DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABI

Regulations 2018

(Applicable to candidates admitted in the Academic Year 2018-2019 onwards)

K.S.R. College of Engineering (Autonomous)

(Approved by AICTE, Accredited by NAAC with A grade & Affiliated to Anna University)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email : info@ksrce.ac.in Website : www.ksrce.ac.in

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	CURRICULUM UG R - 2018
Department	Electrical and Electronics Engineering	
Programme	B.E - Electrical and Electronics Engineering	

SEMESTER - I

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EN151	Technical English – I (Common to all Branches)	HSMC	2	0	1	3	30	70	100
2.	18MA151	Engineering Mathematics – I (Common to all Branches)	BSC	3	1	0	4	30	70	100
3.	18PH043	Engineering Physics (Common to CS,EC,EE &IT)	BSC	3	0	0	3	30	70	100
4.	18GE028	Manufacturing Practices (Common to CS,EC,EE &IT)	ESC	1	0	4	3	30	70	100
MANDATORY COURSES										
5.	18MC052	Environmental Science and Engineering (Common to all Branches)	MC	3	0	0	0	50	50	100
PRACTICAL										
6.	18PH028	Physics Laboratory	BSC	0	0	3	1	50	50	100
7.	18AU027	Engineering Graphics Laboratory (Common to CE, CS,EC,EE &IT)	ESC	0	0	3	1	50	50	100
Total				**12**	**1**	**11**	**15**	**700**		

*Induction program will be conducted for three weeks as per AICTE guidelines

SEMESTER - II

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EN251	Technical English – II (Common to all Branches)	HSMC	2	0	1	3	30	70	100
2.	18MA242	Applied Mathematics (Common to EC & EE)	BSC	3	1	0	4	30	70	100
3.	18CH051	Engineering Chemistry (Common to all Branches)	BSC	3	0	0	3	30	70	100
4.	18EE214	Electric Circuit Analysis	PCC	3	1	0	4	30	70	100
5.	18CS041	Programming for Problem Solving (Common to AU, CE, EC, EE & ME)	ESC	3	0	0	3	30	70	100
MANDATORY COURSES										
6.	18MC051	Constitution of India (Common to all Branches)	MC	3	0	0	0	50	50	100
PRACTICAL										
7.	18EE221	Electric Circuit Analysis Laboratory	PCC	0	0	3	1	50	50	100
8.	18CH028	Chemistry Laboratory (Common to all Branches)	BSC	0	0	3	1	50	50	100
9.	18CS027	Programming for Problem Solving Laboratory (Common to AU,CE,EC,EE & ME)	ESC	0	0	3	1	50	50	100
		Total		**17**	**2**	**10**	**20**	**800**		

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SEMESTER - III

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18MA344	Differential Equations and Numerical Methods (Common to EC & EE)	BSC	3	1	0	4	30	70	100
2.	18EE311	Electro Magnetic Theory	PCC	3	1	0	4	30	70	100
3.	18EE312	Electrical Machines - I	PCC	3	0	0	3	30	70	100
4.	18EE313	Analog Electronics	PCC	3	0	0	3	30	70	100
5.	18EE314	Measurements and Instrumentation	PCC	3	0	0	3	30	70	100
6.	18CS331	Object Oriented Programming with C++	ESC	3	0	0	3	30	70	100
PRACTICAL										
7.	18EE321	Electrical Machines Laboratory - I	PCC	0	0	3	1	50	50	100
8.	18EE322	Analog Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	18CS325	Object Oriented Programming Laboratory	ESC	0	0	3	1	50	50	100
10.	18HR351	Career Development Skills – I (Common to all Branches)	EEC	0	2	0	0	50	50	100
Total				**18**	**4**	**9**	**23**	**1000**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EE411	Power Systems - I	PCC	3	0	0	3	30	70	100
2.	18EE412	Electrical Machines - II	PCC	3	0	0	3	30	70	100
3.	18EE413	Control Systems	PCC	3	1	0	4	30	70	100
4.	18EE414	Digital Electronics	PCC	3	0	0	3	30	70	100
5.	18CS432	Data structure and Algorithms	ESC	3	0	0	3	30	70	100
6.	18HS051	Professional Ethics (Common to all Branches)	HSMC	3	0	0	3	30	70	100
PRACTICAL										
7.	18EE421	Electrical Machines Laboratory - II	PCC	0	0	3	1	50	50	100
8.	18EE422	Digital Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	18EE423	Control and Instrumentation Laboratory	PCC	0	0	3	1	50	50	100
10.	18HR452	Career Development Skills – II	EEC	0	2	0	0	50	50	100
			Total	**18**	**3**	**9**	**22**	**1000**		

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SEMESTER - V

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EE511	Power Systems – II	PCC	3	0	0	3	30	70	100
2.	18EE512	Signals and Systems	PCC	3	1	0	4	30	70	100
3.	18EE513	Power Electronics	PCC	3	0	0	3	30	70	100
4.	18EE514	Renewable Energy Systems	PCC	3	0	0	3	30	70	100
5.	-	Professional Elective - I	PEC	3	0	0	3	30	70	100
6.	-	Open Elective – I	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	18EE521	Power System Simulation Laboratory	PCC	0	0	3	1	50	50	100
8.	18EE522	Power Electronics Laboratory	PCC	0	0	3	1	50	50	100
9.	18EE523	Electronics Design Laboratory	PCC	0	0	3	1	50	50	100
10.	18HR553	Career Development Skills – III	EEC	0	2	0	0	50	50	100
			Total	**18**	**3**	**9**	**22**	**1000**		

SEMESTER - VI

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EE611	Electrical Machine Design	PCC	3	1	0	4	30	70	100
2.	18EE612	Microprocessors and Microcontroller	PCC	3	0	0	3	30	70	100
3.	18CS043	Python Programming (Common to CS, EC & EE)	ESC	3	0	0	3	30	70	100
4.	-	Professional Elective - II	PEC	3	0	0	3	30	70	100
5.	-	Open Elective – II	OEC	3	0	0	3	30	70	100
6.	18HS001	Principles of Management (Common to AU, CE,EC,EE, IT& ME)	HSMC	3	0	0	3	30	70	100
PRACTICAL										
7.	18EE621	Microprocessors and Microcontroller Laboratory	PCC	0	0	3	1	50	50	100
8.	18CS028	Python Programming Laboratory (Common to CS, EC & EE)	ESC	0	0	3	1	50	50	100
9.	18HR654	Career Development Skills – IV	EEC	0	2	0	0	50	50	100
		Total		**18**	**3**	**6**	**21**	**900**		

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SEMESTER - VII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EE711	Embedded Systems	PCC	3	0	0	3	30	70	100
2.	18EE712	Industrial Automation and Control	PCC	3	0	0	3	30	70	100
3.	-	Professional Elective - III	PEC	3	0	0	3	30	70	100
4.	-	Professional Elective - IV	PEC	3	0	0	3	30	70	100
5.	-	Open Elective - III	OEC	3	0	0	3	30	70	100
6.	-	Open Elective - IV	OEC	3	0	0	3	30	70	100
PRACTICAL										
7.	18EE721	Embedded Systems Laboratory	PCC	0	0	3	1	50	50	100
8.	18EE722	Mini Project	PROJ	0	0	6	3	50	50	100
			Total	**18**	**0**	**9**	**22**	**800**		

SEMESTER - VIII

Sl.No.	Course Code	Course Name	Category	Hours/ Week			Credit	Maximum Marks		
				L	T	P	C	CA	ES	Total
THEORY										
1.	18EE811	Energy Auditing and Management	PCC	3	0	0	3	30	70	100
2.	-	Professional Elective - V	PEC	3	0	0	3	30	70	100
3.	-	Professional Elective - VI	OEC	3	0	0	3	30	70	100
PRACTICAL										
4.	18EE821	Project Work & Dissertation	PROJ	0	0	12	6	50	50	200
			Total	**9**	**0**	**12**	**15**	**500**		

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE - I (SEMESTER - V)

Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE561	Industrial Electronics	S1	PEC	3	0	0	3	30	70	100
2.	18EE562	Power Plant Engineering	S2	PEC	3	0	0	3	30	70	100
3.	18EE563	Special Electrical Machines	S3	PEC	3	0	0	3	30	70	100
4.	18EE564	Advance Control System	S3	PEC	3	0	0	3	30	70	100
5.	18EE565	Basic VLSI Design	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE - II (SEMESTER - VI)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE661	Solid State Drives	S1	PEC	3	0	0	3	30	70	100
2.	18EE662	Power System Protection and Switchgear	S2	PEC	3	0	0	3	30	70	100
3.	18EE663	Power System Transients	S2	PEC	3	0	0	3	30	70	100
4.	18EE664	High Voltage Engineering	S3	PEC	3	0	0	3	30	70	100
5.	18EE665	Digital Signal Processing	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – III (SEMESTER - VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE761	Power Electronics for Renewable Energy Sources	S1	PEC	3	0	0	3	30	70	100
2.	18EE762	High Voltage Direct Current Transmission	S2	PEC	3	0	0	3	30	70	100
3.	18EE763	Power System Operation and Control	S2	PEC	3	0	0	3	30	70	100
4.	18EE764	Smart Grid Technology	S2	PEC	3	0	0	3	30	70	100
5.	18EE765	Fundamentals of Nano Technology	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – IV (SEMESTER – VII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE766	Electric and Hybrid Vehicles	S1	PEC	3	0	0	3	30	70	100
2.	18EE767	Flexible AC Transmission Systems	S2	PEC	3	0	0	3	30	70	100
3.	18EE768	Soft Computing Techniques	S4	PEC	3	0	0	3	30	70	100
4.	18EE769	Bio Medical Instrumentation	S4	PEC	3	0	0	3	30	70	100
5.	18EE771	Microcontroller Based System Design	S5	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – V (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE861	Simulation of Power Electronic Systems	S1	PEC	3	0	0	3	30	70	100
2.	18EE862	Power Quality	S2	PEC	3	0	0	3	30	70	100
3.	18EE863	Electric Power Utilization and Conservation	S3	PEC	3	0	0	3	30	70	100
4.	18EE864	Computer Aided Design of Electrical Apparatus	S3	PEC	3	0	0	3	30	70	100
5.	18EE865	Digital Image Processing	S4	PEC	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVE – VI (SEMESTER - VIII)											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18EE866	Batteries and Charging Management Systems	S1	PEC	3	0	0	3	30	70	100
2.	18EE867	Virtual Instrumentation	S4	PEC	3	0	0	3	30	70	100
3.	18EE868	Electronic Instrumentation	S4	PEC	3	0	0	3	30	70	100
4.	18EE869	Robotics Engineering	S5	PEC	3	0	0	3	30	70	100
5.	18EE871	Design and Installation of Solar and Wind Power Conversion System	S6	PEC	3	0	0	3	30	70	100

OPEN ELECTIVE LIST											
Sl.No.	Course Code	Course Name	Specialization	Category	Hours/ Week			Credit	Maximum Marks		
					L	T	P	C	CA	ES	Total
1.	18AU769	Intelligent Vehicles Technology	AU	OEC	3	0	0	3	30	70	100
2.	18AU415	Automotive Electrical and Electronics Systems	AU	OEC	3	0	0	3	30	70	100
3.	18CE091	Basics of Civil and Mechanical Engineering (Common To CS, EE & IT)	CE	OEC	3	0	0	3	30	70	100
4.	18CE313	Fluid Mechanics	CE	OEC	3	0	0	3	30	70	100
5.	18CE867	Municipal Waste and Management	CE	OEC	3	0	0	3	30	70	100
6.	18CE866	Architecture Planning Aspects	CE	OEC	3	0	0	3	30	70	100
7.	18CE664	Remote Sensing and GIS	CE	OEC	3	0	0	3	30	70	100
8.	18CS871	M-Commerce	CS	OEC	3	0	0	3	30	70	100
9.	18CS514	Computer Networks	CS	OEC	3	0	0	3	30	70	100
10.	18CS513	Web Programming	CS	OEC	3	0	0	3	30	70	100
11.	18CS002	JAVA Programming (Common To CS & EE)	CS	OEC	3	0	0	3	30	70	100
12.	18CS003	Operating Systems (Common To CS & EE)	CS	OEC	3	0	0	3	30	70	100
13.	18CS869	Internet of Things	CS	OEC	3	0	0	3	30	70	100
14.	18CS312	Computer Organization and Architecture	CS	OEC	3	0	0	3	30	70	100
15.	18EC662	Medical Electronics	EC	OEC	3	0	0	3	30	70	100
16.	18IT673	Video Analytics	IT	OEC	3	0	0	3	30	70	100
17.	18IT711	Mobile Application Development	IT	OEC	3	0	0	3	30	70	100
18.	18ME413	Thermal Engineering	ME	OEC	3	0	0	3	30	70	100
19.	18ME664	Internal Combustion Engines	ME	OEC	3	0	0	3	30	70	100
20.	18ME097	Industrial Safety Engineering	ME	OEC	3	0	0	3	30	70	100
21.	18HS095	Engineering Economics and Financial Accounting	HS	OEC	3	0	0	3	30	70	100
22.	18HS002	Total Quality Management (Common to AU, CE, CS, EE, IT & ME)	HS	OEC	3	0	0	3	30	70	100

OPEN ELECTIVE LIST											
Sl.No.	**Course Code**	**Course Name**	**Specialization**	**Category**	**Hours/ Week**			**Credit**	**Maximum Marks**		
					L	**T**	**P**	**C**	**CA**	**ES**	**Total**
23.	18HS094	Disaster Management	HS	OEC	3	0	0	3	30	70	100
24.	18MA081	Operations Research	HS	BSC	3	0	0	3	30	70	100

S1 – Power Electronics
S2 – Power Systems
S3 – Electrical Engineering
S4 – Electronics Engineering
S5 – Embedded Systems
S6 – Computer Programming
S7 - Management Studies

LIST OF VALUE ADDED COURSES

Sl.No.	**Course Name**	**Number of Hours**	**Offered by Internal / External**
1	Control of Motors using Drives	15	Internal / External
2	Control Panel Wiring	15	Internal / External
3	Distributed Control System	15	Internal / External
4	Electrical CADD	15	Internal / External
5	MATLAB for Electrical Engineers	15	Internal/ External
6	PCB Design	15	Internal / External
7	Systems, Applications and Products (SAP)	15	Internal / External
8	Electrical Safety Standards and Practices	15	Internal / External
9	Solar PV Systems: Design, Simulation, and Monitoring and Control	15	Internal / External
10	Embedded System Design	15	Internal/ External
11	Automotive Electrical and Electronic Systems	15	Internal / External
12	PLC- SCADA	15	Internal / External

COURSE COMPONENT SUMMARY

S. No.	**Subject Area**	**Credits Per Semester**								**Credits Total**	**Percentage Credits**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1.	HSMC	3	3	-	3	-	3	-	-	12	7.5
2.	BSC	8	8	4	-	-	-	-	-	20	12.5
3.	ESC	4	4	4	3	-	4	-	-	19	11.88
4.	PCC	-	5	15	16	16	8	7	3	70	43.75
5.	PEC	-	-	-	-	3	3	6	6	18	11.25
6.	OEC	-	-	-	-	3	3	6	-	12	7.5
7.	PROJ	-	-	-	-	-	-	3	6	9	5.6
TOTAL		**15**	20	23	22	22	21	22	15	160	100

Total No. of Credits = 160

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

SEMESTER - I

		L	T	P	C
18EN151	**TECHNICAL ENGLISH – I** (Common to all Branches)	2	0	1	3

Prerequisite: *NIL*

Objectives:

- *To develop basic conversation skills.*
- *To build vocabulary skills with the right choice of words.*
- *To improve students' understanding of grammar in context progressively.*
- *To empower students on professional writing*
- *To use the LSRW skills in professional context*

UNIT - I **[9]**

Synonyms & Antonyms – Tenses (Simple Present, Present Continuous, Present Perfect, Simple Past, and Simple Future) - Use of Modal Auxiliaries – Infinitive and Gerund –- Intensive Reading – Predicting Content – Interpretation - Active Listening - Listening for the Main Idea - Need based Correspondence (request for joining hostel, bonafide certificate)

UNIT - II **[9]**

British & American Terminology - Impersonal Passive – Standard Abbreviations and Acronyms - Predicting Content - Drawing inferences - Listening for specific details - Listening to News – Job Application and Resume – Writing Instructions

UNIT - III **[9]**

Preposition of Time, Place and Movement – Concord (Subject & Verb Agreement) – Passive Voice – Consonant Sounds – Pronunciation guidelines related to Vowels and Consonant – Skimming & Scanning - Inference – Context Based Meaning – Welcome Speech – Vote of Thanks.

UNIT - IV **[9]**

Newspaper Reading – Vocabulary Building – Phrasal Verbs (Put, Give, Look, Take, Get, Call) – Note Making – Rearranging the Jumbled Sentences - MoC – Anchoring – Role play in Academic Context – E Mail Etiquette – Introducing others.

UNIT - V **[9]**

Listening to Dialogues – Listening to Telephonic Conversation - Recommendation Writing - Letter of Invitation (inviting, accepting and declining) – Paragraph Writing - Letter to the Editor of a News Paper – Drills using Minimal Pairs – Presentation Skills.

Total = 45 Periods

Course Outcomes : On completion of this course, the student will be able to

CO 1: Comprehend and apply Grammar in context for professional communication.
CO 2: Infer the gist and specific information.
CO 3: Express and interact in the society and place of study.
CO 4: Critically interpret by reading a text and comprehend a given text.
CO 5: Correspond and communicate for jobs.

Text Books :

1 Dr.P.Rathna, English Work Book – I, VRB Publishers Pvt. Ltd., Chennai, Fourth Edition,2018
2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, Second Edition, 2018

Reference Books :

1 Meenakshi Raman. Technical Communication, Oxford University Press, New Delhi, First Edition, 2017
2 Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, First Edition, 2016
3 M Ashra Rizvi, Effective Technical Communication, Tata McGRAW HILL, New Delhi, First Edition, 2005
4 P.Kiranmani Dutt, A course in Communication Skills, Cambridge University Press, New Delhi, First Edition, 2014

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SEMESTER – I

		L	T	P	C
18MA151	**ENGINEERING MATHEMATICS – I** (Common To All branches)	3	1	0	4

Prerequisite: NIL

Objectives:

- *To study the concepts of Matrices and its Applications.*
- *To study the concepts and its applications of Ordinary Differential Equations*
- *To acquire knowledge in solving differential calculus.*
- *To study the concepts of functions of several variables*
- *To acquire the basics of Vector Calculus and its applications.*

UNIT – I LINEAR ALGEBRA [12]

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (Excluding proof) – Cayley Hamilton theorem (excluding proof) – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT – II ORDINARY DIFFERENTIAL EQUATIONS [12]

Linear differential equations of second and higher order with constant coefficients – Differential equations with variable coefficients – Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT – III DIFFERENTIAL CALCULUS [12]

Curvature - Radius of curvature (Cartesian co-ordinates only) – Centre of curvature and Circle of curvature – Involutes and Evolutes.

UNIT – IV FUNCTIONS OF SEVERAL VARIABLES [12]

Partial derivatives – Total derivatives – Euler's theorem for homogenous functions – Taylor's series expansion - Maxima and Minima for functions of two variables – Method of Lagrangian multipliers.

UNIT – V VECTOR CALCULUS [12]

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Green's theorem in plane, Gauss divergence theorem and Stoke's theorem – Problems in Cube, Cuboid and Rectangular paralleopiped only.

Total (L: 45 T:15) = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Interpret the basics of Matrix applications in the field of engineering.
CO2: Acquire knowledge in solving ordinary differential equations.
CO3: Explain and apply the concepts of differential calculus problems.
CO4: Skills in developing and solving the functions of several variables.
CO5: Acquire the basics of vector calculus and its applications

Text Books :

1 Ravish R Singh and Mukul Bhatt, Engineering Mathematics – I, McGraw Hill Publications, Third Edition, New Delhi 2016.
2 Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, Forty Three Edition, New Delhi, 2015.

Reference Books :

1 Bali N. P and Manish Goyal, Engineering Mathematics, Laxmi Publications (p) Ltd., Seventh Edition, 2016.
2 Dass H.K, Advance Engineering Mathematics, S. Chand and company, Eleventh Edition, 2015.
3 Jain R.K. and Iyengar S.R.K., - Advanced Engineering Mathematics, Narosa Publicaitons, Eigth Edition, 2012.
4 http://www.sosmath.com/matrix/matrix.html

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SEMESTER – I

		L	T	P	C
18PH043	**ENGINEERING PHYSICS** (Common to EC,EE,CS & IT)	3	0	0	3

Prerequisite: *NIL*

Objectives:

- *To compute and analyze various problems related to Engineering Physics.*
- *To understand the various optoelectronic devices and its applications in the field of Engineering and also to explore the prism concepts of Quantum physics.*
- *To emphasize the basic concepts behind the types of advanced materials & nanotechnology.*
- *To explore the basic concepts behind the sensors, transducers and Laser.*
- *To comprehend the fundamentals of physics thereby exploring it for potential engineering applications.*

UNIT - I QUANTUM PHYSICS [9]

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect – Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box, Scanning Electron Microscopy (SEM),Transmission Electron Microscopy (TEM), .

UNIT - II OPTOELECTRONIC DEVICES [9]

Photoconductive materials – Light Dependent Resistor (LDR) – Working – Applications – Photovoltaic materials – Solar cell – Construction, working and applications – Light Emitting Diode (LED) – Principle, construction and working - Liquid crystal Display (LCD) – Types and applications.

UNIT - III ADVANCED MATERIALS AND NANOTECHNOLOGY [9]

New Engineering Materials: metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of Ni Ti alloy applications – advantages and disadvantages of SMA.Nanomaterials: Properties-Top-down process: Ball Milling method – Bottom-up process: Vapour Phase Deposition method- Carbon nano tube (CNT): Properties, preparation by electric arc method, Applications

UNIT - IV LASER TECHNOLOGY [9]

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping – Einstein's A and B coefficients (derivation). Types of lasers – Nd-YAG, CO_2 and Semiconductor lasers (homo-junction and hetero-junction) – Qualitative Industrial Applications: Lasers in welding, heat treatment and cutting – Medical applications – Holography (construction and reconstruction).

UNIT - V SENSOR TECHNOLOGY [9]

Definition – Principle of sensor & transducer – classification – types of Sensors – resolution, accuracy, sensitivity, – Inductive sensor– Linear Variable Differential Transistor (LVDT) – Thermal sensors – Thermocouple – Magnetic sensors – Strain gauge torque meters – biosensors – electronic nose –electronic tongue – medical, food and agricultural applications.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Enumerate the preambles of quantum physics and implement its concepts to tackle the cumbersome engineering problems.
CO 2: Explore the concepts of optoelectronic devices for the fabrication of electronic devices.
CO 3: Apply the techniques for manufacturing of advanced materials aided with Nano properties
CO 4: Categorize the types of laser and utilize it for specific application based on their desirable requisite.
CO 5: Utilize the conceived concepts and techniques for sensors and transducers.

Text Book :

1 M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, Seventh Edition, 2014.
2 R.K.Gaur&S.L.Gupta, Engineering Physics, Dhanpat Rai Publication, New Delhi, Seventh Edition, 2014.

Reference Books :

1 D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, John Wiley & sons, USA,nineth Edition, 2011.
2 V. Rajendran, "ngineering Physics, Tata McGraw Hill, New Delhi, first Edition, 2011.
3 R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers with Modern Physics, Cengage Learning, USA, Nineth Edition, 2013.
4 Arthur Beiser, Concepts of Modern Physics, Tata McGraw Hill, New Delhi, Sixth Edition, 2010.

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SEMESTER – I

		L	T	P	C
18GE028	**MANUFACTURING PRACTICES** (Common to CS, EC, EE & IT)	1	0	4	3

Prerequisite: *NIL*

Objective:

- *To study the basic concepts of manufacturing processes.*
- *To hands on training of Welding and Foundry processes.*
- *To acquire the knowledge of various manufacturing methods.*

GROUP-A

(CIVIL & MECHANICAL)

1. MANUFACTURING PROCESS :

Theory (Lectures & videos) **[10]**

1.Foundry
Mould preparation-Metal casting-plastic moulding.
2. Carpentry
Carpentry tools-carpentry operations-carpentry joints.
3. Fitting
Fitting tools-Fitting operations - power tools.
4. Welding
Types-Arc welding-Gas welding-Brazing.
5. Manufacturing Methods
Metal forming-Basic Machining-CNC Machining-Metal joining- Additive manufacturing-Glass Cutting.

2. WORKSHOP PRACTICE:

Practical **[25]**

LIST OF EXPERIMENTS

1. Prepare a mould using solid pattern using foundry process.
2. Make T- joint from the given wooden pieces using carpentry tools.
3. Make Butt joint using arc welding equipment.
4. Perform simple facing and turning operation using Centre Lathe.
5. Make holes as per the given dimensions using drilling machine.

Total [Group-A] = 35 periods

Course Outcomes: ***On completion of this course, the students will be able to***

CO1: Explore the fundamental knowledge of different manufacturing processes.
CO2: Construct different welding joints and preparation of mould cavity.
CO3: Examine various machining operations.

Text Books:

1 Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Vol. I and Vol. II, Media promoters and publishers private limited, Mumbai, Second Edition, 2017.
2 Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I Pearson Education, New Delhi, Second Edition, 2013.

Reference Books:

1 Roy A. Lindberg, Processes and Materials of Manufacture, Prentice Hall India, Delhi, Fourth edition, 1998.
2 Kalpakjian S. And Steven S. Schmid, Manufacturing Engineering and Technology, Pearson Education, Delhi, Seventh edition, 2014.
3 Rao P.N., Manufacturing Technology, Vol. I and Vol. II, Tata McGraw Hill, New Delhi, Third edition, 2013.

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SEMESTER – I / II

18GE028	**GROUP –B (ELECTRICAL & ELECTRONICS)** (Common to CS, EC, EE & IT)	L	T	P	C
		1	0	4	3

Prerequisite: *NIL*

Objectives:

- *To study different types of wiring used in house.*
- To learn the procedure for calibration of Single phase Energy meter
- *To learn components in electronics, different logic gates and the working of CRO.*

(i) Theory (Lectures & videos) **[02]**

Electrical and Electronics

Electrical symbols.

Electrical layout, Electrical wiring materials.

Electronics components.

(ii) Practical **[08]**

List of Experiments:

ELECTRICAL ENGINEERING

1. Fluorescent lamp wiring & Stair-case wiring.
2. Calibration of Single phase Energy meter.

ELECTRONICS ENGINEERING

3. Study of Electronic components and Soldering practice.
4. Study of logic gates AND, OR, EX-OR, NOT, Half and Full Adder.
5. Study of CRO.

Total [Group-B] = 10 periods

Course Outcomes: ***On completion of this course, the students will be able to***

CO1: Construct different types of wiring used in house.

CO2: Calibrate single phase Energy meter.

CO3: Organize different electronic components and logic gates.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

GROUP	*Theory Examinations (Marks)*	*Duration (Minutes)*	*Practical Examinations (Marks)*	*Duration (Minutes)*	*Exam will be conducted for (Marks)*
Group-A	*20*	*30*	*50*	*90*	*70*
Group-B	*10*	*15*	*20*	*45*	*30*
Total	*30*	*45*	*70*	*135*	*100*

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SEMESTER – I / II

		L	T	P	C
18MC052	**ENVIRONMENTAL SCIENCE AND ENGINEERING**				
	(Mandatory, Non - Credit course) (Common to All Branches)	3	0	0	0

Prerequisite: *NIL*

Objectives:

- *To impart knowledge on the principle of environmental science and engineering.*
- *To embellish the students to understand the usages of natural resources, ecosystem and biodiversity.*
- *To create awareness on pollution, value education and social issues.*
- *To appreciate the importance of environment by assessing its impact on the human world.*
- *To envision the surrounding environment, its functions and its value.*

UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES [9]

Environment – definition – scope and importance – need for public awareness; Forest resources – use – over exploitation – deforestation; Water resources – over–utilization of surface and ground water; Mineral resources –environmental effects of extracting and using mineral resources; Food resources – overgrazing – effects of modern agriculture – fertilizer–pesticide problems – water logging – salinity; Role of an individual in conservation of natural resources. **Activity:** Slogan making event on conserving natural resources or plantation of trees.

UNIT - II ECOSYSTEM AND BIODIVERSITY [9]

Concept of an ecosystem – structure and function of an ecosystem – producers – consumers and decomposers – Food chain – food web – energy flow in the ecosystem – ecological pyramids – Ecological succession; Forest ecosystem and Aquatic ecosystems (Estuary and marine ecosystem); Biodiversity – introduction – definition – Values of biodiversity; Hot-spots of biodiversity; Endangered and Endemic Species of India. **Activity:** Arrange a trip to visit different varieties of plants.

UNIT - III ENVIRONMENTAL POLLUTION [9]

Pollution – introduction and different types of pollution; Causes – effects and control measures of air pollution and water pollution – water quality parameters – hardness – definition – types; Alkalinity – definition – types; BOD and COD (definition and significance); Noise pollution – solid waste management – hazardous waste – medical and e-wastes; Role of an individual in prevention of pollution. **Activity:** Drive for segregation of waste or cleanliness drive.

