of sensible Writing	Cognitive	Create
CO5	**Practicing** the writing skills	Psychomotor	Guided Response
CO6	**Grasping** the techniques in learning sounds and etiquettes	Psychomotor	Adapting

UNIT I VOCABULARY BUILDING	**9**
1.1 The concept of Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives 1.4 Synonyms, antonyms, and standard abbreviations.	
UNIT II BASIC WRITING SKILLS	**9**
2.1 Sentence Structures 2.2 Use of phrases and clauses in sentences 2.3 Importance of proper punctuation 2.4 Creating coherence 2.5 Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	
UNIT III IDENTIFYING COMMON ERRORS IN WRITING	**9**
3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	
UNIT IV NATURE AND STYLE OF SENSIBLE WRITING	**9**
4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	
UNIT V WRITING PRACTICES	**9**
5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing	

Table 1: Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
Scaled Value	2	0	0	0	0	0	2	0	1	0	0	0	0	0
	1	0	0	0	0	0	1	0	1	0	0	0	0	0

1-5= 1, 6-10 = 2, 11-15= 3

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

COURSE CODE	COURSE NAME	L	T	P	C
XAC204	APPLIED CHEMISTRY FOR ENGINEERS	3	1	1	5
PREREQUISITES	Nil	L	T	P	H
C:P:A	3.5:1.0:0.5	3	1	3	7

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 Psychomotor	Remember Perception
CO2	**Explain** and **Measure** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understand Set
CO3	**Interpret** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Apply Mechanism Receive
CO4	**Describe, Illustrate** and **Discuss** the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remember Analyze Perception Respond
CO5	**Apply, Measure** and **Distinguish** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remember Apply Mechanism

Table 1: Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	0	0	0	0	0	2	3	3
CO2	2	0	0	0	0	0	1	2	2
CO3	3	0	0	0	0	0	2	3	3
CO4	8	0	0	0	0	0	3	3	3
CO5	3	0	0	0	0	0	2	2	3

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

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

SUB CODE			SUB NAME	L	T	P	C
XWP205			WORKSHOP PRACTICES	1	0	2	3
C	P	A		L	T	P	H
1	2	0		2	0	4	6

PREREQUISITE:

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Summarize** the machining methods and **Practice** machining operation.	Cognitive Psychomotor	Understanding Guided response
CO2	**Defining** metal casting process, moulding methods and **relates** Casting and Smithy applications.	Cognitive Psychomotor	Remembering Perception
CO3	**Plan** basic carpentry and fitting operation and **Practice** carpentry and fitting operations.	Cognitive Psychomotor	Applying Guided response
CO4	**Summarize** metal joining operation and **Practice** welding operation.	Cognitive Psychomotor	Understanding Guided response
CO5	**Illustrate** the, electrical and electronics basics and **Makes** appropriate connections**.**	Cognitive Psychomotor	Understanding Origination

COURSE CONTENT

EXP.NO.	TITLE	CO RELATION
1	Introduction to machining process	CO1
2	Plain turning using lathe operation	CO1
3	Introduction to CNC	CO1
4	Demonstration of plain turning using CNC	CO1
5	Study of metal casting operation	CO2
6	Demonstration of moulding process	CO2
7	Study of smithy operation	CO2
8	Study of carpentry tools	CO3
9	Half lap joint – Carpentry	CO3
10	Mortise and Tenon joint – Carpentry	CO3
11	Study of fitting tools	CO3
12	Square fitting	CO3
13	Triangular fitting	CO3
14	Study of welding tools	CO4
15	Square butt joint - welding	CO4
16	Tee joint – Welding	CO4
17	Introduction to house wiring	CO5
18	One lamp controlled by one switch	CO5
19	Two lamps controlled by single switch	CO5
20	Staircase wiring	CO5

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay

2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES

1. **http://nptel.ac.in/courses/112107145/**

SEMESTER III

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**	**2**	**5**
C:P:A = 3:1:0		**L**	**T**	**P**	**CH**
		3	**1**	**2**	**6**

UNIT I NETWORK THEOREMS **09+03**

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 **08+03**

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 **08+03**

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 **08+03**

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 **12+03**

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	30	90

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.
3. Department Lab Manual
4. Sudhakar.A and Shyam Mohan.S.P, "Circuits and Networks Analysis and Synthesis", Fourth edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.

E REFERENCES

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

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

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	2	4
C:P:A = 3:0:0		L	T	P	H
		3	0	2	5

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.