UNIT - IV SOCIAL ISSUES AND ENVIRONMENT [9]

Water conservation – rain water harvesting and watershed management; Environmental ethics – Issues and possible solutions; Climate change – global warming and its effects on flora and fauna – acid rain – ozone layer depletion; Disaster Management – earth quake – cyclone – tsunami – disaster preparedness – response and recovery from disaster. **Activity:** Poster making event on water management or Climate change.

UNIT - V SUSTAINABILITY AND GREEN CHEMISTRY [9]

Sustainable development – from unsustainable to sustainable development – Environmental Impact Assessment (EIA); Human rights; Value education; HIV/AIDS; Role of information technology in environment and human health; 12 Principles of Green Chemistry. **Activity:** Group discussion on Sustainability or Lecture from an expert on Green chemistry.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Prioritize the importance in conservation of resources for future generation

CO 2: Relate the importance of ecosystem and biodiversity

CO 3: Analyze the impact of pollution and hazardous waste in a global and societal context.

CO 4: Identify the contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems

CO 5: Categorize the concept of Sustainability and Green Chemistry.

Text Book :

1 Dr. T. Arun Luiz, Environmental Science and Engineering, S. Chand & Company Private Limited, New Delhi, First Edition, 2016.

2 Anubha Kaushik and C. P. Kaushik, Environmental Science and Engineering, New Age International Publishers, Chennai, Fourth Edition, 2014.

Reference Books :

1 G. Tyler Miller and Scott E. Spoolman, Environmental Science, Cengage Learning India Private Limited, New Delhi, Fourteenth Edition, 2014.

2 Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri krishna Hi-tech Publishing Company Private Limited, Chennai, Tenth Edition, 2014.

3 Raman Sivakumar, Introduction to Environmental Science and Engineering, Tata McGraw Hill Education Private Limited, Fourth Edition, 2012.

4 S S. Dara, A Text book of Environmental Chemistry and pollution control, S. Chand & Company Limited, New Delhi, Tenth Edition, 2005.

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SEMESTER – I

		L	T	P	C
18PH028	**PHYSICS LABORATORY** (Common to all branches)	0	0	3	1

Prerequisite: *Knowledge in Engineering Physics*

Objectives:

- *To train engineering students on basis of measurements and the instruments.*
- *To gain the practical knowledge and hands on experiences of understanding the physics concepts applied in optics, sound and thermal physics.*
- *To give practical training on basic Physics experiments which are useful to engineers.*
- *Apply the analytical techniques and graphical analysis to the experimental data.*
- *To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.*

List of Experiments:

1. Determination of wavelength of Laser using grating and the Size of the Particles.
2. Determination of thickness of the given material by Air – wedge method.
3. Determination of velocity of Ultrasonic waves and compressibility using Ultrasonic interferometer.
4. Spectrometer grating - Determination of wavelength of mercury spectrum.
5. Determination of thermal conductivity of a bad conductor by Lee's disc method.
6. Determination of Young's modulus of the material of a uniform bar by Non – Uniform bending method.
7. Determination of Band gap energy of a semiconductor.
8. Determination of Viscosity of a given liquid by Poiseuille's method.
9. Torsional pendulum - Determination of rigidity modulus of a given wire.
10. V-I Characteristics of Solar Cell.

Total : 30 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO 1: Comprehend the different physical parameters of optics.
CO 2: Perceive the production of ultrasonic waves through inverse piezoelectric effect and to determine the velocity of sound waves in the given liquid.
CO 3: Explore the principle of thermal conductivity thereby to calculate the thermal conductivity of various bad conductors like cardboard, mica, etc.
CO 4: Confer the experimental counterparts of materials properties such as modulus, solar cell, and energy gap.
CO 5: Imbibe the concept of capillary action in fluid dynamics and to compare the coefficient of viscosity of the given liquid.

Text Book :

1 Faculty Members of Physics, Physics Lab manual, Department of Physics, K.S.R. College of Engineering, Namakkal, seventeenth Edition, 2018.
2 Dr. P. Mani, Physics Lab Manual & Observation Book, Dhanam Publications, tweleth Edition Chennai 2017.

Reference Book:

1 Dr. G. Senthilkumar, "Physics Lab manual", VRB Publications Pvt. Ltd., Chennai, tenth Edition, 2006.
2 R Suresh & Dr. C. Kalyanasundaram, Physics Laboratory, Sri Krishna Hitech Publishing Company Pvt. Ltd., Chennai, fifth Edition, 2017.

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SEMESTER – I

		L	T	P	C
18AU027	**ENGINEERING GRAPHICS LABORATORY** (Common To CE,CS,EC,EE & IT)	0	0	3	1

Prerequisite: *No Prerequisites are needed for enrolling into the course.*

Objective:

- *To improve graphic skills for communication of concepts, ideas, and design of engineering products.*
- *To develop skill for using software to create 2D and 3D models.*
- *To become proficient in drawing the projection of various solids.*
- *To gain knowledge about orthographic and isometric projections.*
- *To improve their visualization skills so that they can apply these skills in developing new products.*

List of Experiments:

1. Study of basic tools, commands and coordinate system (absolute, relative, polar, etc.) used in 2D software.
2. Draw the conic curves and special curves by using AutoCAD.
3. Draw the front view, top view, side view of objects from the given pictorial view.
4. Draw the projections of straight lines.
5. Draw the projections of polygonal surface.
6. Draw the projections of simple solid objects.
7. Draw the sectional view and the true shape of the given section.
8. Draw the development of surfaces like prism, pyramids, cylinders and cone.
9. Draw the isometric projections of simple solids, truncated prism and pyramids.
10. Draw the isometric projections of cylinder and cone.

Total : 45 Periods

Course Outcomes: ***On completion of this course, the students will be able to***

CO 1: Construct the various plane curves.
CO 2: Formulate orthographic projection of lines and plane surfaces.
CO 3: Draw projections of solids and development of surfaces.
CO 4: Prepare the isometric sections of simple solids.
CO 5: Develop the section of solids and surfaces.

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SEMESTER - II

		L	T	P	C
18EN251	**TECHNICAL ENGLISH – II** (Common to all Branches)	2	0	1	3

Prerequisite: *NIL*

Objectives:

- *To make students firm on vocabulary and grammar.*
- *To develop students speaking ability*
- *To enhance students' professional skills on professional writing.*
- *To enable students reading and listening skills.*
- *To optimize LSRW skills for personal development*

UNIT - I **[9]**

Technical Vocabulary – Changing words from one form to another - Articles – Compound Nouns - Critical reading - Need based Correspondence (In plant training & Industrial Visit) - Context based meaning – Introducing Oneself – Writing short Essays.

UNIT - II **[9]**

Numerical Adjectives – Prefixes & Suffixes- If Conditionals – E-mail Writing - Greetings and Introductions – Making Requests – Seeking Information – Inviting People – Likes & Dislikes -. Listening for main ideas - Report Writing.

UNIT - III **[9]**

Framing Questions – 'Wh' Question – Yes / No Question –Discourse markers - Cause and Effect Expression - Critical reading, Making inference - Transcoding (Interpretation of Charts) - Listening and Note taking – Oral Presentation.

UNIT - IV **[9]**

Expression of Purpose – Editing text for Spelling and Punctuation – Redundancies - Business Correspondence – Calling for Quotations, Seeking Clarification, placing order and Complaint - Extensive Listening – Short Comprehension Passages.

UNIT - V **[9]**

Instructions – Describing – Telephone Etiquette - Listening to fill up forms and gapped texts – Agenda and Minutes of meeting – Check list – Essay Writing – Reading Short texts from Journals and Newspapers.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO 1: Comprehend and apply the enriched vocabulary, by knowing the basic grammatical structure, in academic and professional contexts.
CO 2: Recognize and use Standard English in diverse situations.
CO 3: Critically interpret by reading a text and comprehend a given text.
CO 4: Compose and write clearly in professional contest.
CO 5: Enhance the listening skill for academic purposes.

Text Books :

1 Dr.P.Rathna, English Work Book – II, VRB Publishers Pvt. Ltd., Chennai, Second Edition,2016
2 S.Sumant, Technical English – I, Vijay Nicole, Chennai, Second Edition,2018

Reference Books :

1 Dr.S.Sumant, Technical English I, Tata McGraw Hill, Chennai, First Edition, 2016.
2 Dept. of Humanities and social sciences, Anna University, Chennai, English for Engineers and Technologists, Orient Longman, First Edition, 2014.
3 Hory Sankar Mukerjee, Business Communication, Oxford University Press, New Delhi, First Edition, 2013.
4 Department of English, English for Technologists and Engineers, Orient Black Swan, Chennai, First Edition, 2016.

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SEMESTER - II

		L	T	P	C
18MA242	**APPLIED MATHEMATICS** (Common to EC and EE)	3	1	0	4

Prerequisite: NIL

Objective(s):

- *To acquire the concepts of Laplace transform and inverse Laplace transform techniques.*
- *To apply the basics of Complex Variables along with classical theorems involving them.*
- *To develop sound knowledge in double, triple integrals.*
- *To provide basic ideas in Fourier series.*
- *To solve the ideas in Fourier Transforms.*

UNIT - I LAPLACE TRANSFORMATION [12]

Laplace transform: Conditions for existence – Transform of elementary functions – Basic Properties – Transform of derivatives and integrals – Transform of periodic functions. Inverse Laplace transform: Partial Fraction Method - Convolution theorem (excluding proof) – Solution of linear ordinary differential equations of second order with constant coefficients.

UNIT – II COMPLEX VARIABLES [12]

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proof) – Harmonic functions – Harmonic conjugate – Conformal mapping : w = cz, c+z, 1/z and bilinear transformations - Complex integration - Residues – Cauchy's residue theorem.

UNIT - III MULTIPLE INTEGRALS [12]

Double integration – Cartesian coordinates – Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

UNIT - IV FOURIER SERIES [12]

Dirichlet's conditions – General Fourier series - Odd and even functions – Half range sine and cosine series – Parseval's theorem – Harmonic analysis.

UNIT - V FOURIER TRANSFORMS [12]

Fourier integral theorem (without proof) - Fourier Transform pair – Sine and cosine transforms - Properties – Transforms of simple functions – Parseval's identity.

Total (L: 45 T:15) = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Use the concepts of Laplace and inverse Laplace transform
CO 2: Apply the ideas of analytic functions, conformal mapping and bilinear transformations.
CO 3: Develop their skills in double and triple integrals.
CO 4: Apply the ideas of Fourier series and its applications in the field of engineering.
CO 5: Interpret the concepts of Fourier Transforms.

Text Books :

1 Veerarajan.T , Engineering Mathematics III, Tata McGraw Hill Publications, New Delhi, Fourth edition, 2016.
2 Dr.Grewal B.S, Higher Engineering Mathematics, Tata McGraw Hill Pub. Co, New Delhi , Forty four edition, 2018

References :

1 Ravish R Singh and Mukul Bhatt, Engineering Mathematics II, McGraw Hill Publications, New Delhi, Third edition 2016.
2 Dr.P.Kandasamy, Dr.Thilagavathy and Dr.K.Gunavathy, Engineering Mathematics , S.Chand publication, New Delhi, 2006.
3 E.Kreyszig Advanced Engineering Mathematics , Wiley Publishers, Tenth Edition, Reprint 2017.
4 Veerarajan. T , Engineering Mathematics For semester I and II, Tata McGraw Hill Publications, New Delhi, Third edition, 2015.

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SEMESTER – II

		L	T	P	C
18CH051	**ENGINEERING CHEMISTRY (Common to All Branches)**	3	0	0	3

Prerequisite: *NIL.*

Objectives:

- *To Impart knowledge about the manufacture, properties and uses of advanced engineering materials*
- *To acquaint the students with the basic concepts of corrosion mechanism and its control*
- *To understand the concept of thermodynamics*
- *To gain knowledge about atomic structure and chemical bonding*
- *To make the students conversant with various spectroscopic techniques*

UNIT - I ADVANCED ENGINEERING MATERIALS [9]

Abrasives – Moh's scale of hardness – types – natural [Diamond] – synthetic [SiC]; Refractories – characteristics – classifications [Acidic, basic and neutral refractories] – properties – refractoriness – RUL – porosity – thermal spalling; Lubricants – definition – function – characteristics – properties – viscosity index, flash and fire points, cloud and pour points, oiliness; Solid lubricants – graphite and MoS_2; Nano materials – CNT– synthesis [CVD, laser evaporation, pyrolysis] – applications – medicine, electronics, biomaterials and environment.

UNIT - II ELECTROCHEMISTRY AND CORROSION [9]

Introduction – electrode potential – Nernst equation – EMF series and its significance – types of cells (Electrolytic & electrochemical); Corrosion – causes, consequences – classification – chemical corrosion – electro chemical corrosion – mechanism; Galvanic & differential aeration corrosion – factors influencing corrosion – corrosion control – corrosion inhibitors.

UNIT - III CHEMICAL THERMODYNAMICS [9]

Terminology of thermodynamics – second law; Entropy – entropy change for an ideal gas – reversible and irreversible processes – entropy of phase transition – Clausius inequality; Free energy and work function – Helmholtz and Gibb's free energy functions (Problems) – criteria of spontaneity; Gibb's – Helmholtz equation (Problems) – Clausius-Clapeyron equation; Maxwell's relations – Van't Hoff isotherm and isochore (problems).

UNIT - IV ATOMIC STRUCTURE AND CHEMICAL BONDING [9]

Effective nuclear charge – orbitals – variations of s, p, d and f orbital – electronic configurations – ionization energy – electron affinity and electro negativity; Types of bonding – ionic, covalent and coordination bonding – hydrogen bonding and its types; Crystal field theory – the energy level diagram for transition metal complexes ($[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[CoCl_4]^{2-}$ only); Role of transition metal ions in biological system; Band theory of solids.

UNIT - V PHOTOCHEMISTRY AND SPECTROSCOPIC TECHNIQUES [9]

Laws of photochemistry – Grotthuss Draper law – Stark-Einstein law – Beer-Lambert law – phosphorescence – fluorescence and it's applications in medicine – chemiluminescence; Colorimetry – principle – instrumentation (block diagram only) – estimation of iron by colorimetry; principles of spectroscopy – selection rules – vibrational and rotational spectroscopy – applications; Flame photometry – principle – instrumentation (block diagram only) – estimation of sodium; Atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Make use of the manufacture, properties and uses of advanced engineering materials.
CO 2: Recognize the knowledge on the concept of corrosion and its control.
CO 3: Assess knowledge about thermodynamics.
CO 4: Rationalize periodic properties such as ionization energy, electron affinity and electro negativity.
CO 5: Recognize the usage of various spectroscopic techniques.

Text Book :

1 Dr. A. Ravikrishnan, Engineering Chemistry, Srikrishna Hi-tech Publishing Company Private Limited, Chennai, Seventeenth Edition, 2016.

2 P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing company, New Delhi, Seventeenth Edition, 2015.

Reference Books :

1 S S. Dara and S. S. Umare, A Text book of Engineering Chemistry, S. Chand & Company Limited, New Delhi, Fifth Edition, 2015.

2 N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, PHI Learning Private Limited, New Delhi, Third Edition, 2014.

3 S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Private Limited, New Delhi, First Edition, 2013.

4 B. Sivasankar, Engineering Chemistry, Tata McGraw – Hill Education Private Limited, New Delhi, First Edition, 2008.

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SEMESTER - II

		L	T	P	C
18EE214	**ELECTRIC CIRCUIT ANALYSIS**	3	1	0	4

Prerequisite: *Engineering Mathematics (algebraic equation, integral and differential calculus)*

Objectives:

- *To learn the fundamentals of DC & AC circuits*
- *To familiarize with basic concepts related to network reduction techniques and network theorems*
- *To get familiarity with the steady state analysis of sinusoidal circuits*
- *To gain knowledge about the solution of three phase and series resonance circuits*
- *To impart knowledge on behavior of two port networks*

UNIT - I DC & AC CIRCUITS [12]

Basic Definitions – Circuit Terminologies- Ohm's Law & its Limitations – Kirchhoff's Laws – Resistors in Series and Parallel circuits –Voltage and Current division Techniques- Mesh Current and Node Voltage Methods. Characteristics of Sinusoids – Average and RMS Value –Form Factor – Peak Factor- Phase Difference - Phasor Representation - Concept of Impedance and Admittance

UNIT - II REDUCTION TECHNIQUES AND NETWORK THEOREMS [12]

Source Transformation – Star Delta Conversion – Thevenin's Theorem - Norton Theorem – Superposition Theorem – Maximum Power Transfer Theorem – Reciprocity Theorem (DC Circuits only).

UNIT - III SINUSOIDAL STEADY STATE ANALYSIS [12]

Analysis of Purely Resistive Circuit - Purely Inductive Circuit - Purely Capacitive Circuit – Series RL, RC and RLC Circuit: Phasor diagram - Voltage Triangle, Impedance Triangle, Power Factor, Power Triangle.

UNIT - IV THREE PHASE CIRCUITS AND RESONANCE [12]

Three Phase Circuits**:** Advantages of Three Phase System - Star and Delta Connected Balanced and Unbalanced Loads – Two Wattmeter Method of Power Measurements. Series Resonance Circuit : Phasor Diagram – Properties – Variation of X_L, X_C, R and Z with Frequency - Q Factor - Half-Power Frequencies - Selectivity – Bandwidth.

UNIT - V TWO PORT NETWORKS [12]

Two Port Networks, Terminal pairs, Relationship of Two Port Variables, Impedance Parameters, Admittance Parameters, Transmission Parameters, Interconnections of Two Port Networks.

Total = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Solve the direct current DC electric circuits using basic concepts and fundamental laws.
CO2: Apply various network reduction techniques, including network theorems for simplifying the electric circuits.
CO3: Illustrate about AC fundamentals.
CO4: Describe three phase circuits, resonance circuits.
CO5: Analyse two port circuit behaviors.

Text Books :

1 Sudhakar, A. and Shyam Mohan S.P., Circuits and Network Analysis and Synthesis, Tata McGraw Hill Publishing Company Limited, New Delhi, Fourth Edition, 2010

2 Mahadevan K. and Chitra C., Electrical Circuit Analysis, PHI Learning Pvt. Ltd, New Delhi, First Edition, 2015.

Reference Books :

1 Charles K.Alexander, Matthew N.O.Sadiku, Fundamentals of Electric Circuits, McGraw Hill, Fifth Edition, 2013

2 William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill publishers, New Delhi, Seventh Edition, 2010.

3 Chakrabarti A, Circuit Theory (Analysis and Synthesis), Dhanpat Rai& Co, New Delhi, Sixth Edition, 2004

4 NagrathI.J and Kothari D. P., Electric Machines, Tata McGraw Hill Publishing Company Ltd, New Delhi, Fourth Edition, 2012.

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SEMESTER – II

		L	T	P	C
18CS041	**PROGRAMMING FOR PROBLEM SOLVING** (Common to AU, CE, EC, EE & ME)	3	0	0	3

Prerequisite: -

Objectives:

- *To learn the organization of a digital computer and problem solving.*
- *To study basics of C programming.*
- *To discover the knowledge of arrays and strings.*
- *To know the concepts of functions and pointers.*
- *To gain the knowledge of structures, unions and file.*

UNIT - I BASICS OF COMPUTER AND PROBLEM SOLVING [9]

Generation and Classification of Computer – Organization of Digital Computer – Categories of Software – Software Development Life Cycle – Number System and Conversions – Representation of an Algorithm: Pseudo code, Flowchart with examples – Steps in Problem Solving – Problem Solving Strategies.

UNIT - II C PROGRAMMING BASICS [9]

Fundamentals – Structure of a C program – Compilation and Linking processes – Constants, Variables – Data Types – Operators – Expressions – Managing Input and Output operations – Decision Making and Branching – Looping statements – Simple Programs.

UNIT - III ARRAYS AND STRINGS [9]

Arrays: Introduction, One Dimensional Array, Declaration – Initialization of One Dimensional Array, Two-Dimensional Arrays, Initializing Two Dimensional Arrays – Simple Programs. String: Declaring and Initializing String Variables – String handling Functions and Operations.

UNIT - IV FUNCTIONS AND POINTERS [9]

Function: Declaration – Definition – Categories – Pass by Value – Pass by Reference – Recursion – Pointers: Definition – Initialization – Pointers arithmetic – Pointers to Pointers – Pointers and Arrays – Simple Programs.

UNIT - V STRUCTURES AND UNIONS [9]

Structures: Declaration – Definition – Structure within a structure – Union – Storage Classes – Preprocessor Directives – Files: Defining and Opening a file – Closing a file – Input/output operations on files – Command line arguments.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Identify basics of computer and problem solving.
CO 2: Summarize the basics of C programming.
CO 3: Design and Implement C programs for arrays and strings.
CO 4: Demonstrate efficient programs using functions and pointers
CO 5: Implement simple C applications using structures, unions and file.

Text Books :

1 Herbert Schildt, C - The Complete Reference, Tata McGraw-Hill, New Delhi, Fourth Edition, 2013.
2 R.G.Dromey, How to Solve it by Computer, Pearson Education, India, Fifth Edition, 2008.

References :

1 Ashok N.Kamathane, Computer Programming, Pearson Education, India, Second Edition 2014.
2 PradipDey, ManasGhosh, Fundamentals of Computing and Programming in C, Oxford University Press, England First Edition, 2013.
3 Anita Goel and Ajay Mittal, Computer Fundamentals and Programming in C, Dorling Kindersley India Pvt. Ltd., Pearson Education in South Asia, Second Edition, 2013.
4 Nptel.ac.in/courses/106104128/.

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SEMESTER – II

		L	T	P	C
18MC051	**CONSTITUTION OF INDIA** (Common to all branches)	3	0	0	0

Prerequisite: *NIL*

Objectives:

- To promote harmony throughout the nation.
- To enables the supreme law and helps to maintain integrity in the society and to promote unity among the citizens to build a great nation.
- To learn about the fundamentals of our Indian constitution and their structure.
- To understand the formation of state government, union government, Indian Judiciary System and Election Commission.
- To provides a way of life. It includes eternity, liberty, and equality as the notion of a happy life and which cannot be taken from each other.

UNIT - I INTRODUCTION [9]

Historical Background – Significance of the Constitution - Making of the constitution – Constituent Assembly of India - Role of the constituent Assembly - Salient features of the constitution - Nature of Federal system.

UNIT - II FUNDAMENTAL RIGHTS AND DUTIES [9]

Preamble – Citizenship – Fundamental Rights – Fundamental Duties and Responsibilities – Directive Principles of State Policy - Procedure for Amendment.

UNIT - III UNION GOVERNMENT [9]

Union Government – President – Vice President – Prime Minister – Powers and Duties – Cabinet – Council of Ministers – Parliament - Functions – Lok Sabha – Rajya Sabha – Role of the Speaker.

UNIT - IV STATE GOVERNMENT [9]

State Government – The Governor – Council of Ministers and Chief Minister – Powers and Functions – State legislature – Local Governance.

UNIT - V JUDICIAL SYSTEM AND ELECTION COMMISION [9]

The Indian Judicial System – Supreme Court – High Courts of India – Judicial Review – Election Commission of India – Duties and Responsibilities – State Election Commissions – Roles and functions.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Categorize the emergence and evolution of Indian Constitution.

CO 2: Comprehend the fundamental rights and duties of the Indian citizen.

CO 3: Recognize and evaluate the Indian Political scenario amidst the emerging challenges.

CO 4: Analyze the organs of the state in the contemporary scenario.

CO 5: Asses about the Indian judiciary system and working of Election Commission

Text Book :

1 P.M. Bakshi, The Constitution of India, Universal law Publishing, New Delhi, fifteenth Edition, 2018.

2 D.D.Basu, Introduction to the constitution India, Lexis nexis Publisher, New Delhi,second Edition, 2015.

Reference Books :

1 Brij Kishore sharma, Introduction to the constitution India, PHI Learning Pvt. Ltd, New Delhi, seventh Edition, 2015.

2 Sharma B. K, Introduction to the Constitution of India, PHI Learning Pvt. Ltd, New Delhi, sixth Edition, 2011.

3 M. Laxmikanth, Indian Polity, Tata McGraw Hill, New Delhi, Sixth Edition, 2017.

4 Prof. Mahendra Pal Singh, Constitution of India, Eastern Book company, Lucknow, Thirteenth Edition, 2015.

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SEMESTER - II

		L	T	P	C
18EE221	**ELECTRIC CIRCUIT ANALYSIS LABORATORY**	0	0	3	1

Prerequisite: *NIL*

Objectives:

- *To gain knowledge on fundamentals of Ohm's law, Kirchhoff's laws and its practical implementation*
- *To impart hands on experience to understand various network theorems and analyze the circuit performance using modern mathematical tools*
- *To identify the concept of resonance and transient response in electric circuits*
- *To design and analysis the frequency response of a given electric circuit*
- *To get to know the measurement of power in three phase circuits*

List of Experiments:

1. Simulation and Verification of Kirchhoff's Laws.
2. Simulation and Verification of Thevenin's and Norton's Theorems.
3. Simulation and Verification of Superposition Theorem.
4. Simulation and Verification of Maximum Power Transfer Theorem.
5. Simulation and Verification of Reciprocity Theorem.
6. Simulation and determination of frequency response of RL & RC circuit.
7. Design and Simulation of Series and Parallel Resonant Circuits.
8. Simulation of Series RL and RC Transients.
9. Experimental determination of time constant of series RL, RC circuits.
10. Experimental determination of power in a three phase circuits by Two-Wattmeter and Three-Wattmeter Method.

Use personal computers to solve and analyze the real time solution of electrical circuits with simulated results.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO 1. Accomplish fundamental experiments relating electrical circuits using electric instruments such as multimeters, power supplies, signal generators, and oscilloscopes.
CO 2. Validate in actual practice of essential circuit theorems such as Thevenin, Norton, Superposition, Maximum Power Transfer and Reciprocity with its usefulness.
CO 3. Envisage and compute the transient and sinusoidal steady-state responses of simple RL, RC and RLC circuits.
CO 4. Analyze and design resonance circuits.
CO 5. Determine the solution of three phase circuits with balanced loads using Two-Wattmeter Method.

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SEMESTER – I / II

18CH028	**CHEMISTRY LABORATORY (Common to All Branches)**	L	T	P	C
		0	0	3	1

Prerequisite: *NIL*

Objectives:

- *To gain the practical knowledge and hands on experiences of understanding the principle of conductometric titration.*
- *To acquaint the students with the estimation of iron by spectrophotometry.*
- *To analyze the instrumental methods of chemical analysis.*
- *To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.*
- *To impart knowledge about the theoretical principles of corrosion in metals.*

LIST OF EXPERIMENTS:

1. Conductometric Titration – Strong Acid Vs. Strong Base.
2. Conductometric Titration – Mixture of Weak and Strong Acids Vs. Strong Base.
3. Conductometric Titration – Precipitation, $BaCl_2$ Vs. Na_2SO_4.
4. Estimation of Ferrous ion by Potentiometry – Fe^{2+} Vs $K_2Cr_2O_7$.
5. Estimation of Hydrochloric Acid by pH metry.
6. Estimation of Iron by Spectrophotometry.
7. Estimation of hardness in water by EDTA method.
8. Estimation of chloride in water sample by Argentometry.
9. Estimation of dissolved oxygen (DO) in water by Winkler's method.
10. Determination of rate of corrosion of mild steel by weight loss method.

Total : 30 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Apply the principle of conductometric titration.
CO 2: Determine the role of pH in quantitative analysis of a solution.
CO 3: Perceive the knowledge of the concentration of Iron by electrochemical methods.
CO 4: Analyze the application of water in various fields.
CO 5: Identify the nature of corrosion process.

Text Book :

1 Department of Chemistry Staff members, Chemistry Laboratory Manual, K.S.R. College of Engineering, Tiruchengode, Third Edition, 2018.

2 I. Vogel, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & sons, Newyork, Eighth Edition, 2014

Reference Books :

1 S. K. Bhasin and Sudha Rani, Laboratory Manual of Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited, New Delhi, Third Edition, 2012.

2 I. Vogel and J. Mendham, Vogel's Textbook of Quantitative Chemical Analysis, Harlow, Prentice Hall, Sixth Edition, 2000.

3 G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denny, Vogel's Text book of quantitative analysis chemical analysis, Longman, Singapore publishers, Singapore, ELBS Fifth Edition, 1996.

4 B.S. Furniss, A.J, Hannaford, P.W.G. Smith and A.R. Tatchel, Vogels Textbook of practical organic chemistry, John Wiley & sons, Newyork, Fifth Edition, 1989.

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SEMESTER – II

		L	T	P	C
18CS027	**PROGRAMMING FOR PROBLEM SOLVING LABORATORY** (Common to AU, CE, EC, EE & ME)	0	0	3	1

Prerequisite: NIL

Objective:

- *To study and identification of PC hardware and interfacing components.*
- *To learn the basic concept of creating a table, flow chart, mail merge in a word document.*
- *To know spreadsheet for creating the charts and apply formulas and functions.*
- *To get knowledge of power point presentation with animations and generate a report in MS access*
- *To gain the practical knowledge of how to implement C programs for simple application.*

LIST OF EXPERIMENTS

1. Study and Identification of PC Motherboard and its interfacing components
2. Prepare a Bio-data using MS Word with appropriate page, text and table formatting options and send the same to many recipients using mail merge.
3. Prepare a mark sheet with five subjects for five students in MS Excel File using Formulas, Functions and charts.
4. i) Prepare a Power Point presentation for your organization with varying animation effects using timer.
   ii) Prepare a Student Database in MS Access, manipulate the data and generate report.

Implement the following program using Raptor tool and C

5. Generate Fibonacci series and compute factorial for a given number using looping statements. (While and do…while).
6. Consider the five subjects Physics, Chemistry, Biology, Mathematics and Computer. Calculate the average and grade according to following:
   Percentage >= 90%: Grade A
   Percentage >= 80%: Grade B
   Percentage >= 70%: Grade C
   Percentage >= 60%: Grade D
   Percentage >= 40%: Grade E
   Percentage < 40%: Grade F Using if … else & switch
7. Declare an array with N elements then delete given element from the array and display.
8. Maintain a record of 'n' employee details using an array of structures with four fields (Employee ID, Name, salary and designation). Assume appropriate data type for each field. Print the employee details.
9. Generate prime factors of an integer using functions.
10. Implement the following using pointer:
    i) Arithmetic operations ii) Swapping of two variables.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO1: Be familiar with creating a table, flow chart, mail merge and apply text manipulation in a word document
CO2: Design a spreadsheet for creating the charts and apply formulas and functions.
CO3: Create power point presentation with animations and generate a report in MS access.
CO4: Apply good programming design methods for program development.
CO5: Design and implement C programs for simple applications.

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SEMESTER - III

		L	T	P	C
18MA344	**DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS (COMMON TO ECE AND EEE)**	3	1	0	4

Prerequisite: *NIL*

Objectives :

- *To acquire knowledge in solving partial differential equation.*
- *To describe the concepts of solving polynomials and transcendental equations and the system of linear equation*
- *To handle large data's using interpolation.*
- *To study the concepts of numerical differentiation and integration.*
- *To solve the initial value problems of ordinary differential equations numerically.*

UNIT - I PARTIAL DIFFERENTIAL EQUATIONS [12]

Formation of partial differential equations – Lagrange's linear equation - Homogeneous Linear Partial Differential Equations of second and higher order with constant coefficients.

UNIT - II SOLUTION OF EQUATIONS AND INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS [12]

Solutions to polynomials and transcendental equations – Newton's method - Solutions to simultaneous linear equations - Gauss Elimination - Gauss-Seidel method. Solving first order Ordinary Differential Equations (Single step) by Taylor series method **-** Euler method and Modified Euler Method for first order equation - Fourth order Runge-Kutta for solving first order equations.

UNIT - III INTERPOLATION AND APPROXIMATION [12]

Lagrange's interpolation and Divided difference method for solving unequal intervals – Newton's forward and backward difference interpolation techniques (equal intervals) - Cubic Spline.

UNIT - IV NUMERICAL DIFFERENTIATION AND INTEGRATION [12]

Numerical differentiation using Newton's forward and backward interpolation methods only - Numerical integration by trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules – Double integrals using trapezoidal and simpson's rules.

UNIT – V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS [12]

Finite difference solution of one dimensional heat equation by Crank Nicholson and Bender Schmidt method - One dimensional wave equation and two dimensional Laplace and Poisson equations

Total (L:45 T:15) = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Apply the concepts of partial differential equations.

CO 2: Enable to solve polynomial, transcendental equations, simultaneous linear equations numerically

CO 3: Able to apply the Interpolation techniques.

CO 4: Developing their skills in numerical differentiation and integration.

CO 5: Determine the numerical solutions to boundary value problems.

Text Books :

1 Dr. B.S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, Nineth Edition, 2016.

2 Veerarajan.T, Engineering Mathematics, Tata McGraw Hill Publications, New Delhi, Third edition, 2009

Reference Books :

1 Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co, Fifteenth Edition, 2016.

2 Ramana.B.V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Limited, New Delhi, Fourth Edition, 2016.

3 Dr.P.Kandasamy, Dr.Thilagavathy and Dr.K.Gunavathy, Numerical Methods , S.Chand & company Ltd, Third edition, New Delhi, 2003.

4 C.F.Gerald & P.O.Wheatley, Applied Numerical Analysis, Pearson Education (Asia), Seventh Edition, 2007.

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SEMESTER - III

18EE311	ELECTRO MAGNETIC THEORY	L	T	P	C
		3	1	0	4

Prerequisite: *Engineering Mathematics*

Objectives :

- *To impart knowledge on the concepts of Vector algebra in the electromagnetic field context.*
- *To commence knowledge on the concepts of electrostatics, electric potential and energy density.*
- *To commence knowledge on the concepts of magnetostatics, magnetic flux density and its applications.*
- *To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.*
- *To impart knowledge on the concepts of electromagnetic waves and Transmission lines.*

UNIT - I VECTOR CALCULUS [12]

Sources and effects of electromagnetic fields – Scalar and Vector fields –Vector Calculus – Gradient, Divergence and Curl – Divergence theorem - Stoke's theorem - Different Co-ordinate Systems: Rectangular, Cylindrical and Spherical – Relationship between Co-ordinate systems.

UNIT - II ELECTROSTATICS [12]

Coulomb's Law - Electric field intensity (E) - Field due to point and continuous charges – Electric field due to finite line charge, circular disc, two concentric shells and coaxial cylinders - Electric flux density (D) - Gauss's law and its applications - Electrical potential - Electric field in dielectric and equipotential plots - Electric Dipole, Electric field in multiple dielectrics - Boundary conditions between dielectric media, Poisson's and Laplace's equations – Capacitance -Energy density.

UNIT - III MAGNETOSTATICS [12]

Lorentz Law of force, magnetic field intensity (H) - Biot-Savart's Law - Ampere's Law - Magnetic field intensity due to straight conductors, infinite sheet of current, at the centre of the toroid, along the axis of the circular loop and solenoid - Magnetic flux density (B) – Magnetic materials - Magnetization - Boundary conditions – Magnetic Scalar and vector potential - Magnetic force - Torque - Inductance - Energy density.

UNIT - IV ELECTRODYNAMIC FIELDS [12]

Faraday's laws, Induced EMF - Transformer and Motional EMF, Maxwell's Equations (differential and integral forms) – Conduction and Displacement Current –Ohm's law in point form - Relation between field theory and circuit theory.

UNIT - V ELECTROMAGNETIC WAVES [12]

Electro Magnetic Wave equations - Wave parameters; velocity, intrinsic impedance, propagation constant – Uniform plane wave and its properties - Waves in free space, lossy and lossless dielectrics, conductors - Skin depth, Poynting vector and Poynting Theorem.

Total (L:45 T:15) = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Apply the spatial variations of physical quantities using various co-ordinate systems.
CO2: Apply basic laws of electrostatics to determine force and electric field intensity.
CO3: Evaluate magnetic vector quantities, inductance and energy densities of various cables.
CO4: Analyze the electromagnetic fields from the basics of Maxwell's equations.
CO5: Analyze the electromagnetic wave propagation in different media using Poynting vector and theorem.

Text Books :

1 Mathew N. O. Sadiku, Elements of Electromagnetics, Oxford University Press, London, Sixth Edition, 2014.
2 William.H.Hayt, Engineering Electromagnetics, Tata McGraw Hill Educational Private Limited, New Delhi, Seventh Edition, 2012.

Reference Books :

1 K.A.Gangadhar, Field Theory, Khanna Publishers, New Delhi, Sixteenth Edition, 2015.
2 S.P. Ghosh and LipikaDatta, Electromagnetic Field Theory,Tata McGraw Hill Educational Private Limited, New Delhi, First Edition, 2012.
3 Joseph.A.Edminister, Thoery and problems of Electromagnetics, Schaum Series, Tata McGraw Hill Educational Private Limited, New Delhi, Second Edition, 1993.
4 David J.Griffiths, Introduction to Electrodymanics, Pearson Education, New Delhi, Fourth Edition, 2014.

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SEMESTER - III

		L	T	P	C
18EE312	**ELECTRICAL MACHINES - I**	3	0	0	3

Prerequisite: *Engineering Mathematics*

Objectives :

- *To understand the concept of magnetic circuits and torque in round rotor machine.*
- *To Study the constructional details of DC generators, working principle and their performance.*
- *To focus on the study of the DC motors, working principle, characteristics, starting and speed control.*
- *To familiarize with the constructional details of different types of transformers, working principle and their performance.*
- *To study the testing methods of DC machines and transformers.*

UNIT - I MAGNETIC CIRCUITS [9]

Review of magnetic circuit: MMF, flux, Reluctance and Inductance – Self Induced EMF – Dynamically Induced EMF – Hysteresis and Core Losses – AC Operation of Magnetic Circuits - Classification of Electrical Machines – Torque in Round Rotor Machine

UNIT - II DC GENERATORS [9]

Constructional Details – Principle of Operation – EMF Equation –– Methods of Excitation – Types of DC generator – Losses and Efficiency – Armature Reaction – Commutation – Characteristics of DC Generators – Applications of DC Generator- Simple Problems.

UNIT - III DC MOTORS [9]

Principle of Operation – Back EMF –– Types of DC Motor – Torque Equation – Losses and Efficiency – Characteristic of DC Motors – Speed control of DC Shunt and Series Motor – Necessity of Starters – Types of Starters – Applications of DC Motor - Simple Problems.

UNIT - IV TRANSFORMERS [9]

Constructional Details: Shell type and Core Type - Principle of Operation – EMF Equation – Transformation Ratio – Equivalent Circuit – Losses, Efficiency and Regulation – Rating of Transformer – Autotransformer – Simple Problems.

UNIT - V TESTING OF DC MACHINES AND TRANSFORMERS [9]

Testing of DC Machines: Brake test – Swinburne's Test – Retardation Test – Hopkinson's test, Field test for series motor – Testing of transformers: Load test, Open and Short Circuit Tests.- Sumpner's Test.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Discuss the basic concepts in magnetic circuits.
CO2: Explain the construction and operation of DC generator.
CO3: Describe the working of DC motor with starting and speed control methods.
CO4: Expound the construction, working principle and performance of transformers.
CO5: Explore the various testing methods of DC machines and transformers.

Text Books :

1 Nagrath I.J and Kothari D. P., Electrical machines, Tata McCraw Hill Publishing Company Ltd, New Delhi, Fourth Edition, Fifth Reprint 2012.

2 B. L. Theraja and A.K. Theraja, A Text book of Electrical Technology, S.Chand Publishing, New Delhi, First multicolor edition 2005, Reprint 2015.

Reference Books :

1 A.E. Fitzgerald, Charles kingslyJ r, Stephen D. Umans, Electric Machinery, Tata McCraw Hill Publishing Company Ltd, New Delhi, Seventh edition 2013.

2 K.Murugesh Kumar , Electric Machines , Vikas publishing house Pvt Ltd , New Delhi, First edition,2003.

3 P.S.Bhimbhra Electrical Machinery, Khanna Publishers, Delhi, Seventh Edition, 2013.

4 Samarajit Ghosh, Electrical Machines, Pearson Education, New Delhi, Second Edition, 2012.

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SEMESTER - III

		L	T	P	C
18EE313	**ANALOG ELECTRONICS**	3	0	0	3

Prerequisite:-

Objectives :

- *To Impart knowledge on semiconductor devices.*
- *To study the characteristics and applications of transistors.*
- *To gain knowledge on the working of feedback amplifiers and oscillator circuits.*
- *To prepare the students to understand the concept of Op-amp and IC fabrication process.*
- *To illustrate the various applications of an operational amplifier and 555 timer.*

UNIT - I **SEMICONDUCTORS** **[9]**

PN junction diode: VI characteristics, Dynamic Resistance, Temperature coefficients, Drift and diffusion currents - Zener diode: VI characteristics – Voltage Regulators. - Special Diodes: PIN diode, Varactor diode.

UNIT - II **TRANSISTOR AMPLIFIER** **[9]**

Bipolar Junction Transistor: structure, Operation, configurations, h-Parameter: CE, CC and CB configurations - Power amplifier: class A and class B - Junction Field Effect Transistor: structure, operation and characteristics.

UNIT - III **FEEDBACK AMPLIFIERS AND OSCILLATOR CIRCUIT** **[9]**

Introduction to feedback amplifiers - Effect of positive and negative feedbacks – voltage series, current series, voltage shunt, current shunt feedback amplifiers.

Oscillator: condition for oscillation,RC phase shift, Wein bridge, Crystal oscillator,UJT Relaxation Oscillator.

UNIT - IV **IC FABRICATION & OPERATIONAL AMPLIFIERS** **[9]**

Basic planar process for IC fabrication - Op Amp: Ideal characteristics - inverting and non-inverting operational amplifiers - DC and AC characteristics: frequency response of op - amp, slew rate - differential amplifiers - CMRR.

UNIT - V **APPLICATIONS OF OPAMP & 555 TIMER** **[9]**

Differentiator, Integrator, V to I and I to V converters - DAC: R-2R ladder, Weighted resistor types - ADC: Flash type, Successive approximation type - 555 timer: Mode of operations and its applications.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Illustrate the operation of various semiconductors.
CO2: Analyze the function of transistor amplifiers.
CO3: Discuss the various oscillatory circuits.
CO4: Describe the op-amp and its characteristics.
CO5: Explain the applications of op-amp and 555 timers.

Text Books :

1 Albert Malvino & David Bates, Electronic Principles, Tata McCraw Hill Publishing Company Ltd, New Delhi, Eighth Edition, 2016.

2 Roy Choudhary D & Shell B. Jani, Linear Integrated Circuits, New Age International, New Delhi, Fourth Edition, 2017.

Reference Books :

1 Sedha, R.S, A textbook of Applied Electronics, S. Chand & Company Pvt. Ltd., New Delhi, Re-edition 2014.

2 David A Belll, Fundamentals of Electronic Devices and Circuits, Oxford University Press, India, Fifth Edition, 2009.

3 David A. Bell, Op-amp & Linear ICs, Oxford University Press, India, Third Edition, 2011.

4 Gray and Mayer, Analysis and design of Analog Integrated Circuits, Wiley International, New Delhi, Fifth Edition, 2009.

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SEMESTER - III

		L	T	P	C
18EE314	**MEASUREMENTS AND INSTRUMENTATION**	3	0	0	3

Prerequisite: *Electric Circuit Analysis*

Objectives :

- *To impart knowledge on basic functional elements of instrumentation.*
- *To gain knowledge on working of electrical and electronics instruments.*
- *To discuss the resistance, inductance, capacitance and frequency measurements using bridges.*
- *To get familiarized with sensors, transducers.*
- *To understand the concepts of data acquisition system, storage and display devices.*

UNIT - I INTRODUCTION [9]

Introduction to Measurement and Instruments – Functional Elements of an Instrument – Static Characteristics – Dynamic Characteristics – Errors, Uncertainty in Errors – Statistical Evaluation of Measurement Data – Measurement Standards – Calibration Methods – Numerical Problems on Errors.

UNIT - II ELECTRICAL AND ELECTRONICS INSTRUMENTS [9]

Principle and Operation of Analog Meters: Voltmeter, Ammeter – Energy Meters: Single Phase Energy Meter, Three Phase Energy Meter - Wattmeters: Induction, Electro-dynamometer, Power Factor Meter – Frequency Meter – Instrument Transformers - Megger and Multimeters.

UNIT - III BRIDGE MEASUREMENTS [9]

Measurement of Resistance: Kelvin Double Bridge, Wheatstone Bridge – Measurement of Inductance: Maxwell's Bridge, Anderson Bridge – Measurement of Capacitance: Schering Bridge, Desauty's Bridge – Determination of Frequency using Wein Bridge.

UNIT - IV SENSORS AND TRANSDUCERS [9]

Sensors: Proximity Sensor, Accelerometer, IR Sensor - Transducers: Resistive Transducers, Inductive Transducers, Capacitive Transducers, Piezoelectric Transducer, Optical and Digital Transducers.

UNIT - V STORAGE, DISPLAY DEVICES AND DATA ACQUISITION SYSTEMS [9]

Recorders: Strip Chart, X-Y Recorders – Digital Plotters – Digital Storage Oscilloscope – LED – OLED – DLP – Dot Matrix Display – Data Loggers – Digital Meters – Energy Meters – Elements of Data Acquisition System.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the functional elements of instruments, errors, characteristics, various standards and calibration.
CO2: Describe the various electrical and electronics instruments.
CO3: Evaluate unknown R, L, C and frequency using bridges.
CO4: Discuss the various types of sensors and transducers.
CO5: Explain the concepts of storage, display devices and data acquisition system.

Text Books :

1 Ernest O. Doebelin, Measurement Systems Application and Design, Tata McCraw Hill Publishing Company Ltd, New Delhi, Fifth Edition, 2015

2 Sawhney, A.K, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co, New Delhi, Nineteenth Revised Edition, 2017.

Reference Books :

1 H.S.Kalsi, Electronic Instrumentation, Tata McCraw Hill Publishing Company Ltd, New Delhi, Third Edition, 2012.

2 A.J.Bowens, Digital Instrumentation, Tata McCraw Hill Publishing Company Ltd, New Delhi, Third Edition, 1986.

3 J.B.Gupta, A Course in Electronic and Electrical Measurements, S.K.Kataria and Sons, Delhi, Fourteenth Edition, 2014.

4 D.V.S.Moorthy, Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2007.

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SEMESTER – III

		L	T	P	C
18CS331	**OBJECT ORIENTED PROGRAMMING WITH C++**	3	0	0	3

Prerequisite: *Basic knowledge of C Programming*

Objectives:

- *To learn the concepts of Object Oriented Programming.*
- *To learn and use constructors, destructors and inheritance for specific applications.*
- *To study how virtual functions implement dynamic binding with polymorphism and type conversion.*
- *To gain knowledge about how to handle I/O and file operation.*
- *To equip students with comprehensive knowledge in templates, exception handling and STL.*

UNIT – I BASICS OF OOPS [9]

Object Oriented Programming Concepts – Object Oriented Vs Procedure Oriented – Benefits – Applications – Introduction to C++ – Data types – Operators – Classes – Objects – Default Arguments – Static Member Functions – Static Data Members – Const Member Functions – Pointers to Member Functions – Local Classes.

UNIT – II CONSTRUCTORS AND INHERITANCE [9]

Constructors – Default Constructor – Parameterized Constructors – Constructor with Dynamic Allocation – Copy Constructor – Destructors – Inheritance – Derived Class – Types of Inheritance – Single inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical and Hybrid Inheritance – Virtual Base Classes – Abstract Class .

UNIT – III POLYMORPHISM AND TYPE CONVERSIONS [9]

Polymorphism – Compile Time Polymorphism: Function Overloading – Operator Overloading – Unary Operator Overloading – Binary Operator Overloading – Rules for Operator Overloading – Run Time Polymorphism: Virtual Functions – Pure Virtual Function – Type Conversions.

UNIT – IV CONSOLE I/O OPERATIONS AND FILE HANDLING [9]

C++ Streams – Stream Classes – Unformatted I/O Operations – Formatted Console Operations – Managing Output With Manipulators – Files: Opening and Closing a File – Detecting End-Of-File – File Pointers and Manipulations – Sequential I/O Operations – Updating a File – Error Handling in File Operations.

UNIT – V TEMPLATES, EXCEPTION HANDLING AND STL [9]

Class Templates – Function Templates – Exception Handling – Throwing Mechanism – Catching Mechanism – Rethrowing Exception – Specifying Exceptions – Introduction to STL – Components of STL – Containers – Algorithms – Iterators.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Recognize the principles of object-oriented problem solving and programming.

CO2: Implement the concepts of constructor and inheritance.

CO3: Analyze the concept of reusability and polymorphism.

CO4: Demonstrate the concepts of I/O operations and file handling.

CO5: Identify the uses of templates, STL and exception handling.

Text Books :

1 Robert Lafore, Object Oriented Programming in C++, Galgotia Publication, USA, Fourth Edition, 2014.

2 E.Balagurusamy, Object Oriented Programming with C++, Mc Graw Hill, India, Seventh Edition, 2018.

References :

1 B. Trivedi, Programming with ANSI C++, Oxford University Press, England, Second Edition, 2012

2 Deitel & Deitel, C++ How to Program, Prentice Hall,India, Ninth Edition 2014.

3 K.R. Venugopal, Rajkumar and T.Ravishankar, Mastering C++, TMC Publishing Co. Ltd., New Delhi, Second Edition, 2006.

4 http://nptel.ac.in/courses/106103115/36.

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SEMESTER - III

		L	T	P	C
18EE321	**ELECTRICAL MACHINES LABORATORY - I**	0	0	3	1

Prerequisite: *Electrical Circuit and Analysis*

Objectives:

- *To expose the students to operate and test the D.C. shunt and compound generator.*
- *To analyze the performance of the D.C. motors by conducting a direct test.*
- *To expose the students to operate and test the D.C. machines by conducting Swinburne's test.*
- *To examine the performance of the transformers and give the experimental skills.*
- *To understand the three-phase transformer connections.*

List of Experiments:

1. Open circuit and load characteristics of separately excited DC generators.
2. Open circuit and load characteristics of self-excited DC shunt generators.
3. Load characteristics of DC compound generator with differential and cumulative connection.
4. Load characteristics of DC shunt motor.
5. Load characteristics of DC compound motor.
6. Load characteristics of DC series motor.
7. Swinburne's tests on DC shunt motor.
8. Load test on single phase transformer.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's Test on transformer.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Analyze the performance of separately excited and self-excited DC generators.
CO2: Estimate the performance of the series, shunt and compound DC motors.
CO3: Employ the various speed control techniques of DC motor.
CO4: Examine the pre determination of efficiency of DC motor.
CO5: Analyze the performance of transformer.

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SEMESTER - III

		L	T	P	C
18EE322	**ANALOG ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: -

Objectives:

To evaluate the use of computer-based analysis tools to review performance of semiconductor device circuits.

To design and simulate the V - I characteristics of BJT and FET.

To construct and analyse the performance of RC phase shift oscillators using BJT.

To empower students to understand the circuit design and working of various applications of op-amp.

To prepare students to perform the analysis of analog electronics circuit using 555 timer IC.

List of Experiments:

1. Simulation and real time verification of V-I Characteristics of semiconductor diode.
2. Simulation and real time verification of V-I Characteristics of Zener diode.
3. Simulation and real time verification of V-I Characteristics of FET.
4. Characteristics of transistor under common emitter configuration.
5. Design a RC phase shift Oscillator.
6. Design an inverting & non-inverting op-amp.
7. Design an integrator & differentiator using op-amp.
8. Design an astable & monostable multivibrator using NE / SE 555 timer
9. Design a digital to analog converter using op-amp.
10. Design an analog to digital converter using op-amp.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Analyze the characteristics of various semiconductors.
CO2: Design an amplifier and oscillator.
CO3: Examine the applications of op-amp.
CO4: Design an astable and monostable multivibrator using NE / SE 555 timer.
CO5: Construct an A/D and D/A converter using op-amp.

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SEMESTER - III

		L	T	P	C
18CS325	**OBJECT ORIENTED PROGRAMMING LABORATORY**	0	0	3	1

Prerequisite: *Basic Knowledge in C Programming*

Objective:

- *To find out the real world problems using object oriented concepts.*
- *To study the fundamentals of constructor and inheritance.*
- *To gain the skills for writing a program for polymorphism and exception handling.*
- *To train the students with function overloading and operator overloading concepts.*
- *To equip students with comprehensive knowledge on programming by hands-on experiment.*

List of Experiments:

1. Write a C++ program to create a class for student to get and print details of a student.
2. Write a C++ program for counting function calls using static members
3. Write a C++ program for finding volume of cylinder using default arguments
4. Write a C++ program for calculate the area of circle, rectangle and triangle using function overloading
5. Write a C++ program for adding two complex numbers using friend function and operator overloading
6. Write a C++ program for calculating factorial of a given number using copy constructor
7. Write a C++ program for string manipulation using dynamic constructor
8. Write a C++ program to read and display of student details using multiple and multilevel inheritance
9. Write a C++ program to read and display of book details using virtual function (run-time polymorphism)
10. Write a C++ program for handling divide by zero exception using exception handling
11. Write a C++ program to swap the numbers using the concept of function template
12. Write a C++ program for adding two numbers using class template.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO1: Develop simple programs using class and objects concepts.
CO2: Demonstrate the concepts of constructors, destructors and inheritance.
CO3: Demonstrate the concepts of operator overloading and function overloading.
CO4: Develop programs the concepts of polymorphism.
CO5: Develop code segments using templates and exception handling.

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SEMESTER - III

		L	T	P	C
18HR351	**CAREER DEVELOPMENT SKILLS I** (Common to all Branches)	0	2	0	0

Prerequisite: NIL

Objectives:

- *To help individuals cope with continued changes in the world of work.*
- *To help individuals understand their unique abilities, interests, and aptitudes.*
- *Ability to speak, express and interact in the society and place of study.*
- *Critically interpret and comprehend a given text.*
- *Ability to make extempore speech.*

UNIT - I EFFECTIVE ENGLISH – SPOKEN ENGLISH **[6]**

Basic Rules of Grammar – Parts of Speech – Tenses – Verbs – Sentences construction - Vocabulary – idioms & phrases – Synonyms – Antonyms – Dialogues and conversation – Exercise(Speaking).

UNIT - II ESSENTIAL COMMUNICATION **[6]**

Verbal communication – Effective communication – Active Listening – Paraphrasing – Feedback, Non Verbal Communication – Body language of self and Others, Important of feelings in communication – Dealing with feelings in communication practice – Exercise.

UNIT - III WRITTEN COMMUNICATION – PART 1 **[6]**

Usage of noun, pronoun, adjective (Comparative Forms), Verb, Adjectives, Adverb, Tenses, Articles and Preposition – Change of Voice – Change of Speech – One word Substitution – Using the same word as different parts of speech – Odd Man Out – Spelling & Punctuation (Editing).

UNIT - IV WRITTEN COMMUNICATION – PART – 2 **[6]**

Analogies – Sentences Formation – Sentence Completion – Sentence Correction – idioms & Phrases – Jumbled Sentences, Letter Drafting (Formal Letters) – Reading Comprehension (Level 1) – Contextual Usage – Foreign Languages Words used in English – Exercise.

UNIT - V ORAL COMMUNICATION – PART – 1 **[6]**

Self-introduction – Situational Dialogues / Role Play (Telephonic Skills) – Oral Presentations – Prepared –' Just A Minute' Sessions (JAM) – Presentation Skills – Exercise.

Total = 30 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO 1: Have competent knowledge on grammar with an understanding of its basic rules.
CO 2: Communicate effectively and enhance interpersonal skills with renewed self – confidence.
CO 3: Construct sentence in English and make correction.
CO 4: Perform oral communication in any formal situation.
CO 5: Develop their LSRW skills.

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan. Hyderabad, First Edition, 2011.
2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015

Reference Books :

1 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.
2 Raj N Bakshmi, English Grammar Practice, Orient Black Swan, Hyderabad, First Edition, 2009.
3 Norman Lewis. W.R., Word Power Made Easy, Goyal Publications
4 Thakur K B Sinha, Enrich Your English, Vijay Nicole, Chennai, First Edition, 2005.
5 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005.

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SEMESTER - IV

		L	T	P	C
18EE411	**POWER SYSTEMS - I**	3	0	0	3

Prerequisite: *Electro Magnetic Theory*

Objectives :

- *To acquire knowledge about various power system components and various power generation methods.*
- *To understand the transmission line parameters for the different conductor arrangements.*
- *To obtain the equivalent circuits for the transmission line determine voltage regulation and efficiency.*
- *To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.*
- *To study about distribution systems, types of substations and methods of grounding,*

UNIT - I BASIC CONCEPTS [9]

Evolution of Power Systems and Present - Day Scenario. Structure of a power system - Bulk Power Grids and Micro-grids.
Generation: Conventional Thermal, Hydro & Nuclear power plants; Renewable & Distributed Energy Resources.
Comparison of AC and DC transmission- HVDC and EHV AC systems.

UNIT - II TRANSMISSION LINE PARAMETERS [9]

Parameters of Single and Three phase transmission lines with Single circuits: Resistance, Inductance and Capacitance of solid, stranded and bundled conductors: Symmetrical and Unsymmetrical spacing and Transposition - application of Self and Mutual GMD- Skin and Proximity effects.

UNIT - III MODELLING AND PERFORMANCE OF TRANSMISSION LINES [9]

Classification of lines: Short line, Medium line and Long line; Equivalent circuits, Attenuation constant, Phase constant, Surge impedance- Transmission efficiency and Voltage regulation - Real and Reactive power flow in lines - Ferranti effect and Corona loss.

UNIT - IV INSULATION REQUIREMENTS AND CABLES [9]

Insulators: Types, Voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Introduction-Types of cables, Capacitance of Single-core cable, Grading of cables, Capacitance of 3- core belted cable, Constructional features of LT and HT cables

UNIT - V DISTRIBUTION SYSTEMS [9]

Types of AC and DC distributors: 2-wire and 3-wire, Radial and Ring main distribution; Distributed and Concentrated loads Substation Layout and Grounding.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO 1: Describe about power system components.
CO 2: Categorize the transmission line parameters for the different conductor arrangements.
CO 3: Estimate the performance of various transmission lines and determine the line constants.
CO 4: Illustrate the construction of different types of line insulator and cables.
CO 5: Analyze the concepts of AC and DC distributors and Substation Layout.

Text Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 S.N.Singh, Electric Power Generation Transmission and Distribution, Prentice Hall of India Pvt. Ltd., Delhi, Second Edition, 2011.

Reference Books :

1 B.R.Gupta, Power System Analysis and Design, S.Chand Publishing, New Delhi, Third Edition, 2008.

2 D.P.Kothari, I.J.Nagarath, Power System Engineering, Tata McGraw-Hill Publishing Company Ltd, New Delhi, Second Edition, 2007.