LIST OF EXPERIMENTS

1. Design of full wave rectifier with and without filter.
2. Design of bridge rectifier circuits using with and without filter.
3. Conduct an experiment to test clipping and clamping 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.

LIST OF EXPERIMENTS

4. Design of BJT common emitter amplifier using voltage divider bias with and without feedback.

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.

LIST OF EXPERIMENTS

5. Plot the drain and transfer characteristics of MOSFET.

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)

LIST OF EXPERIMENTS

6. Conduct experiment on differential amplifier

UNIT V LINEAR ANDNONLINEARAPPLICATIONS 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.

LIST OF EXPERIMENTS

7. Design of Phase shift and Wien bridge oscillators using op-amp.
8. Conduct experiment on Inverting, Non inverting amplifier using Op-amp.
9. Conduct experiment on astable and monostable multivibrator using Op-amp.
10. Conduct experiment on integrator and differentiator circuit using Op-amp.
11. Conduct experiment on Schmitt trigger circuit using op-amp.

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**30**	**75**

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		
CO 5	3	1			2					1	1	1		
	14	5	0	0	3	0	0	0	0	5	3	6		

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

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
	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 **09**

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 **09**

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 **08**

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**

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

Load test on single-phase transformer.

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

UNIT V AUTOTRANSFORMERS	**08**

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**	**30**	**75**

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.

List of Experiments

1. Study of D.C. Motor Starters. 3
2. Open Circuit Characteristics (OCC) and load Characteristics of D.C self-excited generator. 3
3. Load characteristics of D.C shunt generator 3
4. Load characteristics of D.C. shunt motor. 3
5. Load characteristics of D.C series motor. 3
6. Speed control of D.C shunt motor. 3
7. Load test on single-phase transformer. 4
8. Open circuit and short circuit tests on single phase transformer.4

Total Hours: 30

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**	**PE O1**	**PE O2**
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

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 REVIEWOFVECTORCALCULUS **6+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

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

SUB. CODE	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	**09**
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	**09**
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	**09**
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	**09**
Comparison with overhead line – Types of cables – insulation resistance – potential gradient – capacitance of single-core and three-core cables.	
UNIT V DISTRIBUTION SYSTEM	**09**
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 POs 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**	**2**	**0**	**0**	**0**	**0**	**2**	**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

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 Psychomotor	Understanding Guided Response
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 Psychomotor	Analyze Perception
CO3	Cog (App.): To Apply Logic gates and their applications and construct the simple adders and sub tractors using logic gates.	Cognitive Psychomotor	Apply Mechanism
CO4	Cog (U) : To Understand the process of Analog to Digital conversion and its applications.	Cognitive Psychomotor	Understanding Mechanism
CO5	Cog (U) : To Understand the process of Digital to Analog conversion and its applications.	Cognitive Psychomotor	Understanding Mechanism

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

UNIT I FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES **09**

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.

LIST OF EXPERIMENTS

1. Verification and study of logic gates.
2. Binary to Gray and Gray to binary code converters.
3. Excess -3 to BCD and vice-versa code converters**.**

UNIT II COMBINATIONAL DIGITAL CIRCUITS **09**

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.

LIST OF EXPERIMENTS

4. Implementation and verification of Multiplexers and Demultiplexer using logic gates.
5. Implementation and verification of Encoders and Decoders using logic gates.

UNIT III SEQUENTIAL CIRCUITS AND SYSTEMS **09**

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.

LIST OF EXPERIMENTS

6. Design and verify operation of Half / Full adder.
7. Design and verify operation of Half/Full sub tractor.

UNIT IV A/D AND D/A CONVERTERS | **09**

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.

LIST OF EXPERIMENTS

8. Verification of state tables of RS, JK, T and D flip flops using NAND and NOR gates.

UNIT V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES | **09**

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.

LIST OF EXPERIMENTS

9. Shift registers and Counters.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	30	75

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.
5. Department Lab Manual.
6. M. M. Mano, “Digital logic and Computer design”, Pearson Education India, 2016.

E REFERENCES

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

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	2	1	3	-	-	1	1	1	-	1	-	2	2	1
CO 2	3	2	1	-	-	2	0	2	1	-	-	2	1	2
CO 3	2	2	1	-	-	1	2	2	1	1	-	1	2	2
CO 4	2	2	3	-	-	1	1	1	-	-	1	1	1	2
CO 5	3	2	2	-	-	0	1	1	1	1	1	2	2	2
Total	12	9	10	-	-	5	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 Response
CO2	Determine the operation, characteristics and performance parameters of controlled rectifiers.	Cognitive Psychomotor	Understanding Mechanism
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		**L**	**T**	**P**	**H**
3:0:0		**3**	**0**	**2**	**5**

UNIT I POWER SWITCHING DEVICES **09**

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 **09**

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 **09**

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 **09**

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 **09**

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	30	75

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.

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 POs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	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

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 Mechanism
CO5	To Understand the operation of single phase induction motors and its performance parameters.	Cognitive Psychomotor	Understanding Mechanism

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 **09**

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 **09**

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 **12**

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.

UNIT IV SINGLE PHASE INDUCTION MOTORS	06
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** 8. OCC and load characteristics of three phase alternator. 9. V and inverted V curves of three phase synchronous motor.	
UNIT V SYNCHRONOUS MACHINES	**09**
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	30	75

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 POs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	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

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

SUB. CODE	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 — **09**

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 — **09**

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 — **09**

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 — **06**

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 POs 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
Total	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

SYLLABUS FOR ONE CREDIT (MINOR) COURSES

ELECTRICAL SAFETY

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Describe electrical hazards and safety equipment.	Cognitive	Understanding
CO2	Analyze and apply various grounding and bonding techniques.	Cognitive	Applying
CO3	Select appropriate safety method for low, medium and high voltage equipment.	Cognitive	knowledge

SUBCODE	SUB NAME	L	T	P	C
	ELECTRICAL SAFETY	1	0	0	1
C:P:A = 3:0:0		L	T	P	H
		1	0	0	1

UNIT I **15**

Principals of electric safety - Electricity & Human body - Earthing / Grounding Risk assessment & management - Safety against over voltage, extra-low and residual voltages - Safe practices – RCD, PPE, CB, lockout/tag out -Hazardous areas, Electrical insulation - Electrical fires, Arc flash - Electrical safety in hospitals and Industries. Hazards of electricity - basic physics of electrical hazards - electrical safety equipment safety procedures and methods - grounding and bonding of electrical systems and equipment - electrical maintenance and its relationship to safety - regulatory and legal safety requirements and standards accident prevention, accident investigation, rescue, and first aid - medical aspects of electrical trauma - low-voltage, medium- and high-voltage safety synopsis Human factors in electrical safety.

	LECTURE	TUTORIAL	TOTAL
	15	0	15

TEXT BOOKS

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, Al Winfield, ‘Electrical Safety Handbook’, McGraw-Hill Education, 4thEdition, 2012.

REFERENCE BOOKS

1. Maxwell Adams.J, ‘Electrical Safety- a guide to the causes and prevention of electric hazards’, The Institution of Electric Engineers, IET 1994.
2. Ray A. Jones, Jane G. Jones, ‘Electrical Safety in the Workplace’, Jones & Bartlett Learning, 2000.

MICROGRIDS

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Understand concept of microgrid and implementation issues.	Cognitive	Understanding
CO2	Understand issues related to power electronics interface.	Cognitive	Understanding
CO3	Acquire knowledge about modelling and stability analysis of solving power quality issues in Microgrid.	Cognitive	knowledge

SUB. CODE	SUB. NAME	L	T	P	C
	MICROGRIDS	1	0	0	1
C:P:A = 3:0:0		L	T	P	H
		1	0	0	1

UNIT I MICROGRIDS AND THEIR POWER QUALITY ISSUES **15**

Concept and definition of microgrid, review of sources of microgrids, typical structure and configuration of a microgrid: AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, modes of operation and control of microgrid: grid connected and islanded mode, Power quality issues in microgrids- Modeling and Stability analysis of Microgrid, regulatory standards, Microgrid economics.

	LECTURE	TUTORIAL	TOTAL
	15	0	15

TEXT BOOKS

1. John Twidell and Tony Weir, "Renewable Energy Resources" Tyalor and Francis Publications, 2005.
2. S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution."

REFERENCE BOOKS

1. Chetan Singh Solanki, "Solar Photo Voltaics", PHI learning Pvt. Ltd., New Delhi, 2009.
2. Freris,"Wind Energy Conversion System", Prentice Hall, 1990.
3. "Networks." Institution of Engineering and Technology, 30 Jun 2009.