3 Hadi Saadat, Power System Analysis, Tata McGraw Hill Publishing Company, New Delhi, Third Edition, 2010.

4 K.R.Padiyar, HVDC Power Transmission Systems, New Age International Pvt. Ltd, New Delhi, First Edition, 2007.

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SEMESTER - IV

18EE412	ELECTRICAL MACHINES - II	L	T	P	C
		3	0	0	3

Prerequisite: *Electro Magnetic Theory, Electrical Machines – I*

Objectives :

- *To learn more about Synchronous generators, both theory and performance characteristics.*
- *To study the theory and performance characteristics of Synchronous motors.*
- *To explore the theoretical and performance aspects of three-phase induction machines.*
- *To impart knowledge on the starting methods and speed control of three-phase induction motors.*
- *To study the working principles of different types of single-phase induction motors and special machines.*

UNIT - I SYNCHRONOUS GENERATOR [9]

Basic requirements - Constructional details - Types of rotors - EMF equation - Synchronous reactance - Effect of chording and distribution of Winding - Armature reaction - Voltage regulation: EMF, MMF and ZPF methods - Synchronizing and parallel operation - Synchronizing power - Change of excitation and mechanical input - Determination of direct axis and quadrature axis reactance of salient-pole machines - Alternator on infinite Bus bar.

UNIT - II SYNCHRONOUS MOTOR [9]

Principle of operation - Starting methods- Torque equation - Operation on infinite bus bars - V and inverted V curves - Power input and power developed equations - constant excitation and constant power developed - Damper winding- Hunting - Synchronous condenser - Applications.

UNIT - III THREE PHASE INDUCTION MACHINES [9]

Constructional details-Types of rotors - Principle of operation - Rotating Magnetic field -Slip - Torque equations - Slip-torque characteristics - Equivalent circuit - Types of starters: DOL, Rotor resistance, autotransformer and star-delta starters - Crawling and cogging - Double cage rotors-Induction generator

UNIT - IV PERFORMANCE ANALYSIS AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR [9]

Power flow and performance calculations - Load test - No load and blocked rotor tests - Circle diagram - Separation of no load losses - Speed control: Change of voltage, frequency, number of poles and slip - Slip power recovery scheme.

UNIT - V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES [9]

Constructional details of Single Phase Induction Motor - Double revolving field theory and operation - Equivalent Circuit – Types of starting methods: Split Phase, Capacitor Start, Capacitor Start and Run and Shaded Pole - Working Principles: stepper motor, Hysteresis motor, Reluctance motor and Universal Motor– Applications.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Explicate construction details and study different methods to predetermine the voltage regulation of Synchronous generator.

CO 2: Illustrate the working principle, starting methods and analyze performance of synchronous motor.

CO 3: Elucidate the constructional details, characteristics and starting methods and important phenomenon of three phase induction motor.

CO 4: Exhibit the performance analysis and speed control methods of three phase induction motor.

CO 5: Explain the construction and starting methods of single phase induction motor and special electrical machines.

Text Books :

1 Nagrath I.J and Kothari D. P., Electric Machines, Tata McGraw Hill Publishing Company Ltd, New Delhi, Fourth Edition, 2012.

2 Samarajit Ghosh, Electrical Machines, Pearson Education, New Delhi, Second Edition, 2012.

Reference Books :

1 A.E. Fitzgerald, Charles Kingsely Jr, Stephen D.Umans, Electric Machinery, McGraw Hill Education, New Delhi, Seventh edition, 2017..

2 K. Murugesh Kumar, Induction and synchronous Machines, Vikas publishing house Pvt Ltd, Chennai, First edition, 2009.

3 Charless A. Gross, "Electric Machines, CRC Press, United States, First edition,2010.

4 P.S.Bimbhra, Electrical Machinery, Khanna Publishers, Delhi, Seventh edition, 2011.

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SEMESTER - IV

		L	T	P	C
18EE413	**CONTROL SYSTEMS**	3	1	0	4

Prerequisite: *Applied Mathematics*

Objectives :

- *To realize the representation of systems and obtain transfer function models.*
- *To provide adequate knowledge in the time response of systems.*
- *To accord basic knowledge of the frequency domain analysis of control systems.*
- *To recognize the concept of stability and its analysis.*
- *To design the compensator and controller for various networks.*

UNIT - I SYSTEM AND THEIR REPRESENTATION [12]

Basic elements in control system – Types of system–Open and closed loop systems– Electrical analogous of mechanical translational and rotational system –Thermal system– Transfer function–AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNIT - II TIME RESPONSE ANALYSIS [12]

Types of test signal – First and second order time response –Time domain specification of second order underdamped systems- Types and Order of systems– Generalized error series–Steady state error and error constants.

UNIT - III FREQUENCY RESPONSE ANALYSIS [12]

Frequency response of the system – Bode plot – Polar plot – Constant M and N circles – Determination of closed loop response from open loop response - Correlation between frequency and time response.

UNIT - IV STABILITY OF CONTROL SYSTEM [12]

Characteristics equation – Routh Hurwitz criterion – Root locus construction - Nyquist stability criterion - Effect of pole, zero addition.

UNIT - V COMPENSATOR AND CONTROLLER DESIGN [12]

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots - P, PI, PID controllers.

Total (L:45 T:15) = 60 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Obtain the transfer function of basic elements, servo motors.
CO 2: Determine the time-domain response of first and second order systems.
CO 3: Find the stability of the open loop systems using bode / polar plot.
CO 4: Examine the stability of the system by the Root locus, Nyquist stability and Routh Hurwitz criterion.
CO 5: Design lag, lead, lag-lead compensator using bode plot.

Text Books :

1 J. Nagrath and M. Gopal, Control Systems Engineering, New Age International (p) Limited, Publishers, New Delhi, Fourth Edition, 2007..

2 Benjamin C. Kuo, Automatic Control systems, PHI Learning, New Delhi, Seventh Edition, 2009.

Reference Books :

1 K. Ogata, Modern Control Engineering, PHI Learning, New Delhi, Fifth Edition, 2009.

2 Norman S. Nise, Control Systems Engineering, John Wiley, New Delhi, Seventh Edition, 2014.

3 Smarajit Ghosh, Control systems, Pearson Education, New Delhi, Second Edition, 2009

4 D.Roychoudhury, Modern control engineering, PHI Learning, New Delhi, Second Edition, 2005.

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SEMESTER - IV

		L	T	P	C
18EE414	**DIGITAL ELECTRONICS**	3	0	0	3

Prerequisite: *Analog Electronics*

Objectives :

- *To study the Digital fundamentals, Boolean algebra and its applications in digital systems.*
- *To study the combinational circuits and its application.*
- *To expose the students to design of various synchronous using flip-flops.*
- *To develop the knowledge of Asynchronous sequential circuits.*
- *To introduce the concept of memories and programmable logic devices.*

UNIT - I FUNDAMENTALS OF BOOLEAN ALGEBRA AND GATE LEVEL MINIMIZATION [09]

Boolean algebra- Number systems - Number base conversion, Binary Arithmetic- One's and Two's complements Arithmetic, Gate level Minimization: Standard representation for logic functions- K-map representation- Simplification of logic functions using K-map- Don't care Conditions- Quine–McCluskey Method.

UNIT - II COMBINATIONAL DIGITAL CIRCUITS [09]

Digital Logic Gates: AND, OR, NOT, NAND, NOR and Exclusive-OR operations – NAND-NOR Implementation- Adders- Subtractors- Multiplexer and De-Multiplexer- Encoder and Decoders- Parity checker/generator - Code Converters - Binary to gray, BCD to Excess-3, Gray to Binary.

UNIT - III SEQUENTIAL CIRCUITS AND SYSTEMS [09]

Storage Element- Latches, Flip-Flop: SR , D , JK and D types flip flops- operation and excitation tables - Realization of one flip flop using other flip flops - Analysis of Clocked Sequential Circuits- State Equation, State Table, State Diagram, State reduction and Assignment- shift registers- Counters – ripple(Asynchronous) counters, synchronous counters- Design of Synchronous counters using flip flop & LFSR

UNIT – IV ASYNCHRONOUS SEQUENTIAL CIRCUITS [09]

Design of Asynchronous Sequential Circuits –Flow Table, Primitive Flow Table- State Reduction of completely specified state table and Incomplete Specified State Table-Race free state assignment- Design of Hazard Free Switching circuits. Algorithmic State Machine – Design Example using ASM.

UNIT - V SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES [09]

Semiconductor memories - Random Access Memory (RAM)- Read and Write operation, Read Only Memory (ROM), content addressable memory (CAM), Programmable logic devices: ROM as a PLD, Programmable logic array- Programmable array logic- complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Discuss the reduction of Boolean expression techniques using Boolean laws and K-map.

CO 2: Design and implement various Combinational logic circuits.

CO 3: Explain the operation of flip-flops, shift registers and Counters.

CO 4: Design and analyze the asynchronous Sequential circuits.

CO 5: Describe the operation of various semiconductor memories and programmable logic devices.

Text Books :

1 M. Morris Mano, Digital Design , Pearson Education, New Delhi, Fifth Edition, 2015

2 Thomas L, Floyd, Digital Fundamentals, Pearson Education, New Delhi, Eleventh Edition, 2015.

Reference Books :

1 Charles H.Roth, Fundamentals of Logic Design, Cengage Learning Publishing, Massachusetts, Seventh Edition, 2013.

2 Raj Kamal, Digital Systems-Principles and Design, Pearson education, New Delhi, Second Edition, 2009.

3 A. Anand Kumar, Fundamentals Of Digital Circuits, PHI Publication, New Delhi, Fourth Edition, 2016.

4 Tocci, Digital Systems : Principles and applications, Pearson Education, New Delhi, Tenth Edition, 2011

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SEMESTER - IV

		L	T	P	C
18CS432	**DATA STRUCTURE AND ALGORITHMS**	3	0	0	3

Prerequisite: *Basic knowledge of C Programming*

Objectives :

- *To learn the concepts of linear data structures and its applications.*
- *To impart knowledge on various non-linear tree structures.*
- *To get the knowledge of hashing techniques.*
- *To study the design and applications of Graph non-linear data structure.*
- *To gain important algorithmic design paradigms and methods of analysis.*

UNIT - I LINEAR STRUCTURES [09]

Abstract Data Types (ADT) – List ADT – Array based implementation – Linked list implementation – Singly and Doubly linked lists – Applications of lists – Stack ADT – Queue ADT – Implementation of Stack and Queue using Array and Linked list – Applications of stacks and Queues.

UNIT - II TREE STRUCTURES [09]

Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – Insertion, Deletion, Find Min & Max.

UNIT - III BALANCED TREES AND HASHING [09]

AVL Trees – B-Tree – B+ Tree – Heaps – Binary heaps – Hashing – Separate Chaining – Open Addressing – Linear Probing.

UNIT – IV GRAPHS [09]

Graph Terminology – Topological sort – Breadth First traversal and Depth-first traversal – Shortest path algorithms – Minimum Spanning tree: Prim's and Kruskal's algorithms – Bi connectivity – Euler circuits – Applications of graphs

UNIT - V ALGORITHM DESIGN AND ANALYSIS [09]

Algorithm analysis – Asymptotic notation – Recurrences – Greedy algorithms – Divide and Conquer – Dynamic programming – Back tracking – Branch and Bound.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Analyze the concept of list ADT and its implementation.
CO 2: Evaluate in the tree ADT with its operations.
CO 3: Describe the concept of AVL tree, B tree and B+ tree.
CO 4: Apply shortest path and minimum spanning tree algorithm.
CO 5: Design and analyze the problem using various algorithms.

Text Books :

1 M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, New Delhi, Second Edition, 2015.

2 Anany Levitin, Introduction to the Design and Analysis of Algorithms, Addition-Wesley Professional, US, Third Edition, 2014.

Reference Books :

1 R. F. Gilberg, B. A. Forouzan, Data Structures, Thomson, India, Second Edition, 2005.

2 Sartaj Sahni, Data Structures, Algorithms and Applications in C++, Sartaj Publishers, Universities Press, Second Edition, 2005.

3 V. Aho, J. E. Hopcroft, and J. D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, First Edition, 2003.

4 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

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SEMESTER – IV

		L	T	P	C
18HS051	**PROFESSIONAL ETHICS**	3	0	0	3

Objectives:

- *To gain the knowledge of basic perception of ethics, moral and values*
- *To know the current Industrial standards*
- *To know the risk and safety benefit in industry*
- *To discuss the rights and responsibility of an engineers*
- *To acquire Knowledge in global issues and able to apply in ethical principles in professional life.*

UNIT - I ENGINEERING ETHICS [09]

Senses of 'Engineering Ethics' - Variety of Moral Issued - Types of Inquiry - Moral dilemmas - Moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of Professional roles – Professional Ideals and Virtues-Uses of Ethical Theories.

UNIT - II ENGINEERING AS SOCIAL EXPERIMENTATION [09]

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics –Industrial standards-Balanced Outlook on Law - The Challenger Case Study.

UNIT - III ENGINEER'S RESPONSIBILITY FOR SAFETY [09]

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis - Reducing Risk – Liability–The Chernobyl & Bhopal case studies.

UNIT - IV RESPONSIBILITIES AND RIGHTS [09]

Collegiality and Loyalty - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) – Discrimination-Nestle Maggi Case study.

UNIT - V GLOBAL ISSUES [09]

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers-Consulting Engineers-Engineers as Expert Witnesses and Advisors – Corporate Social Responsibility (CSR) – Moral Leadership –Code of Conduct.

Total = 45 Periods

Course Outcomes: On completion of this course, the student will be able to

CO 1: Explain the basic perceptions of ethics, moral and values.
CO 2: Describe the current industrial standards
CO 3: Discuss the risk and safety benefits in the industry
CO 4: Explain the professional rights and responsibilities of an engineers
CO 5: Illustrate the Various global issues and apply the ethical principles in professional life.

Text Books :

1 Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw-Hill, New Delhi, Fifth Edition, 2017.
2 Dr.K.R.Govindan and S.Senthilkumar, Professional Ethics, Anuradha Agencies, Chennai, Revised Edition, 2014.

Reference Books :

1 Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, Fourth Edition, 2016.
2 Charles D. Fleddermann, Engineering Ethics, Pearson Education / Prentice Hall, New Delhi, Seventh Edition, 2015.
3 Charles E Harris, Michael S. Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Thompson Learning, New Delhi, Sixth Edition, 2015.
4 A.B Rao, Business Ethics & Professional Values– Excel books, New Delhi, Fifth Edition, 2014.

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SEMESTER - IV

		L	T	P	C
18EE421	**ELECTRICAL MACHINES LABORATORY - II**	0	0	3	1

Prerequisite: *Electrical Machines Laboratory - I*

Objectives:

- *To validate experimentally the performance and characteristics of Synchronous generators.*
- *To verify the performance and properties of the Synchronous motor experimentally.*
- *To conduct an experimental validation of the three-phase induction motor's performance and characteristics.*
- *To verify the performance and characteristics of a single-phase induction motor experimentally.*
- *To study three-phase induction motor starters: DOL, Star-Delta and Rotor resistance starter.*

List of Experiments:

1. Regulation of three-phase alternator by EMF, MMF and ZPF methods.
2. Load test on three-phase alternator.
3. V and Inverted V curves of three-phase synchronous motor.
4. Load test on three-phase squirrel cage induction motor.
5. Load test on three-phase slip ring induction motor.
6. No load and blocked rotor test on three-phase induction motor.
7. Loss summation method on three-phase induction motor
8. Load test on single-phase induction motor.
9. Determination of equivalent circuit of single-phase induction motor.
10. Study of three-phase induction motor starters: DOL, Star-Delta and Rotor resistance starter.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Predetermine the performance of three phase alternator.

CO2: Analyze the performance of three phase alternator.

CO3: Predetermine the performance of three phase synchronous motor.

CO4: Analyze the performance of the three phase squirrel cage and slip ring induction motor.

CO5: Analyze the performance of single phase induction motor and study of induction motor starters.

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SEMESTER - IV

		L	T	P	C
18EE422	**DIGITAL ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: *Analog Electronics*

Objectives:

- *To understand the various basic logic gates*
- *To study various combinational circuits and its application.*
- *To study the implementation of Counter using basic flip flops*
- *To design and implement Synchronous sequential circuits*
- *To study FPGA implementation of basic digital circuits.*

List of Experiments:

1. Implementation of basic Boolean expression using basic gates.
2. Design and implement Full adder and Full subtractor.
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
4. Design and implement a parity generator and checker.
5. Design and implement the following code converter: BCD to Excess -3, Binary to Gray, Gray to Binary.
6. Design and implement a MUX and DE-MUX.
7. Design and implement an encoder and a decoder.
8. Implementation and verification of truth table for J-K flip-flop, D flip-flop and T flip-flop.
9. Design and implementation of synchronous counter using J-K flip-flops.
10. Implementation practice of digital circuits using FPGA.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Design the basic Boolean expression using basic gates.
CO2: Design an adder and subtractor circuits.
CO3: Design and implements the various combinational circuits using logic gates.
CO4: Verify and implement the application of various flip flops.
CO5: Design and implements the basic digital circuits using FPGA.

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SEMESTER - IV

		L	T	P	C
18EE423	**CONTROL AND INSTRUMENTATION LABORATORY**	0	0	3	1

Prerequisite: *Electrical Machines – I, Electrical Machines Laboratory – I, Measurement and Instrumentation*

Objectives:

- *To provide knowledge on the transfer function of DC shunt generator and motor.*
- *To analysis Type 0 , Type 1 Systems and position control systems*
- *To design the compensator and analysis the stability of linear systems.*
- *To measure the Resistance and Inductance using bridges.*
- *To measure the capacitance using bridge and displacement using LVDT.*

List of Experiments:

1. Determine the transfer function of DC shunt generator.
2. Determine the transfer function of DC shunt motor.
3. Analog simulation of Type 0 and Type 1 systems.
4. DC and AC position control systems.
5. Digital simulation of lag and lead compensator design.
6. Stability Analysis of linear systems.
7. Measurement of Resistance using Wheatstone and Kelvin's Double bridge.
8. Measurement of Inductance using Maxwell's and Anderson bridge.
9. Measurement of capacitance using Schering's bridge and Desauty's bridge.
10. Measurement of displacement using LVDT.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Determine the transfer function of DC shunt generator and Motor.

CO2: Examine the time domain specifications of Type 0 and Types 1 systems and DC and AC position control systems.

CO3: Examine the lag, lead compensators and stability of linear system.

CO4: Determine the unknown resistance, inductance.

CO5: Determine the unknown capacitance and linear displacement.

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SEMESTER - IV

		L	T	P	C
18HR452	**CAREER DEVELOPMENT SKILLS - II**	0	2	0	0

Prerequisite: *NIL*

Objectives:

- *To make students strong on verbal and logical reasoning*
- *To strengthen students on number system*
- *To develop students on logarithms*
- *Critically interpret and comprehend a given text.*
- *To strengthen students on quick maths*

UNIT - I VERBAL AND LOGICAL REASONING – PART 1 **[6]**

Alphabet Test – Synonyms & Antonyms – Idioms & Phrases – Analogies - Theme Detection – Odd Words – Statement & Conclusions - Family Tree – Blood Relations – Coding & Decoding – Syllogism – Odd Man Out.

UNIT - II QUANTITATIVE APTITUDE – PART 1 **[6]**

Numbers : Number system - Squaring of Numbers – Square Roots – Cube Roots – Divisibility – HCF , LCM – Decimals.

UNIT - III QUANTITATIVE APTITUDE – PART 2 **[6]**

Percentages – Averages – Ratio & Proportion – Mixtures and Allegations – logarithms.

UNIT - IV READING COMPREHENSION & WRITTEN COMMUNICATION – PART 3 **[6]**

READING SKILLS : Importance of Reading – Definition of Reading – Levels of Reading – Requirements of Reading – Types of Reading – Techniques of Reading - Academic Reading Tips.

What is Writing – Sentence – Phrase – Kinds of Sentences – Parts of Sentence – Parts of Speech – Articles – Academic Essay Writing – Precise Writing – Report Abstracts – Letter Writing – Memo – Cover Letter – Resume Writing.

UNIT - V QUANTITATIVE APTITUDE – PART 3 **[6]**

Profit and Loss – Simple Interest & Compound Interest – Problem on Ages – Calendar.

Total = 30 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO 1: Speak and write appropriately by understanding and applying the basic grammatical rules.

CO 2: Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

CO 3: Enhance their communication skills and instructiveness.

CO 4: Enhance interpersonal relationship building skills with self – confidence.

CO 5: Critically evaluate various real life situation by resorting to analysis of key issues and factors.

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.

2 Abhijit Guha, Quantitative Aptitude, TMH, Third Edition,2009.

Reference Books :

1 Agarwal. R.S, A.Modern Approach to Verbal and Non- verbal Reasoning, Revised Edition 2008, Reprint 2009, S.Chand & Co Ltd., New Delhi.

2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015.

3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, First Edition, 2010.

4 Norman Lewis, Word Power Made Easy, W.R.Goyal Publications, Reprint, 2012.

5 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005

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SEMESTER - V

		L	T	P	C
18EE511	**POWER SYSTEMS – II**	3	0	0	3

Prerequisite: *Electric Circuit Analysis, Power Systems-I*

Objectives:

- *To impart knowledge on the need for power system analysis and model various power system components.*
- *To determine the bus admittance and impedance matrix.*
- *To formulate the power balance equations and to conduct the power flow analysis by Gauss-Seidel, Newton-Raphson and fast decoupled power flow analysis.*
- *To carry out fault analysis in symmetrical and unsymmetrical faults in a power system.*
- *To analyze the stability of the power system fault by equal area criteria and explicit integration methods.*

UNIT - I OVERVIEW OF POWER SYSTEM [9]

Introduction to modern power system – Need for system analysis in planning and operation of power system – Basic components of a power system – Single line diagram – Per phase analysis: Generator model, Transformer model, Line model, Load representation – Per unit representation.

UNIT - II ADMITTANCE AND IMPEDANCE MATRIX [9]

Introduction to network equation – Primitive matrix – Formation of Y-bus matrix: Inspection method, Singular transformation method (Without Mutual coupling), Node elimination – Formation of Z-bus matrix using step by step method (Without Mutual coupling) – Equivalent circuit of transformer with off-nominal tap ratio.

UNIT - III POWER FLOW ANALYSIS [9]

Bus classification – Statement of load flow problem – Derivation of power flow equation – Power flow solution using Gauss-Seidel method – Power flow solution using Newton-Raphson method and Fast Decoupled power flow analysis (Quantitative Approach) – Comparison of power flow analysis methods.

UNIT - IV FAULT ANALYSIS [9]

Importance of short circuit study – Short circuit capacity – Balanced three phase fault analysis: using bus impedance matrix, Thevenin's method – Unsymmetrical Fault Analysis: Fundamental of symmetrical components, Sequence impedance, Sequence networks, Single line to ground fault, Line to line fault and Double line to ground fault.

UNIT - V STABILITY ANALYSIS [9]

Basic concepts of stability studies – Classification of power system stability: Rotor angle stability and voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation – Equal area criterion – Critical clearing angle and time – Modified Euler method and Runge-Kutta fourth order method.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Infer the knowledge about modeling of power systems.
CO2: Determine the power system network parameters.
CO3: Analyze the power flow in the power system network.
CO4: Assess the power systems abnormal (fault) conditions.
CO5: Examine the stability of the power system for various disturbances.

Text Books :

1 John J. Grainger and Jr.W.D. Stevenson, "Power System Analysis", Tata McGraw Hill, New Delhi, First Edition, Reprint 2014

2 S.Ramar and S.Kuruseelan, "Power System Analysis", PHI learning private limited, New Delhi, First Edition, 2013.

Reference Books :

1 Nagrath. I.J, Kothari. D.P, "Modern Power system Analysis", Tata McGraw Hill Pub. Co. Ltd., New Delhi, Third Edition, 2003.

2 Hadi Saadat, "Power System Analysis", Tata McGraw Hill Publishing Company, New Delhi, Third Edition, 2011.

3 A.Nagoor Kani "Power System Analysis", RBA Publications, Chennai, First Edition, 1999.

4 P. Kundur, "Power System stability and Control", Tata McGraw Hill Publishing Company, New Delhi, First Edition, 2006.

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SEMESTER - V

		L	T	P	C
18EE512	**SIGNALS AND SYSTEMS**	3	1	0	4

Prerequisite: *Engineering Mathematics*

Objectives:

- *To impart knowledge about the properties of continuous time and discrete time signals.*
- *To study the properties and representation of continuous time systems.*
- *To analyze the continuous time signals using Fourier Series.*
- *To analyze Continuous time LTI system using Fourier Transform.*
- *To study the basic properties of Discrete time Fourier Transform.*

UNIT - I **CONTINUOUS TIME (CT) AND DISCRETE TIME (DT) SIGNALS** **[12]**

Signal representation – Basic operations on signals – CT complex exponential and sinusoidal signals, DT complex exponential and sinusoidal signals, CT unit impulse and unit step function, DT unit impulse and unit step sequence – .Classification of signals – Signal Energy and Power – Periodic signals – Even and Odd signals – Random signal.

UNIT - II **CONTINUOUS TIME SYSTEMS** **[12]**

Properties of continuous time systems – Convolution integral – Representation of continuous time Linear time invariant (LTI) systems using differential equations – Block diagram representation – Unit step and unit impulse response of LTI system – Analysis of LTI systems using Laplace transform.

UNIT - III **FOURIER SERIES ANALYSIS** **[12]**

Fourier series representation of continuous time periodic signals: Trigonometric Fourier series, Exponential Fourier series – Convergence of Fourier series – Gibbs Phenomenon – Properties of continuous time Fourier series.

UNIT - IV **CONTINUOUS TIME FOURIER TRANSFORM** **[12]**

Continuous Time Fourier transform – Existence of Fourier transform – Fourier transform of standard signals - Properties of continuous time Fourier transform – Analysis of continuous time LTI systems using Fourier transform.

UNIT - V **DISCRETE TIME FOURIER TRANSFORM** **[12]**

Discrete Time Fourier Transform (DTFT) – Properties of DTFT – Time and frequency shifting – Conjugation – Parseval's relation – Frequency Response of first order LTI system – Inverse DTFT.

Total (L=45, T=15) = 60 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Examine the properties of continuous and discrete time signals.
CO2: Describe the performance of LTI CT systems using Laplace transform.
CO3: Analyze the continuous time periodic signals using Fourier Series.
CO4: Explain the performance of CT LTI system using Fourier Transform.
CO5: Discuss the concepts of discrete time Fourier transform

Text Books :

1 Alan V Oppenheim, Alan S. Wilskey and Hamid Nawab.S, Signals and Systems, Pearson Education, New Delhi, Second Edition, 2015.

2 Anand Kumar.A, Signals and Systems, PHI Publications, New Delhi, Third Edition, 2015

Reference Books :

1 V. Krishnaveni, and A. Rajeswari, Signals & System, Wiley India Pvt.Ltd , New Delhi, First Edition, 2012.

2 Rodger Ziemer.E, William Tranter.H and Ronald Fannin.D, Signals and Systems-Continuous and Discrete, Pearson Education, New Delhi, Fourth Edition, 2015.

3 Gabel.R.A and Richard.R.A, Signals and Linear Systems, John Wiley and sons, New Delhi, Third edition 1995.

4 Gordan E Carlson, Signals and Linear Systems Analysis, John Wiley and sons, New Delhi, Second Edition, 1998.

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SEMESTER - V

		L	T	P	C
18EE513	**POWER ELECTRONICS**	3	0	0	3

Prerequisite: *Electric Circuit Analysis, Analog Electronics*

Objectives:

- *To get an overview of different types of power semiconductor devices and their switching characteristics.*
- *To understand the operation, characteristics and performance parameters of phase controlled converters.*
- *To study the operation, switching techniques and basic topology of DC chopper.*
- *To study the operation, switching techniques and basic topology of AC chopper.*
- *To study the operation of single phase and three phase inverters.*

UNIT - I POWER SEMICONDUCTOR DEVICES [9]

Introduction – V-I and switching characteristics of power semiconductor devices: Power Diode, Thyristor, Power BJT, Power MOSFET, Power IGBT and TRIAC – SCR protection circuits – SCR firing circuits – SCR Commutation techniques – Gate drive circuits: Power MOSFET and IGBT.

UNIT - II PHASE CONTROLLED CONVERTERS [9]

Principle of phase controlled converter – Single phase semi and fully controlled converter with R, RL, RLE load – Freewheeling diode – Three phase semi and fully controlled converter with R, RL, RLE load – Effect of source inductance.

UNIT - III DC TO DC CONVERTER [9]

Classification: step down chopper, step up chopper, step down/step up chopper – CUK Converter – Control Techniques: Time ratio control and current limit control – Types: Class A, Class B, Class C, Class D and Class E chopper.

UNIT - IV AC TO AC CONVERTER [9]

Introduction: Principle of ON-OFF control and phase angle control - Single phase and three phase AC voltage controllers with R and RL load – Single phase and three phase step up and step down cycloconverters – Operation of single phase matrix converter.

UNIT - V INVERTER [9]

Principle of operation: Single phase voltage source inverter, Three phase voltage source inverters (120° and 180° mode) – Single phase and Three phase current source inverter – PWM techniques.

Power Electronic Applications: UPS, SMPS and HVDC transmission systems.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Describe the characteristics of power semiconductors devices and firing scheme, protection and commutation techniques for SCR.

CO2: Analyze the electrical parameter of different AC to DC phase controlled converters with various loads and summarize the effect of source inductance for various converters.

CO3: Make use of the DC chopper for various quadrant operations and analyze the performance.

CO4: Analyze the performance of AC to AC Converters.

CO5: Explain the principle of various inverter topologies and employing power electronics devices in utility related applications.

Text Books :

1 Rashid.M.H, Power Electronics Circuits Devices and Applications, PHI learning private limited, New Delhi, Fourth Edition, 2017.

2 Bimbhra.P.S, Power Electronics, Khanna Publishing, New Delhi, Fifth Edition, 2013.

Reference Books :

1 M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, 2013.

2 Ned Mohan Tore. M. Undeland, William. P. Robbins, Power Electronics: Converters, Applications and Design, John Wiley and sons Ltd, United States, Second Edition, 2013.

3 Sen.P.C, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Thirtieth reprint, 2008.

4 Dubey.G.K, Doradla.S.R, Joshi.A and Sinha.R.M, Thyristorised Power Controllers, John Wiley and Sons Ltd, United States, First Reprint, 2005.

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SEMESTER - V

		L	T	P	C
18EE514	**RENEWABLE ENERGY SYSTEMS**	3	0	0	3

Prerequisite: *Engineering Physics, Electrical Machines – I, Electrical Machines – II, Power Systems - I*

Objectives:

- *To know the role of energy in economic development and social transformation.*
- *To provide adequate knowledge in the solar energy conversion system.*
- *To impart knowledge on solar energy storage and its applications.*
- *To study the basic structures of wind energy conversion systems.*
- *To give a basic knowledge of biogas and biomass power plants.*

UNIT - I INTRODUCTION [9]

Introduction to various energy sources – Depletion of energy resources – Need for renewable energy sources - Environmental aspects of energy utilization – Statistical report on renewable energy scenario in Tamil Nadu and India - Energy policies – Electricity Act 2003 – National Renewable Energy Act 2015.

UNIT - II SOLAR ENERGY [9]

Basics of Solar Radiation – Measurements of Solar Radiation – Solar Collectors: Flat Plate and Concentrating Collectors, Solar Tower – Behavior of solar cells, Cell properties, PV cell interconnection – Principle of photovoltaic conversion – Schemes for maximum power extraction control .

UNIT - III SOLAR ENERGY STORAGE AND ITS APPLICATIONS [9]

Need for storage – Solar energy storage: Thermal storage, Electrical storage, Mechanical storage and Solar pond. – Solar electric power generation – Solar pumping – Solar furnace – Solar distillation – Solar cooker – Solar drying – Solar water heating – Solar air conditioning and refrigeration.

UNIT - IV WIND ENERGY CONVERSION SYSTEM (WECS) [9]

Components of WECS – Classification of WECS: HAWT and VAWT – Schemes for maximum power extraction – Stand-alone operation of fixed and variable speed WECS – Grid connection Issues – Grid integrated PMSG and SCIG Based WECS – Safety and environmental consideration.

UNIT - V BIOMASS ENERGY [9]

Biomass – Properties of biomass – Combustion, Gasification, Biomass gasifiers and types – Photosynthesis process. Biofuels: Production processes and technologies, applications – Ethanol as a fuel for I.C. engines – Different Types of biogas plants – Aerobic and anaerobic bioconversion processes.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Discuss the various energy sources, energy policies and environmental aspects of energy.

CO2: Explain the principle of solar photovoltaic system and the performance of various solar collectors.

CO3: Outline the solar energy storage and its applications.

CO4: Estimate the performance of wind energy systems and analyze the safety, environmental issues associated with wind turbines.

CO5: Classify the sources of biomass and the technologies of biomass energy generation.

Text Books :

1 Khan.B.H, Non–Conventional Energy Sources, Tata McGraw–Hill, New Delhi, Second Edition, 2009.

2 Rai.G.D, Non-Conventional Energy Sources, Khanna Publishers, New Delhi, First Edition 2011.

Reference Books :

1 Mukund Patel.R, Wind and solar power systems, Taylor & Francis, New Delhi, Second Edition, 2006.

2 Partain.L.D, Solar Cells and Their Application, John Wiley and Sons, United States, Second Edition 2010.

3 Sukhatme.S.P, Solar Energy–Principles of Thermal Collection and Storage Solar Energy, Tata McGraw Hill, New Delhi, Second Edition, 2010.

4 Freris.L.L, Wind Energy Conversion Systems, PHI learning private limited, New Delhi, First Edition, 1990.

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SEMESTER - V

		L	T	P	C
18EE521	**POWER SYSTEM SIMULATION LABORATORY**	0	0	3	1

Prerequisite: *Power Systems-I and Power Systems-II*

Objectives:

- *To impart knowledge on the transmission line parameters of the power system.*
- *To determine the bus admittance and impedance matrix.*
- *To formulate the power balance equations and to conduct the power flow analysis by Gauss-Seidel and Newton-Raphson, Fast decoupled methods.*
- *To carry out fault analysis in symmetrical and unsymmetrical faults in a power system.*
- *To analyze the stability of the power system fault by equal area criteria and explicit integration methods.*

List of Experiments:

1. Computation of performance Parameters and Modeling of Transmission Lines.
2. Formation of Bus Admittance Matrices.
3. Formation of Bus Impedance Matrices.
4. Load Flow Analysis – I: Using Gauss-Seidel Method.
5. Load Flow Analysis – II: Using Newton-Raphson Method.
6. Load Flow Analysis – II: Using Fast decoupled Method.
7. Fault Analysis: Solution of Short circuit analysis.
8. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
9. Transient Stability Analysis of Multi–Machine Power Systems.
10. Economic Dispatch in Power Systems.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Obtain the transmission line parameters of the power system.
CO2: Determine the bus admittance and impedance matrix and evaluate the power flow in the power system network.
CO3: Assess the abnormal (fault) conditions of the power system.
CO4: Analyze the small signal stability limit of the single machine infinite bus system and examine the transient Stability of multi-machine power system.
CO5: Determine the economic dispatch of generating units with and without loss.

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SEMESTER - V

		L	T	P	C
18EE522	**POWER ELECTRONICS LABORATORY**	0	0	3	1

Prerequisite: *Electric Circuit Analysis, Analog Electronics*

Objectives:

- *To study the V-I characteristics of power switching devices.*
- *To gain the knowledge of phase controlled converters.*
- *To acquire the knowledge of single phase PWM inverter and choppers.*
- *To acquire the knowledge of single phase cyclo converter.*
- *To gain the knowledge of implementation of power electronics converters in MATLAB simulink.*

List of Experiments:

1. V-I characteristics of SCR and TRIAC.
2. V-I and transfer characteristics of MOSFET and IGBT.
3. Single- phase half and fully controlled converter.
4. Three-phase half and fully controlled converter.
5. MOSFET based step-down and step-up chopper
6. IGBT based single phase PWM inverter
7. Single- phase cyclo converter
8. Simulations of single- phase half and fully controlled converter
9. Simulations of three- phase half and fully controlled converter
10. Simulation of single and three phase inverter

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Contrast and relate the performance of various power semiconductors.
CO2: Design and analyze the performance of different AC to DC controlled converters.
CO3: Design the step-up and step-down chopper and PWM inverters.
CO4: Analyze the performance of a single phase cyclo converter.
CO5: Design and simulate the different types of converter and inverters using MATLAB.

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SEMESTER - V

		L	T	P	C
18EE523	**ELECTRONICS DESIGN LABORATORY**	0	0	3	1

Prerequisite: *Engineering Practices and Electron Devices and Circuits Laboratory*

Objectives:

- *To expose the students to design and fabricate simple power supply.*
- *To expose the students to design and fabricate domestic UPS.*
- *To provide knowledge to estimate the electrical quantities in industries, residential and commercial building.*
- *To acquire the knowledge of a simple water level controller.*
- *To gain the knowledge of* infrared *motion detector.*

List of Experiments:

1. Design and development of ± 5V, 1A constant voltage power supply
2. Design and development of ± (0-12 V), 1A variable power supply
3. Design and development of domestic UPS
4. Electrical estimation in small scale industries
5. Electrical estimation in Residential / Commercial buildings
6. Design and development of simple water level controller with indicator
7. Design and development of infrared motion detector

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Develop and analyze the circuit model for constant and variable voltage power supply.
CO2: Build and analyze the circuit model of domestic ups.
CO3: Estimate the electrical quantities in industries, residential and commercial buildings.
CO4: Design and development of circuit model for water level controller.
CO5: Design and development of circuit model for infrared motion detector

SEMESTER - V

18HR553	CAREER DEVELOPMENT SKILLS – III	L	T	P	C
		0	2	0	0

Prerequisite: *NIL*

Objectives:

- *To enhance the writing and speaking skills through continuous practices.*
- *To sharpen the verbal and logical reasoning through skillful conceptualization.*
- *To improve the learning skills of students in aptitude*
- *To learn the problem solving skill and to improve thinking capability of the students.*
- *To study the various concept in core subjects.*

UNIT - I WRITTEN AND ORAL COMMUNICATION – PART 1 [6]

Reading Comprehension Level 3 - Self Introduction - News Paper Review - Self Marketing - Debate- Structured and Unstructured GDs Psychometric Assessment – Types & Strategies to answer the questions Practices: Sentence Completion - Sentence Correction - Jumbled Sentences - Synonyms & Antonyms - Using the Same Word as Different Parts of Speech - Interpretation of Pictorial Representations – Editing.

UNIT - II VERBAL & LOGICAL REASONING – PART 2 [6]

Syllogism - Assertion and Reasons - Statements and Assumptions - Identifying Valid Inferences - identifying Strong Arguments and Weak Arguments - Statements and Conclusions- Cause and Effect - Deriving Conclusions from Passages - Seating Arrangements Practices: Analogies - Blood Relations - Statement & Conclusions.

UNIT - III QUANTITATIVE APTITUDE – PART 3 [6]

Probability - Calendar- Clocks - Logarithms - Permutations and Combinations.

UNIT - IV QUANTITATIVE APTITUDE – PART 4 [6]

Algebra - Linear Equations - Quadratic Equations – Polynomials – Problem on Numbers – Ages – Train – Time and Work – Sudoku – Puzzles.

UNIT - V DOMAIN PROFICIENCY [6]

Fundamentals of electric circuits, Construction and operation of Electrical machines, Electrodynamic fields and field equation solution, Introduction to Non-conventional energy sources.

Total = 30 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO 1: *Understand the nearness of leading various texts.*
CO 2: *Perform well in verbal and logical reasoning.*
CO 3: *Understand and develop the etiquette necessary to present oneself in a professional setting.*
CO 4: *Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.*
CO 5: Enhance the comprehension Skills in core subjects.

Text Books :

1 Anne Laws, Writing Skills, Orient Black Swan., Hyderabad, 2011.
2 Abhijt Guha, Quantitative Aptitude, TMH, Third Edition, New Delhi, 2009.

Reference Books :

1 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005
2 Sarah Freeman, Written Communication in English, Orient Black Swan, Hyderabad, First Edition, 2015.
3 M.B. Lal & Goswami, Objective Instant Arithmetic, Upkar Publications, First Edition, 2010.
4 Norman Lewis, Word Power Made Easy, W.R.Goyal Publications, Reprint, 2012.
5 V.K. Mehta & Rohit Mehta, Objective Electrical Technology, S Chand publications, First Edition, 2012.

SEMESTER - VI

18EE611	ELECTRICAL MACHINE DESIGN	L	T	P	C
		3	1	0	4

Prerequisite: *Electrical Machines - I, Electrical Machines - II*

Objectives:

- *To study MMF calculation and thermal rating of various types of electrical machines.*
- *To design core, yoke, windings and cooling systems of transformers.*
- *To design armature and field systems for D.C. machines.*
- *To design stator and rotor of induction machines.*
- *To design stator and rotor of synchronous machines and study their thermal behavior*

UNIT - I BASIC CONSIDERATION IN DESIGN [12]

Considerations and limitations in design – Specific electric and magnetic loadings – Thermal consideration – Heat flow: Conduction, Radiation and Convection – Rating of machines.

Concept of magnetic circuit – MMF calculation for various types of electrical machines – Real and apparent flux density of rotating machines – Leakage reactance calculation for transformers, induction and synchronous machine.

UNIT - II TRANSFORMERS [12]

kVA rating of single phase and three phase transformers – Relation between output and volt per turn – Choice of specific loadings – Optimum design of transformers – Design of core, yoke and windings for core and shell type transformers – Design of tank and cooling tubes of transformers.

UNIT - III DC MACHINES [12]

Output equation – Main dimensions – Choice of specific loadings – Choice of number of poles – Armature design – Design of air gap – Design of commutator and brushes

UNIT - IV THREE PHASE INDUCTION MOTORS [12]

Output equation - Main Dimensions - Choice of specific loadings - Design of stator - Length of air gap - Design of squirrel cage rotor - Rotor bars and slots - Design of endrings - Design of wound rotor.

UNIT - V SYNCHRONOUS MACHINES [12]

Output equation – Main dimensions – Choice of specific loadings – Short circuit ratio – Design of stator and rotor of cylindrical pole and salient pole machines – Design of damper windings – Design of field coil – Cooling of large alternators.

Total (L=45 , T=15) =60 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Apply the concept of specific loadings and MMF to design the electrical machines.

CO2: Identify the optimal design for the transformer.

CO3: Design a DC machine's armature, air-gap, commutator, brushes and investigate the choice of number of poles.

CO4: Formulate the procedure to design stator and squirrel cage rotor for three phase induction machine.

CO5: Design stator and rotor windings of salient and non-salient pole machines and identify the factors for the choice of specific loading to design of synchronous machine.

Text Books :

1 A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai and Sons, New Delhi, Eighth edition, 2016.

2 R.K. Agarwal, Principles of Electrical Machine Design, S.K.Kataria and Sons, Delhi, Fifth edition, Reprint 2020.

Reference Books :

1 S.K.Sen, Principles of Electrical Machine Design with Computer Programmes, Oxford and IBH Publishing Co Pvt.Ltd., New Delhi, Second edition,2006.

2 V.N.Mittle and A.Mittle, Design of ElectricaL Machines, Standard Publications Distributors,Delhi, Fifth Edition, 2013.

3 M.V.Deshpande, Design and Testing of Electrical Machines, PHI learning private limited, New Delhi, Third Edition, 2010.

4 A.Shanmugasundaram, G.Gangadharan, R.Palani, Electrical Machine Design Data Book, New Age International Pvt Ltd, New Delhi, Second Edition, 2015

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SEMESTER - VI

		L	T	P	C
18EE612	**MICROPROCESSORS AND MICROCONTROLLER**	3	0	0	3

Prerequisite: *Digital Electronics, Analog Electronics*

Objectives:

- *To study the architecture, instruction set and addressing modes of 8085.*
- *To study the architecture of programming ICs 8255, 8251, 8259 and 8279.*
- *To study the functional block diagram, instruction sets and addressing modes of 8051.*
- *To study about the applications of 8051.*
- *To know the architecture and instruction sets of ARM processor.*

UNIT - I 8085 PROCESSOR [9]

Introduction to microprocessor – Hardware architecture of 8085 – Signals – Memory interfacing – Instruction format – Instruction set and addressing modes – Assembly language programming – Stack – Timing diagram – Interrupt structure.

UNIT - II PERIPHERAL INTERFACING [9]

Study of architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 Keyboard and display controller and 8253 Timer/ Counter – Interfacing with 8085 – ADC and DAC interfacing.

UNIT - III 8051 MICROCONTROLLER [9]

Functional block diagram – Data transfer, manipulation, control & I/O instructions – Addressing modes –– Interrupt structure – Timer – I/O ports – Serial communication.

UNIT - IV MICROCONTROLLER APPLICATIONS [9]

LCD interfacing – ADC and DAC interfacing – Keyboard and display interface – Stepper motor interfacing –– Closed loop control of servo motor – DC motor speed control.

UNIT - V ARM PROCESSOR FUNDAMENTALS [9]

ARM Core Introduction – Registers – Current Program Status Register – Pipeline – Exception – Interrupts – Vector Table – Architecture Revisions – ARM Instruction Set – Thumb Instruction Set – Thumb Register Usage – ARM-Thumb Interworking-Ericsson-VLSI Bluetooth Baseband Controller.

Total (L=45 , T=0) =45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Illustrate the instruction set, addressing modes and programming of 8085 microprocessor.
CO2: Demonstrate the functions of different peripheral ICs and design the interfacing logic using 8085.
CO3: Explain the architecture, interrupts and addressing modes of 8051 Microcontroller.
CO4: Design and develop the interfacing circuits for various applications using 8051 Microcontroller.
CO5: Illustrate the fundamental and instruction sets in ARM processor and simple programming.

Text Books :

1 Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing Private Ltd., Mumbai, Sixth Edition, 2013.
2 Muhammad Ali Mazidi and Janice Gilli Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, New Delhi, Second Edition, 2007.

Reference Books :

1 Steve Furbe, ARM System-on-chip Architecture, Addison-Wesley Professional, United States, Second Edition, 2015.
2 William Kleitz, Microprocessor and Microcontroller fundamental of 8085 and 8051 Hardware and Software, PHI learning private limited, New Delhi, First Edition, 1998.
3 Krishna Kant, Microprocessors and Microcontrollers, PHI learning private limited, New Delhi, Second Edition, 2013.
4 Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide, Morgan Kaufmann, First Edition, 2004.

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SEMESTER – VI

		L	T	P	C
18CS043	**PYTHON PROGRAMMING** (Common to CS, EC & EE)	3	0	0	3

Prerequisite: *Basic knowledge of C programming.*

Objectives:

- *To impart the fundamental concepts of python programming.*
- *To know various data structures provided by python library including string, list and dictionary.*
- *To learn to write programs using class and objects.*
- *To study database system for storing and retrieving data.*
- *To learn the concept of Web and GUI design.*

UNIT – I FUNDAMENTALS OF PYTHON [9]

Introduction to Python – Advantages of Python programming – Variables and Data types – Comments – I/O function – Operators – Selection control structures – Looping control structures –Functions: Declaration – Types of arguments – Anonymous functions: Lambda.

UNIT – II DATA STRUCTURES AND PACKAGES [9]

Strings – List – Tuples – Dictionaries – Sets – Exception Handling: Built-in Exceptions – User-defined exception– Modules and Packages.

UNIT – III OBJECT ORIENTED PROGRAMMING [9]

Object Oriented Programming basics –Inheritance and Polymorphism – Operator Overloading and Overriding – Get and Set Attribute Values – Name Mangling –Duck Typing – Relationships.

UNIT – IV FILES AND DATA BASES [9]

File I/O operations – Directory Operations – Reading and Writing in Structured Files: CSV and JSON – Data manipulation using Oracle, MySQL and SQLite.

UNIT – V GUI AND WEB [9]

UI design: Tkinter – Events – Socket Programming – Sending email – CGI: Introduction to CGI Programming, GET and POST Methods, File Upload.

Total (L=45 , T=0) =45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Illustrate basic concepts of python programming.
CO 2: Apply the necessary data structures includes list, tuple and dictionary in the required fields.
CO 3: Analyze, design and implement the problems using OOPs technology
CO 4: Demonstrate the simple file operations
CO 5: Design web site using GUI.

Text Books :

1 Mark Lutz, Learning Python, O'Reilly Media, California, Fifth Edition, 2013.

2 Wesley J.Chun, Core Python Programming, Pearson Education, New Delhi, Second Edition, 2017.

References :

1 Bill Lubanovic, Introducing Python Modern Computing in Simple Packages, O'Reilly Media, California, First Edition 2014.

2 David Beazley, Brian K. Jones, Python Cookbook, O'Reilly Media, California, Third Edition, 2013.

3 Mark Lutz, Python Pocket Reference, O'Reilly Media, California, Fifth Edition, 2014.

4 www.python.org.

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SEMESTER – VI

		L	T	P	C
18HS001	**PRINCIPLES OF MANAGEMENT (Common to All Branches)**	3	0	0	3

Objectives:

- *To explain the historical background and fundamentals of management thought.*
- *To discuss about various concepts of planning.*
- *To describe the various concepts of Organizational structure.*
- *To illustrate the various management leadership concepts.*
- *To develop the emerging concepts of management though and philosophy.*

UNIT - I OVERVIEW OF MANAGEMENT [9]

Definition of Management – Importance of management – Management functions – Levels of management – Role of managers – Management a science or an art – Evolution of Management thought: Scientific management and Administrative Principles of management – Ethical issues in Management.

UNIT - II PLANNING [9]

Planning: Meaning, purpose, Steps and Types of Plans - Management by objectives (MBO) – Decision Making: Types of Decisions, Steps in Rational Decision making, Common difficulties in Management Decision Making.

UNIT – III ORGANISING [9]

Nature and purpose of organizing : Organization structure, Process and Principles of organizing – Line & Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing : Sources of Recruitment, Selection process – Training methods – Performance appraisal methods.

UNIT - IV DIRECTING [9]

Creativity and Innovation – Motivation and Satisfaction: Motivation Theories – Leadership: Leadership theories and Styles – Communication: Barriers to communication, Principles of effective Communication.

UNIT - V CONTROLLING [9]

Steps in a control Process: Need for control system, Budgetary and Non-Budgetary control techniques, Problems of the control system, Essentials of effective control system, and Benefits of control.

Total (L: 45 T: 0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Explain the fundamentals of Management thoughts and the conceptual frame work of Management
CO 2: Discuss the various concepts of planning, MBO and Strategy to help solving managerial problems
CO 3: Explain the concepts of organizing, Delegation and Decision making.
CO 4: Describe the management concepts and styles in Leading.
CO 5: Illustrate the various controlling and emerging concepts in management thought and philosophy

Text Books :

1. L.M.Prasad, Principles and Practices of Management, Sultan Chand & Sons, New Delhi, Eleventh Edition, 2015.
2. P.C.Tripathi and Reddy, Principles of Management, McGraw Hill , New Delhi, Eighth Edition,2015.

Reference Books :

1. Hellriegel, Slocum & Jackson, Management A Competency Based Approach, Thomson South Western, London, Fifteenth Edition, 2017.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, Management – A GlobalEntrepreneurial Perspective, Tata McGraw Hill, New Delhi, Twelveth Edition, 2014.
3. Andrew J. Dubrin, Essentials of Management, Thomson South western, London, Tenth edition, 2014.
4. Robbins S.P., Fundamentals of Management, Pearson Education, New Delhi, Second Edition, 2003

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SEMESTER - VI

		L	T	P	C
18EE621	**MICROPROCESSORS AND MICROCONTROLLER LABORATORY**	0	0	3	1

Prerequisite: *Analog Electronics Laboratory and Digital Electronics Laboratory*

Objectives:

- *To perform simple arithmetic operations using assembly language program in 8085 & 8051.*
- *To develop skills in simple program writing in assembly languages.*
- *To write an assembly language program to convert Digital input to Analog output.*
- *To perform interfacing experiments with 8085 & 8051.*
- *To simulate 8051 microcontroller program.*

List of Experiments:

1. Programming for 8/16 bit arithmetic operations using 8085.
2. Programming with control instructions using 8085.
   a. Maximum / Minimum of numbers
   b. Ascending / Descending order
3. Programming for Hex. / ASCII / BCD code conversions using 8085.
4. Interfacing 8251, 8253 and 8279 with 8085.
5. Interfacing D/A Converters with 8085.
6. Interfacing and programming of Traffic light control with 8085.
7. Programming for 8 bit Arithmetic operations using 8051.
8. Interfacing and programming of stepper motor control using 8051.
9. Simulate stepper motor control with 8051 Microcontroller and keil software.
10. Simulate Serial Communication with 8051 Microcontroller and keil software.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the data transfer and processing and to perform basic operations using 8085 microprocessor.
CO2: Construct and develop a program to interface the peripheral IC's and with 8085 microprocessor.
CO3: Design the control word and develop the program for traffic light Control with 8085.
CO4: Develop a program to perform basic operations, Interfacing of stepper motor and DAC using 8051 microcontroller.
CO5: Design and develop a program for 8051 microcontroller using KEIL software.

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SEMESTER – VI

		L	T	P	C
18CS028	**PYTHON PROGRAMMING LABORATORY** (Common To CS, EC & EE)	0	0	3	1

Prerequisite: *Basic knowledge of C programming.*

Objectives:

- *To learn the python environment script code.*
- *To study python programs with conditionals and looping statement.*
- *To use functions for python structured programs.*
- *To implement object oriented programming concepts in python.*
- *To read and write data from and to files in python.*

List of Experiments:

1. Write a program to display the largest number among three numbers.
2. Write a program to check the prime number and to display the twin prime numbers.
3. Write a program to display the Fibonacci series and multiplication table by using looping constructs.
4. Write a program for converting decimal to octal, hexadecimals and vice versa by using functions.
5. Write a function to compute the GCD of two numbers.
6. Write a function to perform sorting list of numbers.
7. With the help of string array or list, display a simple calendar in python program without using the calendar module.
8. Demonstrate class and inheritance in python.
9. Create a text file using python file I/O. Read the content of the file and change them from lower to upper case characters. Write the updated content in another file and display it.
10. Write a program to demonstrate the user-defined exception handling mechanism in Python.
11. Design and implement a graphical user interface to perform any arithmetic operation.
12. Write a python program to insert and retrieve data using MySQL.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO 1: Design simple programs using conditionals and loops.
CO 2: Write functions to solve mathematical problems
CO 3: Demonstrate the use of files in python.
CO 4: Develop simple applications using python.
CO 5: Construct GUI applications using python programming

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SEMESTER - VI

		L	T	P	C
18HR654	**CAREER DEVELOPMENT SKILLS – IV**	0	2	0	0

Prerequisite: *NIL*

Objectives:

- *To enhance their writing and reading skills in a technical concept.*
- *To improve their own problem solving skills.*
- *To study the data interpretation and analysis of various methods.*
- *To enhance their own growth opportunities.*
- *To learn the different concepts in core subjects.*

UNIT - I WRITTEN AND ORAL COMMUNICATION [6]

Self-Introduction – GD – Personal Interview Skills Practices on Reading Comprehension Level 2 – Paragraph Writing – Newspaper and Book Review Writing – Skimming and Scanning – Interpretation of Pictorial Representations – Sentence Completion – Sentence Correction – Jumbled Sentences – Synonyms& Antonyms – Using the Same Word as Different Parts of Speech – Editing.

UNIT - II QUANTITATIVE APTITUDE [6]

Geometry – Straight Line – Triangles – Quadrilaterals – Circles – Co-ordinate Geometry – Cube – Cone – Sphere.

UNIT - III DATA INTERPRETATION AND ANALYSIS [6]

Data Interpretation based on Text – Data Interpretation based on Graphs and Tables. Graphs Column Graphs, Bar Graphs, Line Charts, Pie Chart, Graphs representing Area, Venn Diagram & Flow Charts.

UNIT - IV RESUME WRITING & PRESENTATION SKILLS [6]

An Introduction to the Resume – Types of Resumes – Common Resume Errors – Anatomy of a Resume – What is a Cover Letter? – Types of Cover Letters – Enhancing the Language and Style of Your Resume and Cover Letter – Assessment.

Presentation Skills: Oral presentation and public speaking skills; business presentations. – Understand the Situation – Know Your Tools – Know Yourself – Organize it, Write the Script – Practice – Delivering a Presentation.

UNIT - V DOMAIN PROFICIENCY [6]

Competitive exam training: Basics concept of Transformer – D.C Machines – Three phase induction motors – Microprocessor and Microcontroller.

Total (L=0 , T=30) =30 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Employ critical thinking in personal interviews type situations.

CO2: Understand the Quantitative Aptitude problems in geometry.

CO3: Understand the data interpretation and analysis by using various graphs.

CO4: Enhance the skills in resume writing and presentation.

CO5: Enhance the comprehension Skills in core subjects.

Text Books :

1 Dr.R.S.Aggarwal, Quantitative Aptitude, S. Chand & Company Limited, New Delhi, Sixteenth Edition, 2018.

2 Dr.R.S.Aggarwal, A Modern Approach to Verbal & Non -Verbal Reasoning, S. Chand & Company Limited, New Delhi, Fourth Edition, 2015.

Reference Books :

1 M Ashra Rizvi, Effective Technical Communication, Tata McGraw HILL, New Delhi, First Edition, 2005

2 Abhijit Guha, Quantitative Aptitude, TMH,New Delhi, Third Edition,2016.

3 M.B. Lal, Goswami, Objective Instant Arithmetic, Upkar Publications, Delhi, Second Edition,2012.

4 W.R. Norman Lewis, Word Power Made Easy, Goyal Publications, New Delhi, Fourth Edition,2016.

5 B.L Theraja, V.K Pandey, Objective Electrical Technology, S Chand Publications, New Delhi, Fourth Edition,2014.

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SEMESTER - VII

18EE711 **EMBEDDED SYSTEMS**

L	T	P	C
3	0	0	3

Prerequisite: *Microprocessor and Microcontroller*

Objectives:

- *To learn and understand the fundamental concept of embedded systems.*
- *To Study the embedded networks.*
- *To understand the concepts of software development Process.*
- *To understand the functions of RTOS.*
- *To learn system design concepts.*

UNIT - I INTRODUCTION TO EMBEDDED SYSTEMS [9]

Embedded System Vs General Computing System – Classification of embedded systems – Functional building blocks of embedded systems – Structural units in embedded processor – Selection of processor & memory devices – Processor interfacing with memory and I/O units – Embedded hardware units – PIC16F877A: Architecture – Instruction set.