PLC PROGRAMMING

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Understanding about the basics of PLC	Cognitive	Understanding
CO2	Describe different problems in PLC	Psychomotor	Perception

SUB. CODE	SUB. NAME	L	T	P	C
	PLC PROGRAMMING	1	0	0	1
C:P:A = 1:0:0		L	T	P	H
		1	0	0	1

UNIT I INTRODUCTION — **6**

Definitions of PLC, basic structure of PLC, working principles, data storage methods, inputs / outputs flag processing's, types of variables, definition of firmware, software, programming software tool and interfacing with PC (RS232 & TCP-IP), methods of PLC programming (LD, ST, FBD & SFC), What is logic, Conventional Ladder v/s PLC ladder, series and parallel function of OR, AND, NOT logic function blocks logical / mathematical operators & data types, array & data structure.

`UNIT I Lab Exercises — **9**

1. Draw and verify the ladder diagram for the given problem using the PLC: - Double acting Cylinder operation using solenoid valves.
2. Problems on OR logic ex: Stair case lighting problems, Problems on AND logic ex: Pressing unit other relevant simple problems like Railway platform example, flashing of light, Burglar alarm, Selection committee, Testing unit , Pressing unit problem, Drilling tool etc.
3. Problems on Timers

LECTURE	TUTORIAL	TOTAL
15	0	15

TEXT BOOKS

1. Programmable Logic Controllers by W.Bolton.
2. Programmable Logic Controllers and Industrial Automation: An Introduction Second Edition by Madhuchhanda Mitra, Samarjit Sen Gupta.

REFERENCE BOOKS

1. Programmable Logic Controllers: Programming Methods and Applications, (2003)by Hackworth

ENERGY AUDITING

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	Understand the importance of energy auditing & energy management.	Cognitive	Understanding
CO2	Apply their own ideas in optimizing the energy requirements to overcome the demand.	Cognitive	Applying
CO3	Acquire knowledge about energy monitoring and targeting to improve the energy efficiency.	Cognitive	knowledge

SUBCODE	SUB NAME	L	T	P	C
	ENERGY AUDITING	1	0	0	1
C:P:A = 1:0:0		L	T	P	H
		1	0	0	1

UNIT I ENERGY MANAGEMENT & AUDIT — **15**

Energy Scenario: energy needs of growing economy, energy pricing, energy sector reforms, Re-structuring of the energy supply sector, Energy Conservation Act-2001 and its features - Need for energy audit - Energy management & audit approach: understanding energy ts, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, energy audit instruments. Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM) - Energy Efficiency in Electrical Utilities: electrical load management and maximum demand control, power factor improvement, energy saving opportunities with energy efficient motors.

	LECTURE	TUTORIAL	TOTAL
	15	0	15

TEXT BOOKS

1. Energy Management Principles: C.B.Smith, Pergamon Press, 1981.
2. Industrial Energy Management and Utilization – L.C. Witte, P.S. Schmidt, D.R. Brown Hemisphere Publication, Washington, 1988.

REFERENCE BOOKS

1. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
2. Energy Conservation guide book Patrick/Patrick/ Fardo, Prentice hall, 1993.
3. Energy Management Handbook – W.C. Turner, John Wiley and Sons, A Wiley Interscience publication, 1988.

PROGRAMMING WITH AURDINO

COURSE OUTCOMES		Domain	Level
CO1	Understand the basics of Audino kit	Cognitive	Understanding
CO2	Applying the programming concept with different interfaces	Cognitive	Applying

SUBCODE	SUB NAME	L	T	P	C
	PROGRAMMING WITH AURDINO	**1**	**0**	**0**	**1**
C:P:A = 1:0:0		**L**	**T**	**P**	**H**
		1	**0**	**0**	**1**

UNIT I **15**

Arduino Basics - The Arduino platform - Block Diagram – Architecture. Basic programming essentials - Control structure - Functions - operators - Sketch Structure. Interfacing LED with Arduino. Interfacing 7-Segment display with Arduino. Interfacing LCD display with Arduino. Interfacing different sensors with Arduino

	LECTURE	TUTORIAL	TOTAL
	15	**0**	**15**

TEXT BOOKS

1. Exploring Arduino: Tools and Techniques for Engineering Wizardry 1st Edition by Jeremy Blum
2. Arduino: 101 Beginners Guide: How to get started with Your Arduino (Tips, Tricks, Projects and More!) by Erik Savasgard

REFERENCE BOOKS

1. Arduino Workshop: A Hands-On Introduction with 65 Projects 1st Edition by John Boxall