UNIT - II EMBEDDED NETWORKS [9]

Introduction to I/O device ports & buses – Serial communication using I^2C,CAN,SPI,USB and PROFI buses – Parallel communication using PCI,PCI-X buses, ARM bus – Internet enabled systems – Wireless and mobile system protocols.

UNIT - III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT [9]

Introduction to embedded software development process and tools – Host and target machines – linking and locating software – Embedded Product Development Life Cycle – objectives, different phases of EDLC, Modeling of EDLC – Fundamental issues in hardware and software Co-design – Data Flow Graph – state machine model.

UNIT - IV REAL TIME OPERATING SYSTEMS [9]

Introduction to basic concepts of RTOS – Task, process & threads – Context switching – Multiprocessing and Multitasking – Preemptive and nonpreemptive scheduling – Round Robin scheduling – Task communication – shared memory, message passing – Interprocess communication – semaphores, Message queue, Mailbox, pipes – priority inversion – priority inheritance.

UNIT - V RTOS BASED EMBEDDED SYSTEM DESIGN [9]

Basic Functions and Types of RTOS – Interrupt routines in RTOS – Case Study of Washing Machine – Automotive Application – Smart card system – ATM machine – Digital camera.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Illustrate the fundamentals of embedded systems.

CO2: Outline the various types of embedded communication protocols.

CO3: Explain the concept of software development process and tools.

CO4: Describe the functions of real time operating systems.

CO5: Apply the knowledge of embedded product development.

Text Books :

1 Rajkamal.P. Embedded System – Architecture, Programming, Design, Tata McGraw Hill Education Private Limited, New Delhi, Third Edition, 2016.

2 John B.Peatman, Design With PIC microcontroller, Pearson Education, India, First Edition, 2009.

Reference Books :

1 Frank Vahid and Tony Givargi, Embedded System Design - A Unified Hardware & Software Introduction, John Wiley, New Jersey, Third Edition, 2011.

2 David E.Simon, An Embedded software primer, Pearson Education, India, First Edition, 2007.

3 Steve Heath, Embedded System Design, Elsevier, India, Second Edition, 2003.

4 Wayne wolf, Computers as components: Principles of embedded computing system design, Morgan Kaufmann publishers, USA, Third Edition, 2012.

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SEMESTER - VII

18EE712	INDUSTRIAL AUTOMATION AND CONTROL	L	T	P	C
		3	0	0	3

Prerequisites: *Digital Electronics, Control Systems*

Objectives:

- *To introduce the basic concepts of PLC.*
- *To study the logic fundamentals, PLC timer and counter.*
- *To gain knowledge in PLC programming.*
- *To understand the basic concepts of DCS.*
- *To categorize the applications of PLC and DCS.*

UNIT - I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC) [9]

Introduction – PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC – Principles of Operation – Modifying the Operation – PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications – PLC Programming Languages.

UNIT - II LOGIC FUNDAMENTALS, TIMER AND COUNTER [9]

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic – Developing circuits from Boolean instructions –Programming Word Level Logic Instructions – PLC timer: classification and instructions – PLC counter: classification, instructions and applications.

UNIT - III PLC PROGRAMMING [9]

PLC-memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart.

UNIT - IV DISTRIBUTED CONTROL SYSTEM [9]

Distributed control system: Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – General purpose computers in DCS – Introduction to SCADA.

UNIT - V APPLICATIONS OF PLC AND DCS [9]

PLC interfaces – PLC applications: Automatic Control of Ware House Door – Automatic Lubricating Oil Supplier – Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

Total (L=45 , T=0) =45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the major components of programmable logic controller and its applications.
CO2: Summarize the logical functions, timers and counters of PLC.
CO3: Discuss the various instructions and modes of operation related to PLC.
CO4: Realize the architecture and various interfacing techniques of Distributed Control Systems.
CO5: Examine the different applications of PLC and Distributed Control Systems.

Text Books :

1 Frank D.Petruzella, Programmable Logic controllers, Tata McGraw Hill Publishing Co Ltd., New Delhi, Fifth Edition, 2017.
2 Lucas, M.P., Distributed Control System, Van Nostrand and Reinhold Co., Newyork, First Edition, 1986.

Reference Books :

1 Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Thomson Learning, Third Edition, 2010.
2 John W.Webb and Ronald A.Reis, Programmable Logic Controllers: Principles and Applications, PHI learning private limited, New Delhi, Fifth Edition, 2003.
3 Krishna Kant, Computer - Based Industrial Control, PHI learning private limited, New Delhi, Second Edition, 2011.
4 Madhuchhanda Mitra and Smarajit Sen Gupta, Programmable Logic Controllers and Industrial Automation, Penram International Publishing (India) Pvt. Ltd., Mumbai, First Edition, 2008.

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SEMESTER - VII

		L	T	P	C
18EE721	**EMBEDDED SYSTEMS LABORATORY**	0	0	3	1

Prerequisite: *Microprocessor and Microcontroller Laboratory*

Objectives:

- *To write the program for ALU and relay output interfacing using KEIL software.*
- *To write the program for ALP and alarm clock with PIC microcontroller.*
- *To write the program for elevator control and model train controller interfacing using MPLAB software.*
- *To verify the LED and logical level interface with ARM processor using KEIL software.*
- *To write the program to interface matrix hex keypad and LCD with the ARM processor using KEIL software.*

List of Experiments

1. Write ALU and Flash programming with 8051 microcontroller using KEIL software.
2. Write the program for Relay output interface and verify with 8051 microcontroller using KEIL software.
3. Write the PIC ALP program for simple arithmetic operations.
4. Design an Alarm clock with PIC microcontroller using MPLAB software.
5. Design an elevator control interface with PIC microcontroller using MPLAB software.
6. Design a model train controller interface with PIC microcontroller using MPLAB software.
7. Verify LED output interface with ARM processor using KEIL software.
8. Verify logical controller interface with ARM processor using KEIL software.
9. Design Matrix Hex Keypad interface with ARM processor using KEIL software.
10. Design a graphical LCD interface with an ARM processor using KEIL software.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Develop the Programs for simple ALU.
CO2: Construct the applications using 8051 microcontrollers.
CO3: Construct the different applications using PIC microcontrollers.
CO4: Develop the programs for various interfacing kits.
CO5: Construct the different applications using ARM processor.

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SEMESTER - VII

		L	T	P	C
18EE722	**MINI PROJECT**	0	0	6	3

Prerequisite: *Measurement and Instrumentation, Digital Electronics, Power Electronics*

Objectives:

- *To gain confidence in solving real time problems related to electrical and electronics.*
- *To develop their own innovative prototype of ideas.*
- *To train themselves in preparing mini project reports and examinations.*
- *To do effective trouble-shooting of the mini project.*
- *To develop Knowledge for the assembling of circuits with components on PCB.*

The students should adhere the following Guidelines:

1. They should select a problem which addresses some basic home, office or other real life applications.
2. Group of maximum three students can be permitted to work on a single mini project.
3. The mini project must have hardware parts. The software part is optional.
4. A detailed study of the problem and its financial implications and physical and mental hazards can be studied.
5. The methodology to tackle this problem can be studied and analyzed.
6. It is desirable that the systems developed by the students have some novel features.
7. A mini project report should be submitted at the end of the semester as per guidelines.
8. This project report should be evaluated jointly by external and internal examiners.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Practice acquired knowledge within the chosen area of technology for project development.
CO2: Study and enhance software/ hardware skills.
CO3: Work as an individual or in a team in development of technical projects.
CO4: Reproduce, improve and refine technical aspects for engineering projects.
CO5: Report and present the findings of the study conducted in the preferred domain

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SEMESTER - VIII

		L	T	P	C
18EE811	**ENERGY AUDITING AND MANAGEMENT**	3	0	0	3

Prerequisite: *Power System – I, Power Systems – II*

Objectives:

- *To enable the students to understand the concept of energy management*
- *To know energy cost and load management techniques*
- *To understand the energy management in motors and electrical equipments*
- *To understand the concepts of metering in energy management*
- *To be familiar with the concepts of lighting system and BEE*

UNIT - I Introduction [09]

Energy Scenario: Present Energy Scenario - Primary energy resources - Energy Pricing in India, Need for energy management – energy basics - designing and starting an energy management program – energy accounting - energy monitoring, targeting and reporting- Energy audit, Definition, need, types of energy audit, Energy Audit Process.

UNIT - II Energy Cost and Load Management [09]

Important concepts in an economic analysis – Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation - Load management: Demand control techniques - Utility monitoring and control system - HVAC and energy management - Power factor improvement and its benefits.

UNIT - III Energy management for Motors, Electrical Equipment and Cogeneration [09]

Energy management for electric motors – Transformer and reactors – Capacitors and synchronous machines, Energy management by cogeneration – Forms of cogeneration - Feasibility of cogeneration – Electrical interconnection.

UNIT - IV Metering for Energy Management [09]

Energy audit instruments - Utility meters – Timing of meter disc for kilowatt measurement – Demand meters – Paralleling of current transformers – Instrument transformer burdens - Multitasking solid-state meters – Metering location vs. requirements- Metering techniques and practical examples.

UNIT - V Lighting Systems & BEE [09]

Concept of lighting systems – The task and the working space -Light sources – Ballasts – Luminaries – Lighting controls - Optimizing lighting energy – Power factor and effect of harmonics on power quality – Lighting and energy standards - Role of Bureau of Energy Efficiency(BEE) - Functions of BEE - Objectives of Standards & Labeling.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Describe the concept of energy management and auditing.
CO2: Explain the energy cost and Load management.
CO3: Enlighten the role of motors and electrical equipments in energy management
CO4: Elucidate the Metering in energy management.
CO5: Describe the concepts and controls of the lighting system.

Text Books :

1 Yogi Goswami D and Frank Kreith, Energy Management and Conservation Handbook, CRC Press, New Delhi, Second Edition, 2017.

2 Wayne C.Turner, Energy Management Handbook, Fairmont Press, USA, Eighth Edition, 2012.

Reference Books :

1 Anil Kumar, Om Prakash, Prashant Singh Chauhan and Samsher Gautam, Energy Management Conservation and Audits, CRC Press, New Delhi, First Edition, 2021.

2 Albert Thumann and William J. Younger, Handbook of Energy Audits, CRC Press, New Delhi, Ninth Edition, 2012

3 Amlan Chakrabarti, “Energy Engineering And Management”, PHI Publications, New Delhi, Second Edition, 2011.

4 Success stories of Energy Conservation by BEE, New Delhi (https://beeindia.gov.in/)

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SEMESTER - VIII

		L	T	P	C
18EE821	**PROJECT WORK & DISSERTATION**	0	0	12	6

***Prerequisites*:** All the core and elective courses of the programme.

Objectives:

- *To provide opportunity for the students to implement their skills acquired from the previous semesters to practical problems/problems faced by industry/development of new concepts.*
- *Make the students come up with innovative/ new ideas in his/her area of interest.*
- *Learn methodology to select a project and able to work in a team leading to development of hardware/software product.*
- *Impart the knowledge to model any design using modern tools and demonstrate the working of the model.*
- *To train the students in preparing project report and to face reviews and viva voce examination.*

The students should adhere the following Guidelines:

1. To start with literature review about the proposed idea of the project and executing the same in consultation with the project guide/project coordinator/Industry experts.
2. A detailed analysis/modeling/simulation/design/problem solving/experiment is must to complete and an effort leading to paper publication or patenting is desired.
3. A working model or prototype is to be submitted at the end semester for evaluation.
4. Project work done at Industry should be duly supported by certificate from the Industry. The students should provide a copy of certificate at the end of the project report.
5. The progress of the project is evaluated based on a minimum of three reviews and the review committee may be constituted by the Head of the Department.
6. A project report is required to be submitted at the end of the semester in the prescribed format.
7. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total : 180 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1 Identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas of the department interests or of Industrial importance.

CO2 *Solve a specific problem right from its identification and literature review till the successful solution of the same.*

CO3 *Apply the theoretical concepts to solve real time problems with teamwork and multidisciplinary approach.*

CO4 *Design /develop/conduct experiment and document the results by using modern tools/methods.*

CO5 *Prepare a good project report and be able to present the ideas with clarity.*

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SEMESTER - V

		L	T	P	C
18EE561	**INDUSTRIAL ELECTRONICS (Professional Elective - I)**	3	0	0	3

Prerequisite: *Power Electronics, Power Electronics and Drives*

Objectives:

- *To get an overview of various types of power semi-conductor devices and their Switching characteristics.*
- *To understand the control and firing circuits of different devices.*
- *To know the concept of types sensors and digital conversion techniques.*
- *To learn the different methods speed control of DC and AC drives using power semiconductor devices.*
- *To study the various types of special machines and applications of industrial heating control.*

UNIT - I **POWER SEMICONDUCTOR DEVICES** **[9]**

Introduction to power semiconductor devices, Power Transistor, SITs, RCT, SITH, MCT, FCT, LASCR and application.

UNIT - II **FIRING AND PROTECTING CIRCUITS** **[9]**

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT - IC555 based motor driver circuit – Over voltage, over current and gate protections.

UNIT - III **SENSORS** **[9]**

Smart sensors, Integrated smart sensors – definition – Interface electronics: Design, sensing elements and their parasitic effects, ADC, Accuracy over a Dynamic range - Sensor Interfaces – front end circuits – DAQ board design - Digital conversion techniques - Electronic contactor for motor control

UNIT - IV **MOTOR CONTROL** **[9]**

Introduction - Speed control methods for DC motors (phase controlled converters and choppers), Three phase induction motors. (phase controlled converters) – UPS - SMPS

UNIT - V **STEPPER MOTORS AND HEATING CONTROL** **[9]**

Variable reluctance, Permanent magnet and hybrid stepper motors. Resistance heating control, Induction heating control and Dielectric heating control.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Describe the various power semiconductor devices and their application.
CO2: Discuss the firing and production circuits of power semiconductor devices.
CO3: Analyze the different types of sensors and digital conversion techniques used in an industrial application
CO4: Explicate the speed control methods of DC and AC drives using power semiconductor devices.
CO5: Explain the concept of stepper motor and heating control in an industrial application.

Text Books :

1 Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, New Delhi, Third Edition, 2004.
2 P.C. Sen, Power Electronics, Tata McGraw - Hill Publishing, New Delhi, Third Edition, 2008.

Reference Books :

1 MD Singh and K.B Khanchandani, Power Electronics, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2001.
2 Gerord C.M. Meijer, Smart Sensor Systems, John Wiley and Sons, United States, First Edition, 2008.
3 T.H.E.Kissell, Industrial Electronics, PHI Learning, New Delhi, Third Edition, 2011.
4 P.P. Acarnley, Stepping Motors – A Guide to Motor Theory and Practice, Peter Perengrinus, London, First Edition, 1982.

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SEMESTER - V

		L	T	P	C
18EE562	**POWER PLANT ENGINEERING**				
	(Professional Elective - I)	3	0	0	3

Prerequisite: *Engineering Physics, Electrical machines*

Objectives:

- *To acquire knowledge about layout and working of various components of thermal power plant*
- *To study the classification, layout and working of a hydel power plant.*
- *To understand the working principle and types of nuclear reactor in a nuclear power plant.*
- *To learn about the operation and types of gas and diesel power plant*
- *To know the basic concepts of various non-conventional energy sources*

UNIT - I THERMAL POWER PLANTS [9]

Basic thermodynamic laws - various components of steam power plant – layout - pulverized coal burners - Fluidized bed combustion - coal handling and ash handling systems - Forced draft and induced draft fans – Boilers - feed pumps – superheater - regenerator – condenser – deaerators - cooling tower.

UNIT - II HYDEL POWER PLANTS [9]

Hydel power plant classifications- essential elements, selection of water turbines - selection of site for a hydel power plant - layout – dams – pumped storage power plants - micro hydel developments.

UNIT - III NUCLEAR POWER PLANTS [9]

Principles of nuclear energy - nuclear fission - nuclear reactor, types – pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor-nuclear power plants.

UNIT - IV GAS AND DIESEL POWER PLANTS [9]

Fuels - gas turbine material, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance - advantage and disadvantages- types of diesel engine power plant- components and layout.

UNIT - V NON-CONVENTIONAL POWER GENERATION [9]

Solar energy collectors – OTEC - wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation-principle.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Describe the layout and function of various parts inside the thermal power plant.

CO2: Demonstrate the layout, construction, working of the components inside the hydro power plant.

CO3: Explain the principle of operation, layout and types of nuclear reactor in a nuclear power plant.

CO4: Discuss about the types, performance and layout of gas and diesel power plants.

CO5: Explain the basic concepts of different non-conventional energy sources.

Text Books :

1 Domkundwa, Arora Domkundwar, A Course in Power Plant Engineering, Dhanpat Rai and Co. Pvt. Ltd., New Delhi, Eighth edition, 2016.

2 P.K. Nag, Power Plant Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2010.

Reference Books :

1 Philip Kiameh, Power Generation Handbook, Tata McGraw Hill Publishing Co Ltd., New Delhi, Third Edition, 2013.

2 P.C. Sharma, Power Plant Engineering, S.K. Kataria and Sons, New Delhi, First Edition, 2013.

3 Raja, A.K., Amit Prakash Manish Dwivedi, Power Plant Engineering, New Age International, New Delhi, First Edition, 2012.

4 Gupta, Manoj Kumar, Power Plant Engineering, PHI learning private limited, New Delhi, First Edition, 2012.

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SEMESTER - V

		L	T	P	C
18EE563	**SPECIAL ELECTRICAL MACHINES (Professional Elective - I)**	3	0	0	3

Prerequisite: *Electrical Machines*

Objectives:

- *To explain the performance and control of stepper motors and characteristics.*
- *To study the classification, control and characteristics of permanent magnet synchronous motors.*
- *To describe the operation and characteristics of permanent magnet brushless dc motors.*
- *To understand the operation and types of synchronous reluctance motors.*
- *To know the theory of operation, power converter and control of switched reluctance motor.*

UNIT - I STEPPER MOTORS [9]

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi-stack configurations – Torque equation – Modes of excitation – Characteristics – Drive circuits –Processor control of stepping motors – closed loop control.

UNIT - II PERMANENT MAGNET SYNCHRONOUS MOTORS [9]

Permanent magnet motors – Classifications of PMSM – Principle of operation – EMF and torque equations – Armature reaction MMF – Synchronous reactance – Phasor diagram – Converter volt ampere requirements – Torque speed characteristics – Processor based control.

UNIT - III PERMANENT MAGNET BRUSHLESS D.C. MOTORS [9]

Permanent magnetic materials – Magnetic characteristics – Permeance coefficient – Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Commutation in DC motors, electronic commutation, difference between mechanical and electrical commutators – Power controllers – Motor characteristics and control.

UNIT - IV SYNCHRONOUS RELUCTANCE MOTORS [9]

Constructional features – Types – Axial and radial flux motors – Operating principle: Variable reluctance and hybrid motors – voltage and torque equations – Phasor diagram – Characteristics.

UNIT - V SWITCHED RELUCTANCE MOTORS [9]

Constructional features – Rotary and linear SRMs – Principle of operation – Torque production – Steady state performance prediction – Analytical method – Power converters and their controllers – Methods of rotor position sensing – Sensorless operation – close loop control of SRM – Processor based control of SRM – Applications**.**

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the construction, operating principles of various stepper motors and develop its torque equation.

CO2: Demonstrate the principle of operation of permanent magnet synchronous motors and illustrate its phasor diagram along with torque speed characteristics.

CO3: Explain the operation, performance characteristics of permanent magnet brushless dc motors and its various commutation techniques.

CO4: Illustrate the constructional features of various synchronous reluctance motors and realize its phasor diagram.

CO5: Summarize the constructional features of switched reluctance motors and illustrate the various rotor position sensing techniques.

Text Books :

1 Miller.T.J.E, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford, First Edition, 1989.

2 Kenjo.T and Nagamori.S, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, Second Edition, 1988.

Reference Books :

1 Krishnan.R, Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, First Edition, 2009.

2 P.P. Acarnley, Stepping Motors – A Guide to Motor Theory and Practice, Peter Perengrinus, London, First Edition, 1982.

3 Kenjo.T, Stepping Motors and Their Microprocessor Controls, Clarendon Press, London, Second Edition, 2003.

4 E.G.Janardanan, Special Electrical Machines, PHI learning private limited, New Delhi, First Edition, 2014.

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SEMESTER - V

		L	T	P	C
18EE564	**ADVANCE CONTROL SYSTEM (Professional Elective - I)**	3	0	0	3

Prerequisite: *Control systems*

Objectives:

- *To impart knowledge on Concepts of the state Space analysis*
- *To examine the State Variable design,*
- *To analyze Sampled Data Control System,*
- *To learn the conventional technique of non-linear systems.*
- *To investigate the asymptotic stability, Liapunov's stability and Popov's criterion.*

UNIT - I STATE SPACE ANALYSIS [9]

Introduction to state space analysis – Physical variable, Phase variable and Canonical variables forms - State transition matrix- controllability and observability.

UNIT - II STATE VARIABLE DESIGN [9]

Design by state feedback – output feedback – Pole assignment technique – Design of state and output feedback controllers – Design of reduced and full order observers – PI feedback – Dynamic state feedback.

UNIT - III SAMPLED DATA CONTROL SYSTEM [9]

Introduction to Sample data control systems –Sampling process, signal reconstruction, difference equation, Z-transform– Inverse Z transform, Z-transform analysis of sampled data control system, Z and S domain Relationship.

UNIT - IV NON-LINEAR SYSTEMS [9]

Types of non-linearity – Typical examples – Equivalent linearization - Phase plane analysis – Limit cycles – Describing functions- Analysis using Describing functions.

UNIT - V STABILITY [9]

Stability concepts – Equilibrium points – BIBO and asymptotic stability – Direct method of Liapunov – Application to non-linear problems – Frequency domain stability criteria –Popov's method and its extensions.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Apply state variables to form state equations and analyze for controllability and observability.
CO2: Design feedback controllers and observers.
CO3: Analyze sampled data control system.
CO4: Discuss the features of phase plane analysis and describing function analysis.
CO5: Examine BIBO, asymptotic stability, Liapunov's stability and Popov's criterion.

Text Books :

1 M.Gopal, Digital control and state variable methods, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2007.
2 M.Gopal, Modern control system theory, John Wiley & Sons Ltd, United States, Second Edition,1993.

Reference Books :

1 I.J. Nagarth and M. Gopal, Control Systems Engineering, New Age International Pvt Ltd, New Delhi, Sixth edition 1993
2 K. Ogata, Discrete - Time Control Systems, PHI learning private limited, New Delhi, Second Edition, 2005.
3 Benjamin C. Kuo Farid Golnaraghi, Automatic Control systems, John Wiley and Sons Ltd, India, Ninth Edition, 2014.
4 Sarkar B.N, Advanced Control Systems, PHI learning private limited, New Delhi, First Edition, 2013

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SEMESTER - V

		L	T	P	C
18EE565	**BASIC VLSI DESIGN (Professional Elective - I)**	3	0	0	3

Prerequisite: *Electronic Devices and Circuits, Digital Electronics*

Objectives:

- *To study the fundamentals of CMOS circuits and its characteristics.*
- *To learn about design rules and layout for CMOS inverter and gate.*
- *To understand the concept of CMOS logic gate design and power dissipation.*
- *To gain knowledge about storage elements and different types of dynamic logic circuits.*
- *To acquire knowledge on FPGA architectures.*

UNIT - I **INTRODUCTION TO MOS TRANSISTOR** **[9]**

A brief history-MOS transistors- Ideal I-V characteristics- Non-ideal I-V effects, Inverter DC transfer characteristics

Fabrication: nMOS fabrication, CMOS fabrication [P-well process, N-well process, Twin tub process].

UNIT - II **VLSI CIRCUIT DESIGN PROCESSES** **[9]**

VLSI design flow- CMOS technologies, NMOS and CMOS inverters - MOS layers- Stick diagrams-Design rules and Layout - Transistors layout diagrams for NMOS and CMOS inverters and logic gates.

UNIT - III **CMOS LOGIC GATE DESIGN AND POWER DISSIPATION** **[9]**

NAND and NOR gates - Complex logic gates - Tri state circuits - Large FETs - Transmission gate and pass transistor logic – Static and dynamic power dissipation.

UNIT - IV **STORAGE ELEMENTS AND DYNAMIC LOGIC CIRCUITS** **[9]**

SR latch - Bit level register - D flip flop - Dynamic D flip flop - Static RAM cell - Clocked CMOS - Dynamic logic - Domino logic - SR logic - Dynamic memories.

UNIT - V **FIELD PROGRAMMABLE GATE ARRAYS** **[9]**

Types of ASICs - Standard cell design and cell libraries, FPGA building block architectures-Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 – Altera FLEX Design.

Total = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the basic CMOS circuits and the CMOS process technology.

CO2: Design a layout for CMOS logic gates.

CO3: Design the complex logic gates and estimate the power dissipation.

CO4: Describe various memory elements and types of logic design.

CO5: Explain the architecture of FPGA.

Text Books :

1 N.Weste, D.Harris, CMOS VLSI Design-A circuits and System Approach, Pearson education, New Delhi, Third Edition, 2013

2 John P. Uyemura, Chip Design for Submicron VLSI: CMOS layout and simulation, Cengage Learning, India, Eleventh Indian Reprint, 2013.

Reference Books :

1 M.J. Smith, Application Specific Integrated Circuits, Pearson education, New Delhi, Third Edition, 2009.

2 Wayne Wolf, Modern VLSI Design System-On-Chip, PHI learning private limited, New Delhi, Third Edition, 2007.

3 http://nptel.ac.in/courses/108101089/

4 https://nptel.ac.in/courses/108/107/108107129/

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SEMESTER - VI

		L	T	P	C
18EE661	**SOLID STATE DRIVES (Professional Elective - II)**	3	0	0	3

Prerequisite: *Electrical Machines – I, Electrical Machines – II, Power Electronics*

Objectives:

- *To study the basic concepts of electric drives.*
- *To understand the conventional and solid state speed control of DC motor.*
- *To study and understand the operation and performance of AC motor drives.*
- *To analyze and design the current and speed controllers for a closed loop DC motor drives.*
- *To implicit the concept and application of special drives.*

UNIT - I INTRODUCTION [9]

Concept of electric drive – Advantages of electric drives – Classification of electrical drives – Basic elements of an electric drive – Speed-torque characteristics of various types of loads and drive motors – Classes of duty and selection of motors with regard to thermal overloading – Multi quadrant operation.

UNIT - II DC DRIVES [9]

Ward-Leonard scheme – Controlled rectifier fed DC drives: single, two and four quadrant operations – Chopper fed DC motor drives: Single, two and four quadrant operations – Effect of ripples on the motor performance – Closed loop speed control of DC motor.

UNIT - III AC DRIVES [9]

Stator control of Induction Motor: voltage control, frequency control, V/f control – VSI, CSI and Cyclo converter fed induction motor drives – Rotor control of Induction Motor: rotor resistance control, Slip power recovery schemes: Static Kramer and Scherbius drives – Synchronous Motor: Variable frequency control and self-control of synchronous motor: power factor control, stator voltage equations in arbitrary and rotor reference frame variables.

UNIT - IV DESIGN OF CONTROLLERS FOR DRIVES [9]

Transfer function for DC motor / load and converter – closed loop control with Current and speed feedback–armature voltage control and field weakening mode – Design of controllers: current controller and speed controller – converter selection and characteristics.

UNIT - V SPECIAL DRIVES AND APPLICATIONS [9]

Principle of operation: DC and AC Servo drives, Stepper motor drives – Comparison between Servo drive and Stepper drive – Switched Reluctance motor drives – Solar and Battery powered drives. Selection of drive and Control schemes for Steel industry – Textile industry – Paper industry – Control system for Elevators and Cranes.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the characteristics of motors, load dynamics and performance parameters of DC and AC drives.

CO2: Demonstrate the conventional, chopper and rectifier control of DC Motor.

CO3: Illustrate the suitable speed control technique for induction and synchronous motors by using solid state controllers in AC drives.

CO4: Analyze and design the current and speed controllers of DC motor drives.

CO5: Describe the concept and application of special machines in modern electric drives.

Text Books :

1 Dubey.G.K, Fundamentals of Electrical Drives, Narosa Publishing House, New Delhi, Second Edition, 2010.

2 Vedam Subramanyam, Electric Drives: Concepts and Applications, Tata McGraw hill Pvt. Ltd, New Delhi, Second Edition, 2011.

Reference Books :

1 Bose.B.K, Modern Power Electronics and AC Drives, Pearson Education Pvt. Ltd, New Delhi, First Edition, 2015.

2 N.K.De.,and P.K.Sen, Electric drives, Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2014.

3 Krishnan.R, Electric Motor Drives: Modeling, Analysis and Control, PHI Pvt. Ltd, New Delhi, First Edition, 2002.

4 Ned Mohan, Electric Machines and Drives, John Wiley and Sons Ltd, India, First Edition, 2012.

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SEMESTER - VI

		L	T	P	C
18EE662	**POWER SYSTEM PROTECTION AND SWITCHGEAR (Professional Elective - II)**	3	0	0	3

Prerequisite:Power Systems – I & Power Systems – II

Objectives:

- *To understand the characteristics and functions of relays.*
- *To learn the protection schemes of electrical apparatus.*
- *To impart knowledge about circuit interruption its associated problems.*
- *To discuss the working of fuses and circuit breakers under normal and abnormal operating conditions of the power system.*
- *To study the concept of earthing and over voltage protection methods.*

UNIT - I OPERATING PRINCIPLES AND RELAY CHARACTERISTICS [9]

Principles and need for protective schemes – Nature and causes of faults – Types of faults – Zones of protection and essential qualities of protection – Protection scheme – Construction and Characteristics of relays – Over current relays – Directional, distance and differential relays – Under frequency relays – Static relays.

UNIT - II APPARATUS AND LINE PROTECTION [9]

Apparatus protection – Generator and Transformer protection – Electric Motor protection – Protection of Busbar and Transmission lines.

UNIT - III THEORY OF CIRCUIT INTERRUPTION [9]

Physics of arc phenomena and arc interruption – Restriking voltage and Recovery voltage, Rate of rise of recovery voltage, Current chopping, Interruption of capacitive current, Resistance switching – DC and AC circuit breaking.

UNIT - IV FUSES & CIRCUIT BREAKERS [9]

Fuses: Types and its specification – Fault clearing process – Interruption of current – Types of Circuit Breakers – Air blast, Air break, Oil, SF6 and Vacuum circuit breakers – Comparative merits of different circuit breakers – Rating of circuit breakers.

UNIT - V EARTHING AND PROTECTION AGAINST OVER VOLTAGES [9]

Power system earthing – Concepts of Step potential and Touch potential – Effectof electric shock on human beings –Causes of over voltages – Methods of protection against over voltages, Ground wires, Lightning, Switching, Insulation failure, Peterson coil, Surge absorbers, Surge diverters – Relay coordination – Selection of protective system.

Total (L=45, T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Outline various faults and different types of relays used for protection of power system equipment.

CO2: Explain the protection schemes for different power system components.

CO3: Discuss the fundamentals of arcing phenomena.

CO4: Demonstrate the functionality of various protecting devices used in power systems.

CO5: Explain power system earthing and the methods of protection against over voltages in protection scheme.

Text Books :

1 Badri Ram and Vishwakarma, Power System Protection and Switchgear, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Tenth Reprint, Second Edition, 2015.

2 Ravindra P. Singh, Switchgear and Power System Protection, Prentice-Hall of India Pvt. Ltd.,New Delhi, Second Reprint, First Edition, 2011.

Reference Books :

1 Soni.M.L, Gupta.P.V, Bhatnagar.V.S, Chakrabarti.A, A Text Book on Power System Engineering, Dhanpat Rai & Co., New Delhi, Second Edition, 2013.

2 Ravindranath.B and Chander.N, Power System Protection & Switchgear, New Age Publishers, India, Second Edition, 2018.

3 Paithankar Y.G., Bhide S.R., Fundamentals of Power System Protection, Prentice-Hall of India Pvt. Ltd., New Delhi, Eleventh Reprint, Second Edition, 2012.

4 Bhuvanesh A. Oza, Nirmal-Kumar C. Nair, Rashesh P. Mehta and Vijay H. Makwana, Power System Protection and Switchgear, Tata McGraw-Hill Publishing Company Ltd., New Delhi, Fourth Reprint, First Edition, 2012.

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SEMESTER - VI

		L	T	P	C
18EE663	**POWER SYSTEM TRANSIENTS**				
	(Professional Elective - II)	3	0	0	3

Prerequisite: *Power System Analysis and High Voltage Engineering*

Objectives:

- *To study the basic concepts of transients.*
- *To study the generation of switching transients.*
- *To know the mechanism of lightning strokes and the production of lightning surges.*
- *To understand the propagation, reflection and refraction of travelling waves.*
- *To learn the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power systems.*

UNIT - I INTRODUCTION OF TRANSIENTS [9]

Review and importance of the study of transients - Causes for transients - RL circuit transient with sine wave excitation - Double frequency transients - Basic transforms of the RLC circuit transients - Different types of power system transients - Effect of transients on power systems.

UNIT - II SWITCHING TRANSIENTS [9]

Switching transients – Double frequency transients – Abnormal switching transients – Transients in switching a three phase reactor - Three phase capacitor.

UNIT - III LIGHTNING TRANSIENTS [9]

Review of the theories in the formation of clouds and charge formation - Rate of charging of thunder clouds – Mechanism of lightning discharges and characteristics of lightning strokes model for lightning stroke - Factors contributing to good line design - Protection using ground wires – Tower footing resistance - Interaction between lightning and power system.

UNIT - IV TRAVELLING WAVES ON TRANSMISSION LINE [9]

Travelling waves in transmission lines – Circuits with distributed constants – Wave equations – Reflection and refraction of travelling waves – Travelling waves at different line terminations.

UNIT - V TRANSIENTS IN INTEGRATED POWER SYSTEM [9]

The short line and kilometric fault - Distribution of voltages in a power system - Line dropping and load rejection - Voltage transients on closing and reclosing lines - Over voltage induced by faults.

Total (L=45, T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Realize the basic concepts of transients.

CO2: Illustrate the various switching transients.

CO3: Examine the lighting transients.

CO4: Analyze the travelling waves on the transmission line.

CO5: Interpret the transients in an integrated power system.

Text Books :

1 Allan Greenwood, Electrical Transients in Power Systems, Wiley India Pvt. Ltd., New York, Second Edition, 2010.

2 M.S. Naidu and V. Kamaraju, High Voltage Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2013.

Reference Books :

1 R.D. Begamudre, Extra High Voltage AC Transmission Engineering, New Academic Science, London, Fourth Edition, 2011.

2 B. M. Weedy, B.J. Cory, N. Jenkins, J.B. Ekanayake and G. Strbac, Electric Power Systems, John Wiley & Sons, United States, Fifth Edition, 2012.

3 C.S. Indulkar, D.P. Kothari and K. Ramalingam, Power System Transients – A Statistical approach, PHI Learning Pvt. Ltd., New Delhi, Second Edition, 2010.

4 C.L. Wadhwa, High Voltage Engineering, New Age International Pvt Ltd, New Delhi, Third Edition, 2012.

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SEMESTER - VI

		L	T	P	C
18EE664	**HIGH VOLTAGE ENGINEERING (Professional Elective - II)**	3	0	0	3

Prerequisite: *Power system I , Power system II*

Objectives:

- *To expose the students to the various breakdown mechanisms in gas and vacuum.*
- *To import knowledge about the various breakdown mechanisms in liquid and solid dielectrics.*
- *To understand the generation of high voltages and high currents.*
- *To understand the measurement of high voltages and high currents.*
- *To acquire knowledge of necessity and methods of testing in various apparatus in power systems.*

UNIT - I ELECTRIC BREAKDOWN IN GASES AND VACUUM [9]

Ionization and decay processes: Ionization by collision, Photo-ionization and Secondary ionization processes – Electric Breakdown in Gases: Townsend's breakdown mechanism – Breakdown in Electronegative gases – Time lags for breakdown – Streamer mechanism of spark – Paschen's law –Gaseous breakdown in non-uniform fields and corona discharges – Mechanisms for breakdown in vacuum insulation.

UNIT - II ELECTRIC BREAKDOWN IN LIQUIDS AND SOLIDS [9]

Electric Breakdown in Liquids: Properties of liquid dielectrics, Conduction and Breakdown in Pure Liquids – Conduction and Breakdown in Commercial Liquids: Suspended particle Mechanism, Cavitation and Bubble Mechanism, Stressed oil volume Mechanism – Breakdown in Solids: Electromechanical breakdown – Thermal breakdown – Electrochemical breakdown – Breakdown due to Treeing and Tracking – Breakdown due to Internal Discharges – Breakdown in Composite Insulation.

UNIT - III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS [9]

Generation of High DC voltages: Greinacher voltage doubler circuit – Cockcroft Walton voltage multiplier circuit – Vande Graaff Generator – Generation of High Alternating Voltages: Cascade Transformers – Resonant Transformers – Generation of Impulse Voltages: Standard Impulse Wave shapes – Marx circuit – Generation of Switching Surges – Generation of Impulse Currents – Tripping and Control of Impulse Generators.

UNIT - IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS [9]

Measurement of High DC Voltages: Series Resistance Micro ammeter – Resistance Potential Dividers– Generating Voltmeters – Measurement of High AC Voltages: CVT – Electrostatic Voltmeters – Sphere gaps for measurement of high DC, AC and Impulse Voltage Measurements – Measurement of High DC, AC and Impulse Currents: DC current transformer – Hall generator – Rogowskicoils – Magneto Optical Method – CRO for Impulse Measurements.

UNIT - V HIGH VOLTAGE TESTING [9]

Testing of Insulators – Testing of Bushings – Testing of Isolators and Circuit Breakers – Testing of Cables – Testing of Transformers – Testing of Surge Arresters – Radio Interference Measurements.

Total (L= 3, T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Realize the basic concepts of various breakdown processes occurring in gases and vacuum insulation.
CO2: Discuss about the concepts of various breakdown processes occurring in liquid and solid insulation material.
CO3: Explain the generation of high AC, DC, Impulse Voltages and generation of high AC, DC and Impulse Currents.
CO4: Describe the various techniques used to measure the high AC, DC, Impulse Voltages and Current.
CO5: Analyze the methods of test procedure to various apparatus in the power system.

Text Books :

1 Naidu,M.S. and Kamaraju,V., High Voltage Engineering, Tata McGraw Hill Publishing Co Ltd., New Delhi, Sixth Edition, 2020.
2 C.L. Wadhwa, High Voltage Engineering, New Age International Pvt Ltd, New Delhi, Third Edition, 2012.

Reference Books :

1 Kuffel,E., Kuffel,J. and Zaengl, W.S., High Voltage Engineering: Fundamentals, Newnes Publisher, New Delhi, Second Edition Elsevier, 2014.
2 Dieter Kind and Kurt Feser, High Voltage Test Techniques, Newnes Publisher, New Delhi, Second Edition, 2001.
3 Subir Ray, An Introduction to High Voltage Engineering, PHI Learning Private Limited, New Delhi, Second Edition, 2013.
4 Alston,L.L., High Voltage Technology, Oxford University Press, New Delhi, First Edition, 2011.

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SEMESTER - VI

		L	T	P	C
18EE665	**DIGITAL SIGNAL PROCESSING (Professional Elective - II)**	3	0	0	3

Prerequisite: *Engineering Mathematics, Signals and Systems.*

Objectives:

- *To acquaint the students with Discrete Time System Analysis.*
- *To compute the Discrete Fourier Transform using FFT algorithms.*
- *To impart knowledge about the design of IIR Filters.*
- *To design the FIR filters using various windowing techniques.*
- *To learn about the DSP hardware architectures and its applications.*

UNIT - I DISCRETE TIME SYSTEM ANALYSIS [9]

Need and advantages of Digital Signal Processing – Typical DSP System: Sampling, Quantization, Quantization Error, Nyquist rate, Aliasing effect – Z-Transform and ROC – Properties of Z-Transform – Inverse Z-Transform – Solution of Difference Equation using Z-Transform – Stability Analysis – Convolution using Z-Transform.

UNIT - II DISCRETE FOURIER TRANSFORM [9]

DFT: Definition and its properties – Computation of DFT and IDFT – Computation of DFT using DIT and DIF-FFT Radix 2 algorithms – Computation of IDFT using DIT and DIF FFT algorithms.

UNIT - III DESIGN OF IIR FILTERS [9]

Realization of IIR filter: Direct form I and II, Cascade and Parallel forms – Analog low pass filter design: Butterworth and Chebyshev – Digital filter design: Impulse invariant method and Bilinear transformation – Warping, prewarping.

UNIT - IV DESIGN OF FIR FILTERS [9]

Amplitude and Phase response of FIR filters – Linear phase characteristics – Design of FIR filters using windows: Rectangular, Triangular, Hamming and Hanning.

UNIT - V DSP HARDWARE [9]

Introduction – Selection of DSP processor – Application of DSP processor – Van Neumann architecture – Harvard architecture – TMS320C50 digital signal processor: Architecture, addressing modes and Instruction set.

Total (L=45, T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Examine the discrete time system using Z-Transform

CO2: Compute the Discrete Fourier Transform using the FFT algorithms.

CO3: Design digital IIR filters using analog filter design methods.

CO4: Design the FIR filters using various windowing techniques

CO5: Explain the digital signal processors hardware architecture and its real time applications.

Text Books :

1 Anand Kumar.A, Digital Signal Processing, PHI Learning Private Limited, India, Second Edition, 2015.

2 John G.Prokis, Dimtris G. Manolakis, Digital Signal Processing Principles, Algorithms and Application, Pearson Education, India, Fourth Edition, 2011.

Reference Books :

1 Alan V. Oppenheim, Ronald W. Schafer, John R.Back, Discrete Time Signal Processing, Pearson Education, India, Third Edition, 2014.

2 Johny R.Johnson, Introduction To Digital Signal Processing, Pearson Education, India, First Edition, 2015.

3 Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, India, First Edition, 2015.

4 Salivanan.S, Vallavaraj.A, Gnanapriya.C, Digital Signal Processing, Tata McGraw Hill Publishing Co Ltd., New Delhi, Second Edition, 2011.

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SEMESTER - VII

		L	T	P	C
18EE761	**POWER ELECTRONICS FOR RENEWABLE ENERGY SOURCES (Professional Elective - III)**	3	0	0	3

Prerequisite: *Power Electronics, Renewable Energy Systems*

Objectives:

- *To provide knowledge about the stand alone and grid connected Renewable Energy Systems (RES).*
- *To equip with required skills to design the electrical machines for RES.*
- *To design different power converters namely AC to DC, DC to DC and AC to AC converters for RES.*
- *To analyze and comprehend the various operating modes of wind and solar energy systems.*
- *To know the various types of hybrid energy systems.*

UNIT - I INTRODUCTION [09]

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) – Qualitative study of different renewable energy resources: Ocean, Biomass, Hydrogen energy systems, Solar PV, Fuel cells, wind electrical systems - control strategy.

UNIT - II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION [09]

Review of reference theory fundamentals – principle of operation and analysis: Induction Generator (IG), Permanent Magnet Synchronous Generator (PMSG), Squirrel Cage Induction Generator (SCIG) and Doubly Fed Induction Generator (DFIG).

UNIT - III POWER CONVERTERS [09]

Line commutated converters (inversion mode) – Boost, Buck and Buck-boost converters – Three phase AC voltage controllers - AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid interactive Inverters.

UNIT - IV ANALYSIS OF WIND AND PV SYSTEMS [09]

PV System: Solar Cell – Solar PV system costs – General scheme of solar PV system – Grid Connected PV system – Stand-alone PV systems – Maximum Power Point Tracking of PV system – Energy Storage System for PV applications – PV and Battery Sizing – Control of PV system – Operational Issues of PV system.

Wind System: Wind power generation – Technological challenges and driving forces – Wind turbine concepts - Maximum Power Point Tracking of wind – Power electronics converters in wind power applications – Control of wind turbines.

UNIT - V HYBRID RENEWABLE ENERGY SYSTEMS [09]

Introduction - Drawbacks of standalone renewable energy sources – need for hybrid renewable energy systems - Type of hybrid systems: PV-Wind, PV-Hydraulic, Hydraulic-Wind and Solar-Biomass – Components of Hybrid Renewable Energy Systems – Power Converters in Hybrid Renewable Energy Systems.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Explain the functions of renewable energy generation systems.*

CO2: *Describe the principles behind the electrical machines for renewable energy conversion.*

CO3: *Analyze the performance of power converters and its types.*

CO4: *Analyze the performance of wind and PV systems with grid systems.*

CO5: *Interpret the concept hybrid systems for renewable energy sources.*

Text Books :

1. Rai. G.D, Non-conventional energy sources, Khanna Publishing, New Delhi, First Edition, 2004.
2. Bimal K.Bose, Power Electronics in Renewable Energy Systems and Smart Grid: Technology and Applications, John Wiley & Sons, United States, First Edition, 2019.

Reference Books :

1. Bhadra, S.N, Kastha, D & Banerjee. S, Wind Electrical Systems, Oxford University Press, London, Seventh Impression edition, 2005.
2. Rashid, M.H, Power Electronics Hand Book, Butterworth-Heinemann, United Kingdom, Third Edition, 2011.
3. Rai. G.D, Solar Energy Utilization, Khanna Publishing, New Delhi, Fifth Edition, 1993.
4. S. Chakraborty, M.G. Simoes, W.E. Kramer, Power Electronics for Renewable and Distributed Energy Systems, Springer, First Edition, 2013.

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SEMESTER - VII

		L	T	P	C
18EE762	**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION (Professional Elective - III)**	3	0	0	3

Prerequisite: *Power System I, Power System II, Power System Protection and Switchgear*

Objectives:

- *To acquire knowledge about the concept, planning of DC power transmission and comparison with AC power transmission.*
- *To analyze the concepts of HVDC converters.*
- *To discuss compounding and regulation.*
- *To gain knowledge about generation, characteristics of harmonics and design of filters.*
- *To learn about HVDC cables and simulation tools.*

UNIT - I INTRODUCTION [09]

Introduction of DC power transmission – Comparison of AC and DC transmission – Economics of HVDC power transmission, Technical performance and reliability – Description of HVDC transmission system – Planning for HVDC transmission – Modern trends in HVDC transmission – Application of DC transmission.

UNIT - II ANALYSIS OF HVDC CONVERTERS [09]

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit – Converter bridge characteristics – Analysis of a 12 pulse converters – Analysis of VSC topologies and firing schemes.

UNIT - III COMPOUNDING AND REGULATIONS [09]

General – Required regulation – Inverter compounding – Uncompounded inverter – Rectifier compounding – Transmission characteristics with the rectifier and inverter compounding – Communication link – Current regulation from the inverter side – Transformer tap changing.

UNIT - IV HARMONICS AND FILTERS [09]

Introduction – Generation of harmonics – Characteristics and uncharacteristic harmonics – Design of AC filters and DC filters – Active filters – Interference with neighboring communication lines.

UNIT - V HVDC CABLES AND SIMULATION OF HVDC SYSTEMS [09]

Introduction of DC cables – Basic physical phenomenon arising in DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables – Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Realize the concept of AC, DC, and HVDC transmission.*
CO2: *Analyze the performance of HVDC converters and its characteristics.*
CO3: *Interpret the concept of compounding and outline the regulation of HVDC transmission.*
CO4: *Design the filters to eliminate the harmonics.*
CO5: *Analyze the performance of HVDC cables and modeling of HVDC systems using simulation.*

Text Books :

1. Padiyar, K.R, HVDC power transmission system, New Age International (P) Ltd., New Delhi, Second Edition, 2010.
2. Kamakshaiah,S, Kamaraju,V, HVDC Transmission, Tata McGraw Hill Education Private Limited, First Edition, 2011.

Reference Books :

1. Dragan Jovcic, High Voltage Direct Current Transmission: Converters, Systems and DC Grids, John Wiley & Sons Ltd., Second Edition, 2019.
2. Arrillaga, J, High Voltage Direct Current Transmission, Peter Pregrinus, London, Second Edition,1998.
3. Rakosh Das Begamudre, Extra High Voltage AC Transmission Engineering, New Age International (P) Ltd., New Delhi, First Edition, 2011.
4. Chan-Ki Kim, Gil-Soo Jang, Seok-Jin Lee, Seong-Joo Lim, Vijay K. Sood, HVDC Transmission: Power Conversion Applications in Power Systems, John Wiley & Sons Pvt Ltd., First Edition, 2009.

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SEMESTER - VII

		L	T	P	C
18EE763	**POWER SYSTEM OPERATION AND CONTROL (Professional Elective - III)**	3	0	0	3

Prerequisite: *Power Systems I, Power Systems II*

Objectives:

- *To have an overview of Power System Operation and Control.*
- *To understand the concepts of unit commitment problem.*
- *To acquire knowledge about Real power-frequency controller.*
- *To learn about Reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.*
- *To gain the knowledge about SCADA and its application for real time operation and control of power systems.*

UNIT - I BASICS OF OPERATION CONTROL & ECONOMIC DISPATCH [09]

An overview of PS operation and control – Definitions – Load curves and Economics of generation – Statement of economic dispatch problem – Cost of generation – Incremental cost curve co–ordination equations without loss and with loss, solution by direct method and λ–iteration method (No derivation of loss coefficients).

UNIT - II UNIT COMMITMENT [09]

Statement of Unit Commitment problem – Constraints: spins reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints – Solution methods – Priority–list methods – Forward dynamic programming approach – Qualitative treatment only in priority–list method using full–load average production cost.

UNIT - III REAL POWER – FREQUENCY CONTROL [09]

Basics of speed governing mechanism and modeling – Control area concept LFC control of a single area system – Static and dynamic analysis of uncontrolled and controlled cases – Integration of economic dispatch control with LFC – Two-area system – Static analysis of uncontrolled case.

UNIT - IV REACTIVE POWER–VOLTAGE CONTROL [09]

Basics of reactive power control – Excitation systems – Modeling – Generation and absorption of reactive power – Relation between voltage, power and reactive power at a node – Method of voltage control – tap–changing transformer – System level control using generator voltage magnitude setting, tap setting of OLTC transformer.

UNIT - V COMPUTER CONTROL OF POWER SYSTEMS [09]

Importance of load forecasting - Linear State estimation - Concept of energy control centre (or) load dispatch centre and the functions – System monitoring – Data acquisition and control – System hardware configuration – SCADA and EMS functions.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Describe the concepts of power system operation and control and economic dispatch.*
CO2: *Infer the concepts of unit commitment problem*
CO3: *Explain real power-frequency controller*
CO4: *Illustrate the reactive power-voltage interaction and maintain the voltage profile against varying system load.*
CO5: *Outline the operation and application of SCADA for real time operation of power systems.*

Text Books :

1. Allen. J. Wood and Bruce F. Wollen berg, Power Generation, Operation and Control, John Wiley & Sons, Inc., 2016
2. Abhijit Chakrabarti and Sunita Halder, Power System Analysis Operation and Control, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

Reference Books :

1. Olle.I.Elgerd, Electric Energy Systems theory - An introduction, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Thirty Fourth Reprint, 2010.
2. Kothari D.P. and Nagrath I.J., Power System Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second Edition, 2008.
3. Hadi Saadat, Power System Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Twenty First reprint, 2010.
4. Kundur P., Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Tenth reprint, 2010.

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SEMESTER - VII

		L	T	P	C
18EE764	**SMART GRID TECHNOLOGY (Professional Elective - III)**	3	0	0	3

Prerequisite: *Measurement and Instrumentation, Transmission and Distribution*

Objectives:

- *To summarize the components used in smart grid and technologies involved in smart grid.*
- *To understand the concept of smart metering and implementation of demand side integration.*
- *To analyze the concepts in automated distribution systems in smart grid.*
- *To analyze the concepts in automated transmission systems in smart grid.*
- *To analyze the significance of high performance computing in smart grid.*

UNIT - I INTRODUCTION [09]

Electrical Grid – Definition of Smart Grid – Opportunities, Challenges and Benefits of Smart Grid – Difference between conventional & Smart Grid – Inventory of Smart Grid Technologies – Operating Principles and Models of Smart Grid Components, Implementation of Smart Grid – Early Smart Grid initiatives in India – Overview of the technologies required for the Smart Grid.

UNIT - II SMART METERING AND DEMAND-SIDE INTEGRATION [09]

Introduction – Smart metering – Smart meters – An overview of the hardware used – Communications infrastructure and protocols for smart metering, Demand – side integration – Services provided by DSI , Implementations of DSI, Hardware support to DSI implementations, Flexibility delivered by prosumers from the demand side, System support from DSI.

UNIT - III DISTRIBUTION AUTOMATION [09]

Distribution automation, automated meter reading (AMR), automated metering infrastructure (AMI), Intelligent Electronic Devices(IED), fault location isolation and service restoration (FLISR), Outage Management Systems (OMS), High Efficiency Distribution Transformers, Phase Shifting Transformers.

UNIT - IV TRANSMISSION SYSTEM AUTOMATION [09]

Substation automation, Feeder Automation, Supervisory control and data acquisition (SCADA), energy management system (EMS), phasor measurement units (PMU), Wide area Monitoring systems (WAMS).

UNIT - V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS [09]

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Examine the operating principles and models of smart grid components.*

CO2: *Classify the protocols of smart metering used in demand side integration.*

CO3: *Outline the distribution system automation in smart grid.*

CO4: *Outline the transmission system automation in smart grid.*

CO5: *Analyze the high performance computing in smart grid.*

Text Books :

1. Stuart Borlase, Smart Grid : Infrastructure, Technology and Solutions, CRC Press, United States, First Edition, 2012.
2. James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley and Sons, United States, First Edition, 2012.

Reference Books :

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid: Technology and Applications, John Wiley and Sons, United States, First Edition, 2012.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang, Smart Grid–The New and Improved Power Grid: A Survey, IEEE Transaction on Smart Grids, 2012.
3. Ryszard Strzelecki, Grzegorz Benysek, Power Electronics in Smart Electrical Energy Networks, Springer, New Zealand, First Edition, 2008
4. https://nptel.ac.in/courses/108/107/108107113/.

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SEMESTER - VII

		L	T	P	C
18EE765	**FUNDAMENTALS OF NANO TECHNOLOGY (Professional Elective - III)**	3	0	0	3

Prerequisite: *Engineering Physics, Engineering Chemistry*

Objectives:

- *To help the learners to impart the basic knowledge on Nano science and technology.*
- *To explore the various process techniques available for the processing of nano structured material.*
- *To identify the nano material's structures and properties*
- *To learn the characterization techniques of nano materials.*
- *To understand applications of nanotechnology*

UNIT - I INTRODUCTION [09]

Nanoscale Science and Technology – Implications for Physics, Chemistry, Biology and Engineering – Classifications of nano structured materials – nano particles – quantum dots, nano wires - ultra-thin films – multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT - II GENERAL METHODS OF PREPARATION [09]

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapor phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT - III NANOMATERIALS [09]

Nanoforms of Carbon – Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes,Plasma CVD), structure-property Relationships applications- Nanometal oxides - ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays - functionalization and applications-Quantum wires - Quantum dots: preparation, properties and applications.

UNIT - IV CHARACTERIZATION TECHNIQUES [09]

X-ray diffraction technique - Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques - AFM, SPM, STM, SNOM, ESCA,SIMS-Nanoindentation.

UNIT - V APPLICATIONS [09]

NanoInfoTech: Information storage - nanocomputer, molecular switch, super chip, nanocrystal; Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery; Bioimaging – Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) - Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products – In Photostat, printing, solar cell, battery.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Describe the basics of nanotechnology in physics, chemistry and biology.*
CO2: *Recognize the methods of preparation of nano materials.*
CO3: *Categorize the nano materials and its properties.*
CO4: *Relate the characterization techniques for confirming nano materials.*
CO5: *Identify the area of application and its field.*

Text Books :

1. John Dinardo. N, Nanoscale characterization of surfaces & Interfaces, Weinheim Cambridge, Wiley-VCH, Second Edition, 2000.
2. Chattopadhyay K.K and Banerjee, Introduction to Nanoscience and Nanotechnology, PHI Learning (P) Ltd, New Delhi, First Edition, 2013.

Reference Books :

1. Akhlesh Lakhtakia, The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulation, Prentice-Hall of India (P) Ltd, New Delhi, First Edition, 2007.
2. Charles P. Poole,Jr Frank Owens J, Introduction to Nanotechnology, Wiley India (P) Ltd, New Delhi, First Edition, 2006
3. Das, A.K, An Introduction to Nanomaterials and Nanoscience, CBS Publishers and Distribution (P) Ltd, Kindle Edition, 2020.
4. Timp .G, Nanotechnology, AIP press/Springer, 1999.

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SEMESTER - VII

		L	T	P	C
18EE766	**ELECTRIC AND HYBRID VEHICLES (Professional Elective - IV)**	3	0	0	3

Prerequisite: *Basics of Electrical and Electronics Engineering*

Objectives:

- *To present a comprehensive overview of electric and hybrid Vehicles.*
- *To know the properties of batteries and its types.*
- *To understand the concept of AC and DC motor used in hybrid electric vehicle systems.*
- *To know the concept of sizing the drive systems used in electric and hybrid vehicles.*
- *To teach the different energy management strategies used in hybrid and electric vehicles.*

UNIT - I ELECTRIC AND HYBRID ELECTRIC VEHICLES [09]

History of electric and hybrid vehicles – Social and environmental importance of electric and hybrid vehicles – Impact of modern drive – Trains on energy supplies – Conventional Vehicles: Basics of vehicle performance – Vehicle power source characterization – Transmission characteristics – Mathematical models to describe vehicle performance.

UNIT - II ENERGY STORAGE FOR EV AND HEV [09]

Energy storage requirements – Battery parameters –Types of batteries – Modelling of battery – Fuel Cell basic principle and operation – Types of fuel Cells – PEMFC and its operation – Modelling of PEMFC – Ultra capacitors.

UNIT - III ELECTRIC PROPULSION UNIT [09]

Introduction to electric components used in electric and hybrid vehicles – Configuration and control of DC machines – Three phase AC machines – Induction machines – Permanent magnet machines – Switched reluctance machines.

UNIT - IV SIZING THE DRIVE SYSTEMS [09]

Matching the electric machine and the Internal Combustion Engine (ICE) – Sizing the propulsion motor – Sizing the power electronics – Selecting the energy storage technology – Communications – Supporting subsystems.

UNIT - V ENERGY MANAGEMENT STRATEGIES [09]

Introduction to energy management strategies used in hybrid and electric vehicles – Classification of different energy management strategies – Comparison of different energy management strategies – Implementation issues of energy management strategies.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Explain the working principle of Electric and hybrid Vehicles.*
CO2: *Choose proper energy storage systems for electric vehicle applications.*
CO3: *Develop the electric propulsion unit and its control for application of hybrid electric vehicles.*
CO4: *Design the electric drive sizing procedure for electric and hybrid vehicles*
CO5: *Design efficient energy management system for hybrid electric vehicles.*

Text Books :

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, United States, Second Edition, 2011.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, United States, Third Edition, 2018.

Reference Books :

1. Chris, Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, India, Second Edition, 2017.
2. Chan, C.C, and K.T. Chau, Modern Electric Vehicle Technology, Oxford University Press, London, First Edition, 2001.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley Publication, India, Second Edition, 2012.
4. https://nptel.ac.in/courses/108/103/108103009/

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SEMESTER - VII

		L	T	P	C
18EE767	**FLEXIBLE AC TRANSMISSION SYSTEMS (Professional Elective - IV)**	3	0	0	3

Prerequisite: *Power Electronics, Power System – I, Power System - II*

Objectives:

- *To understand the concept of flexible AC transmission systems and its associated problems.*
- *To review the static devices for series and shunt control.*
- *To study the operation of thyristor controlled series capacitor and its applications.*
- *To discuss the voltage source converter based FACTS controllers.*
- *To learn the co-ordination of FACTS controllers.*

UNIT - I FACTS CONTROLLERS [09]

Need for FACTS controllers – Concept of FACTS – Flow of power in an AC system – Dynamic stability consideration – Basic types of FACTS controllers: Static shunt compensators, series compensators – Basic concepts of Static VAR Compensator (SVC) – Thyristor Switched Series Capacitor (TSSC) – Unified Power Flow Controller (UPFC).

UNIT - II VAR COMPENSATORS [09]

Methods of controllable VAR generation – Switching converter type VAR generators – Basic operating principle and control approaches – Voltage control by SVC – Dynamic characteristics – Design of SVC as voltage regulator – Modeling of SVC for power flow – Applications – Steady state power transfer – Prevention of voltage instability.

UNIT - III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS [09]

Principle and operation of TCSC – Operating modes of TCSC – Modeling of TCSC – Modeling for power flow studies – Applications: Improvement of system stability limit, enhancement of system damping.

UNIT - IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS [09]

Principle and operation of Static Synchronous Compensator (STATCOM) – V-I Characteristics. Applications: Enhancement of transient stability, prevention of voltage instability – Static Synchronous Series Compensator (SSSC): Operation, control of power flow, modeling of load flow studies – Comparison of different FACTS controllers.

UNIT - V CO-ORDINATION OF FACTS CONTROLLERS [09]

Controller interactions – SVC to SVC interaction – Co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination – Synchronous Reference Frame (SRF) theory based control algorithm for DVR –Case studies of practical applications of various FACTS devices.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Identify the conditions in conventional power system where the installation of FACTS controllers or Devices becomes vital.*

CO2: *Analyze the performance of a conventional transmission system and apply the principles of reactive power compensation for improvement.*

CO3: *Illustrate the modes of operation of thyristor controlled series capacitor.*

CO4: *Discuss the various modes of operation of thyristor based and voltage source converter based FACTS controllers.*

CO5: *Explain the co-ordination of FACTS controllers.*

Text Books :

1. Mohan Mathur.R, Rajiv. K. Varma, Thyristor-Based Facts Controllers for Electrical Transmission Systems, IEEE press and Wiley India Pvt Ltd., Delhi, First Edition, 2011.
2. Narain G.Hingorani, Laszlo Gyugyi, Understanding Facts: Concepts and Technology of Flexible AC Transmission Systems, Wiley India Pvt Ltd., Delhi, First Edition, 2011.

Reference Books :

1. John.A.T, Flexible AC Transmission System, Institution of Engineering and Technology, London, 1999.
2. Padiyar.K.R, FACTS Controllers in Power Transmission System and Distribution, New Age International (P) Limited, New Delhi, Second Edition, 2016.
3. Rakosh Das Begamudre, Extra High Voltage AC Transmission Engineering, New Academic Science Ltd, London, Fourth Edition, 2011.
4. Timothy J.E. Miller, Reactive Power Control in Electric Systems, Wiley India Pvt Ltd., Delhi, First Edition, 2010

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SEMESTER - VII

		L	T	P	C
18EE768	**SOFT COMPUTING TECHNIQUES (Professional Elective - IV)**	3	0	0	3

Prerequisite:-

Objectives:

- *To acquire basic knowledge about neural networks.*
- *To understand the concept of different neural networks.*
- *To impart knowledge on fuzzy logic system.*
- *To gain knowledge about various soft computing techniques.*
- *To apply soft computing techniques to classical problems.*

UNIT - I INTRODUCTION [07]

Fundamental concept to Neural Networks and its basic models of Artificial Neural Network, Weights, Bias and thresholds, Common activation functions, Learning rules, Learning methods, McCulloch–Pitts neuron, Linear Separability, Hebb Network, Perceptron Networks.

UNIT - II ARTIFICIAL NEURAL NETWORKS [11]

Adaptive Linear Neuron, Back-Propagation Network, Auto associative Memory Network, Hopfield Networks, Kohonen Self-Organizing Feature Maps and Boltzmann Machine.

UNIT - III FUZZY LOGIC SYSTEM [09]

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases.

UNIT - IV OPTIMIZATION ALGORITHMS [09]

Genetic algorithm – operators - stopping condition – constraints – classification - Advantages and Limitations of Genetic Algorithm, Simulated Annealing, Ant colony optimization.

UNIT - V APPLICATIONS OF SOFT COMPUTING [09]

Stability Analysis using Artificial Neural Networks, Fuzzy Logic in Control Systems, Neural Network Toolbox, Fuzzy Logic MATLAB Toolbox and Genetic Algorithm MATLAB Toolbox.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Infer the concepts of artificial neural network.

CO2: Outline the various types of neural network.

CO3: Discuss the basic concepts of fuzzy logic system.

CO4: Illustrate the fundamentals of different soft computing techniques.

CO5: Apply the knowledge of neural networks and fuzzy logic controller for classical applications.

Text Books :

1 Sivanandam S.N and Deepa S.N, Principles of soft computing techniques, John Wiley and Sons Ltd, United States, Third Edition, 2011.

2 Jacek M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing Home, Mumbai, First Edition, 2002.

Reference Books :

1 Laurance Fausett Englewood cliffs, N.J., Fundamentals of Neural Networks, Pearson Education, New Delhi, First Edition, 1992.

2 Kosko, B. Neural Networks And Fuzzy Systems, Prentice-Hall of India Pvt. Ltd., New Delhi, Third Edition, 1994.

3 David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education, New Delhi, Thirteenth Edition, 2013.

4 Simon Haykin, Neural Networks Comprehensive Foundation, Pearson Education, New Delhi, Second Edition, 2005.

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SEMESTER - VII

		L	T	P	C
18EE769	**BIO-MEDICAL INSTRUMENTATION (Professional Elective - IV)**	3	0	0	3

Prerequisite: *Measurement and Instrumentation*

Objectives:

- *To impart knowledge of the physiology of the heart, blood circulation & respiration.*
- *To introduce the student to the sensing and measurement devices of electrical origin.*
- *To know the importance and working of diagnostic instruments.*
- *To learn the principle of operation and usefulness of medical imaging devices.*
- *To provide an idea of instruments used for diagnosis, medical assistance & therapeutic equipments.*

UNIT - I ELECTROPHYSIOLOGY [09]

Cell & its structure – Electrical and chemical activities – Action and resting potential – Neurons – Axons – Synapse - CNS – PNS - Propagation of electrical impulses along the nerve – Sodium pump – Cardiopulmonary system – Physiology of heart and lung.

UNIT - II BIO POTENTIAL ELECTRODES AND TRANSDUCERS [09]

Components of biomedical instrument system – Electrodes: Micro electrodes, Needle electrodes, Surface electrodes – Transducers: Piezoelectric, Ultrasonic – Passive transducers: Resistive, Capacitive, Inductive – Isolation amplifier– Pre-amplifier – Current amplifier – Chopper amplifier.

UNIT - III INSTRUMENTS USED FOR DIAGNOSIS [09]

ECG – Einthoven triangle – Leads – Electrodes – Measurement of cardiac output, heart rate and heart beat – EEG – EMG EOG– Blood flow measurements – Holter monitor– Respiratory rate measurement – Oximeter–Blood gas analyzer: pH– pCo_2 – pO_2 of blood – Glucometer.

UNIT - IV MEDICAL IMAGING [09]

Radiographic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of bio telemetry systems – Patient monitoring – Sources of electric hazards and safety techniques.

UNIT - V ASSISTING AND THERAPEUTIC EQUIPMENTS [09]

Pacemaker – Defibrillators – Automated External Defibrillator – Ventilators – Nerve and muscle stimulators – Diathermy – Heart lung machine – Audio meters – Dialysers – Lithotripsy.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Explain the electrophysiological activity of nerves and cardiopulmonary system of the human body.*

CO2: *Illustrate different types of electrodes and transducers used for the biosignal measurement.*

CO3: *Outline the procedure used for the measurement of electrical and non-electrical parameters of the human body.*

CO4: *Explain the working principle and applications of medical imaging systems.*

CO5: *Demonstrate the usage of therapeutic and assisting equipment's in medical applications.*

Text Books :

1. R. S. Khandpur, Hand Book of Biomedical instrumentation, Tata McGraw-Hill, New Delhi, Third Edition, 2014.
2. Mandeep Singh, Introduction to Biomedical Instrumentation, PHI Learning Private Ltd, New Delhi, Second Edition, 2014

Reference Books :

1. R. Anandanatarajan, Biomedical Instrumentation and Measurements, PHI Learning Private Ltd, New Delhi, Second Edition, 2013
2. M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Tamilnadu, Second Edition, 2002
3. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education, New Delhi, Fourth Edition, 2013
4. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, Biomedical Instrumentation and Measurements, PHI Learning Private Ltd, New Delhi, Second Edition, 2014.

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SEMESTER - VII

		L	T	P	C
18EE771	**MICROCONTROLLER BASED SYSTEM DESIGN (Professional Elective - IV)**	3	0	0	3

Prerequisite: *Microprocessors and Microcontroller*

Objectives:

- *To expose the instruction set, addressing modes and interfacing in 8096 microcontroller.*
- *To learn PIC microcontroller and interfacing.*
- *To introduce the functional blocks of ARM processors.*
- *To know the importance and working of ARM organization.*
- *To impart knowledge about ARM processor-7.*

UNIT – I 8096 MICROCONTROLLER AND INTERFACING [09]

CPU operation – Interrupt structure – Timers – High speed input / output ports – I/O control and status registers – Instruction set – Addressing modes -- Serial ports-- External ROM and RAM expansion – PWM control– A/D interfacing.

UNIT – II PIC MICROCONTROLLER AND INTERFACING [09]

Memory organizations – Program memory, Data memory – Addressing modes – Interrupts – I/O ports – Timers – CCP modules – Master synchronous serial port – USART – ADC – I^2 C.

UNIT – III INTRODUCTION TO ARM PROCESSOR [09]

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM assembly language programming–Simple examples–Architectural support for operating systems.

UNIT – IV ARM ORGANIZATION [09]

3-Stage pipeline ARM organization – 5-Stage pipeline ARM organization – ARM instruction execution - ARM implementation– ARM instruction set – ARM coprocessor interface– Architectural support for high level languages – Embedded ARM applications.

UNIT – V ARM PROCESSOR-7 [09]

MSP430 architecture – Addressing modes – Constant generator and Emulsion instructions – Instruction set, Functions – Interrupts low power modes.

Total (L=45 , T=0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: *Illustrate the Instruction set, addressing modes and interfacing of 8096 microcontroller.*
CO2: *Explain the Memory organizations, addressing modes and interfacing of PIC microcontroller.*
CO3: *Interpret the concept of architecture in ARM processor.*
CO4: *Analyze the organization of ARM.*
CO5: *Explain the Architecture of MSP430 Processor.*

Text Books :

1. John B. Peatman, Design with PIC Microcontrollers, Pearson Education, New Delhi, Eighth Edition.2009.
2. Steve Furber, ARM System-on-chip Architecture, Pearson Education, New Delhi, Second Edition, 2009.

Reference Books :

1. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, Microprocessors and Microcontrollers, Oxford University Press, London, Third Edition, 2010.
2. Muhammad Ali Mazidi, Janice Gillipie Mazidi, Microprocessors and Microcontrollers, Pearson Education, New Delhi, Fourth Edition, 2013.
3. Sriram. V.Iyer & Pankaj Gupta, Embedded Real Time Systems Programming, Tata McGraw Hill Publishing Co Ltd., New Delhi, First Edition, 2003.
4. John H. Davies, MSP430 Microcontroller Basics, Newnes publishers, London, First Edition, 2008.

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SEMESTER - VIII

		L	T	P	C
18EE861	**SIMULATION OF POWER ELECTRONIC SYSTEMS (Professional Elective - V)**	3	0	0	3

Prerequisite: *Power Electronics, Power Electronics Laboratory*

Objectives:

- *To know the challenges, process, solution techniques for simulation.*
- *To provide adequate knowledge about PSPICE.*
- *To acquire knowledge about MATLAB/Simulink.*
- *To study the basic concepts of PSIM.*
- *To develop new models in power electronics components using different software.*

UNIT - I INTRODUCTION [09]

Need for simulation - Challenges in simulation - Classification of simulation programs - Overview of PSPICE, MATLAB and SIMULINK - Static and dynamic model of power electronics switches.

UNIT - II PSPICE [09]

File formats - Description of circuit elements - Circuit description - Output variables - Dot commands – SPICE models of Diode, Thyristors, TRIAC, BJT, MOSFET and IGBT.

UNIT - III MATLAB AND SIMULINK [09]

MATLAB – Intro Variables – Matrix representation and operation, Trigonometric functions, Logical relations, Exponential Complex Numbers – m file – function – for loop – while – if else, Graphics- 2D plots. SIMULINK: Basic Block-Sources and Sinks model analysis using SIMULINK – S-functions – converting S-functions to blocks.

UNIT - IV INTRODUCTION TO PSIM [09]

General information – Power circuit components – Control circuit – other components – Analysis specification-Circuit schematic design-waveform processing - Error and warning messages.

UNIT - V SIMULATION USING PSPICE, MATLAB AND SIMULINK [09]

Diode rectifiers-controlled rectifiers - AC voltage controllers - DC choppers - PWM inverters – Voltage source – Current source inverters - Zero current switching and zero voltage switching inverters.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Analyze the mathematical model of power electronic systems.

CO2: Illustrate PSPICE models of power electronics components.

CO3: Analyze the function of MATLAB and SIMULINK.

CO4: Discuss about the function of PSIM.

CO5: Design and Simulate the power electronic system using PSPICE, MATLAB and SIMULINK.

Text Books :

1 M.H.Rashid, SPICE for Power Electronics and Electric Power, CRC Press,United States, Third Edition, 2017.

2 M.B.Patil, V. Ramanarayanan and V.T.Ranganathan, Simulation of Power Electronic Converters, Narosa Publishers, New Delhi, First edition, Reprint 2013.

Reference Books :

1 Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics: Converters, Applications, and Design, John Wiley & Sons, United States,Third Edition, 2009.

2 Agam Kumar Tyagi, MATLAB and SIMULINK for Engineers, Oxford University Press India, New Delhi, First Edition, 2012.

3 Farzin Asadi and Kei Eguchi, Power Electronics Circuit Analysis with PSIM, De Gruyter, Berlin, First Edition, 2021

4 E. Ramshaw and D.C. Schuurman, PSpice Simulation of Power Electronics Circuits, Springer United States, First Edition, 1996.

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SEMESTER - VIII

		L	T	P	C
18EE862	**POWER QUALITY (Professional Elective - V)**	3	0	0	3

Prerequisite: *Power Electronics, Power Systems – I, Power Systems - II*

Objectives:

- *To study the various issues affecting power quality.*
- *To understand the sources and effects of voltage sags and interruptions.*
- *To explore the concepts of transients.*
- *To implicit the awareness of harmonics and to know about devices for controlling harmonic distortion.*
- *To study the various methods of power quality monitoring.*

UNIT - I INTRODUCTION TO POWER QUALITY [09]

Definitions: Power quality, voltage quality – Need for power quality – Power quality issues: short duration voltage variations, long duration voltage variations, voltage imbalance, voltage fluctuations, waveform distortion, transients, power frequency variations – Power Acceptability Curves – Power quality problem evaluation.

UNIT - II VOLTAGE SAGS AND INTERRUPTIONS [09]

.Sources of voltage sags and interruptions – Estimating voltage sag performance – Motor starting sags – Estimating the voltage sag severity – Devices for mitigation of voltage disturbances: Active series compensator, Static VAR compensator, Uninterruptable Power Supply (UPS), Buck-Boost regulators and Static transfer switches and fast transfer switches.

UNIT - III TRANSIENT OVERVOLTAGES [09]

Sources of transient over voltages: Capacitor switching, lightning, Ferro resonance – Principle of overvoltage protection – Mitigation of overvoltage: surge arresters, isolation transformers, low pass filters and low impedance power conditioners – Lightning protection: Shielding, line arresters and cable protection – An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT - IV HARMONICS [09]

Definitions: Harmonics, Harmonics indices, Harmonic Distortion Factor (HDF), Total Harmonic Distortion (THD), Inter harmonics, Notching – Voltage Vs Current distortion – Sources and effects of harmonic distortion – Power system response characteristics – Devices for controlling harmonic distortion: Passive and active filters – Computer tools for harmonic analysis – IEEE 5192-555 Standards for Harmonics.

UNIT - V POWER QUALITY MONITORING [09]

Need for power quality monitoring – Monitoring considerations – Power quality measurement equipment – Assessment of power quality data – Applications of expert system in power quality monitoring – Standards on power quality monitoring.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Distinguish between the various categories of power quality problems, root of the power quality problems in industry and their impacts.

CO2: Explore the sources and effects of voltage sags, interruptions and solution techniques for power quality mitigation.

CO3: Illustrate the concepts of transients and its controlling overvoltage techniques.

CO4: Explain the concepts of harmonics and to know about devices for controlling harmonic distortion.

CO5: Discuss the various methods and applications of expert systems in power quality monitoring.

Text Books :

1 Roger C.Dugan, Mark F.McGranaghan and H.Wayne Beaty, Electrical Power Systems Quality, McGraw-Hill, New York, Third Edition, 2012.

2 Math H.J.Bollen, Understanding Power Quality Problems: Voltage Sags and Interruptions, IEEE Press, New York, First Edition, 2000.

Reference Books :

1 Barry W.Kennedy, Power Quality Primer, McGraw-Hill, New York, First Edition, 2000.

2 Sankaran.C, Power Quality, CRC Press, New Delhi, First Edition, 2002.

3 Arrillaga.J, Watson.N.R and Chen.S, Power System Quality Assessment, John Wiley & Sons Ltd., England, First Edition, 2000.

4 Arindam Ghos and Gerard Ledwich, Power Quality Enhancement using Custom Power Devices, Springer (India) Pvt. Limited, Second Edition, 2009.

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SEMESTER - VIII

		L	T	P	C
18EE863	**ELECTRIC POWER UTILIZATION AND CONSERVATION (Professional Elective - V)**	3	0	0	3

Prerequisite:

Objectives:

- *To learn and understand the principle and design of illumination systems.*
- *To study the methods of heating and welding.*
- *To understand the operation of electric traction systems.*
- *To impart knowledge on electrolytic process and storage of electricity.*
- *To understand the electrical energy conservation and power quality.*

UNIT - I ILLUMINATION [09]

Nature of radiation – Definition – Laws of illumination – Photometry – Lighting calculations – Design of lighting scheme for residential, industrial, commercial and street lightings – Types of lamps – Energy efficient lamps

UNIT - II ELECTRIC HEATING AND WELDING [09]

Advantages of electric heating – Modes of heat transfer – Requirement of heating material –Design of heating element – Heating methods: Resistance heating, Induction heating, Dielectric heating – Electric arc furnaces – Introduction to electric welding – Types of electric welding – Welding generator – Welding transformer and its characteristics.

UNIT - III ELECTRIC TRACTION [09]

Introduction – Requirements of an ideal traction system – Supply systems – Mechanics of train movement – Tractive effort – Traction motors and control – Braking methods – Current collection systems – Recent trends in electric traction.

UNIT - IV ELECTROLYTIC PROCESS AND STORAGE OF ELECTRICITY [09]

Electrolysis – Faraday's law of electrolysis – Polarization factor – Electroplating – Method of charging and maintenance – Nickel–iron,Nickel–Cadmium and Lithium–iron batteries – Components and materials – Capacity rating of batteries – Battery chargers.

UNIT - V ENERGY CONSERVATION [09]

Introduction, Motivation for Energy Conservation, Principles of Energy Conservation, Energy Conservation Planning, Energy Conservation in Industries, Electrical Energy Conservation in Small Scale Industries, Energy Conservation in Electrical Generation, Transmission and Distribution, Energy Conservation in Household and Commercial Sectors, Energy Conservation in Transport, Energy Conservation in Agriculture, Energy Conservation Legislation.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Illustrate the fundamentals of illumination systems, various types of lamps and design of lighting scheme.
CO2: Describe the various types of heating and welding.
CO3: Discuss the operation of electric traction systems.
CO4: Elucidate the fundamentals of electrolytic process and illustrate the various types of batteries.
CO5: Explain the electrical energy conservation and energy management.

Text Books :

1 G.C.Garg, Utilization of Electric Power and Electric Traction, Khanna Publishers, Delhi, First Edition,2019.
2 J.B. Gupta, Utilization of Electric Power and Electric Traction, S.K. Kataria and Sons, New Delhi,Tenth Edition, 2012.

Reference Books :

1 E.Openshaw Taylor, Utilization of Electrical Energy in SI Units, Orient Longman Private Limited, Hyderabed, First Edition, 2003.
2 B.R.Gupta, Generation of Electrical Energy, Eurasia Publishing House Private Limited, New Delhi, Seventh Edition, 2017.
3 P.S.Dhogal, Basic Electrical Engineering, Tata Mc–Graw Hill Publishing Company Limited, New Delhi, Volume 1, 35th Reprint, 2008.
4 G.D.Rai, Non–Conventional Energy Sources, Khanna Publishers, Delhi, First Edition, 2011.

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SEMESTER - VIII

		L	T	P	C
18EE864	**COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS (Professional Elective - V)**	3	0	0	3

Prerequisite: *Electrical Machines I and Electrical machines II*

Objectives:

- *To introduce the importance of computer aided design methods.*
- *To provide basic electromagnetic field equations and the problem formulation for CAD applications.*
- *To get familiarized with the Finite Element Method as applicable for Electrical Engineering.*
- *To introduce the organization of a typical CAD package.*
- *To introduce the Finite Element Method for the design of different Electrical apparatus.*

UNIT - I INTRODUCTION [09]

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT - II MATHEMATICAL FORMULATION OF FIELD PROBLEMS [09]

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance – Inductance – Laplace and Poisson‘s Equations – Energy functional.

UNIT - III PHILOSOPHY OF FEM [09]

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT - IV CAD PACKAGES [09]

Elements of a CAD System – Pre-processing – Modeling – Meshing – Material properties – Boundary Conditions – Setting up solution – Post processing.

UNIT - V DESIGN APPLICATIONS [09]

Voltage Stress in Insulators – Capacitance calculation – Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Summarize the basic principles of design procedure.
CO2: Develop the basic mathematical formulation techniques of CAD.
CO3: Illustrate the concept of FEM for designing electrical apparatus.
CO4: Implement any design functions using CAD.
CO5: Formulate and solve the optimum design problems with computers.

Text Books :

1 S.J Salon, Finite Element Analysis of Electrical Machines, Springer, Yes DEE publishers, Chennai, Third Edition, 2007.

2 V.K. Maurya, Ritu Raj Jallan, Shasya Shukla, Computer Aided Design of Electrical Machines, S.K. Kataria & Sons, New Delhi, Second Edition, 2021.

Reference Books :

1 K.M.Vishnu, Computer Aided Design of Electrical Machines, B.S. Publications, Hyderabad, Second Edition, 2015.

2 A.K.Sawhney A Course in Electrical Machine Design, Dhanpat Rai and sons, New Delhi, Fifth Edition, 2004.

3 J.N.Reddy, An Introduction to the Finite Element Method, McGrawHill International Editions, New York, Third Illustrated Edition, 2006.

4 Joao Pedro, A. Bastos and Nelson Sadowski, Electromagnetic Modeling by Finite Element Methods, Marcell Dekker Inc., New York, Fifth Edition, 2003.

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SEMESTER - VIII

		L	T	P	C
18EE865	**DIGITAL IMAGE PROCESSING (Professional Elective - V)**	3	0	0	3

Prerequisite: Digital Signal Processing

Objectives:

- *To study the image fundamentals and mathematical preliminaries necessary for image processing.*
- *To impart knowledge on image enhancement techniques.*
- *To get familiarized with the concept of* Image restoration *procedures.*
- *To expose the students to the various image segmentation and recognition methods.*
- *To study the methods of compression.*

UNIT - I DIGITAL IMAGE FUNDAMENTALS [09]

Introduction; Elements of digital image processing systems; Elements of visual perception - brightness, contrast, hue, saturation; Color image fundamentals - Color models, Mach Band effect, Image sampling and Quantization; Dither

UNIT - II IMAGE ENHANCEMENT [09]

Basic Gray Level Transformations; Histogram equalization and specification; Spatial averaging- Smoothing filters, Sharpening filters; Median; Geometric mean; Harmonic mean; Contra harmonic mean filter; Homomorphic filtering; Application to medical images.

UNIT - III IMAGE RESTORATION [09]

Image restoration - degradation model; Noise models; Unconstrained and Constrained restoration; Inverse filtering; Wiener filtering; Geometric transformations; Spatial transformations; Gray Level interpolation; Application to medical images.

UNIT - IV IMAGE SEGMENTATION AND RECOGNITION [09]

Image segmentation – Line and Edge detection; Edge linking and boundary detection; Region growing; Region splitting and Merging; Image Recognition; Patterns and pattern classes; Matching by minimum distance classifier; Matching by correlation.

UNIT - V IMAGE COMPRESSION [09]

Need for data compression; Redundancy; Huffman; Arithmetic coding; Run Length Encoding; Shift codes; Vector Quantization; Transform coding; JPEG, MPEG and GIF standards.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the basic concepts of image signal, sampling and quantization.
CO2: Discuss the effect of quality enhancement techniques on images.
CO3: Illustrate the methodology of image restoration algorithms.
CO4: Describe the procedure of image segmentation and recognition methods to digital images.
CO5: Apply image compression algorithms to digital Images.

Text Books :

1 Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson India Education Services Pvt. Ltd., India, Fourth Edition, 2017.
2 Anil K. Jain, Fundamentals of Digital Image Processing, Pearson India Education Services Pvt. Ltd., India, First Edition, 2015

Reference Books :

1 S. Jayaraman, S. Esakkirajan, T.Veerakumar, Digital Image Processing, Tata McGraw Hill, Noida, India, Third Edition, 2009.
2 Malay K.Pakhira, Digital Image Processing and Pattern Recognition, PHI Learning Private Limited, New Delhi, First Edition, 2015.
3 David Salomon, Data Compression – The Complete Reference, Springer Verlang, New York, Fourth Edition, 2006.
4 C. Rafael Gonzalez, E. Richard Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson India Education Services Pvt. Ltd., India Third Edition, 2010.

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SEMESTER - VIII

		L	T	P	C
18EE866	**BATTERIES AND CHARGING MANAGEMENT SYSTEMS (Professional Elective - VI)**	3	0	0	3

Prerequisite: *Engineering Chemistry, Electric Circuit Analysis*

Objectives:

- *To introduce learner about batteries and its parameters.*
- *To infer knowledge on operational factors of battery technology.*
- *To acquire the knowledge on lead acid batteries.*
- *To understand the battery management system and life prediction of batteries.*
- *To gain knowledge on traction batteries and miscellaneous applications of batteries.*

UNIT - I INTRODUCTION TO BATTERIES [09]

Types of Batteries - Energy conversion in batteries - Battery components - Principle of operation - Electrode selection - Calculating battery cell voltage - Battery cell voltage and Nernst equation - Electrolyte for batteries - Gibbs free energy and battery voltage - Theoretical battery capacity - Practical energy of a battery - Specific energy and power - Battery testing.

UNIT - II OPERATIONAL FACTORS OF BATTERY SYSTEMS [09]

Performance parameters - Battery voltage -Secondary battery systems - Battery limiting factors - Battery current modes of discharge - Discharge current effect on voltage - Discharge current effect on capacity - The effect of temperature on battery performance - Self discharge - Calendar and Cycle Life - Internal resistance - safety - Battery selection.

UNIT - III LEAD ACID BATTERIES [09]

Introduction - Principle of operation-Types of lead acid batteries - Cell components and fabrication - Failure modes - Charge process - Discharge process – Electrolyte - State of charge - Capacity - Cycle life – Self discharge.
Applications:Telecommunications and UPS, solar and wind energy storage.

UNIT - IV BATTERY MANAGEMENT AND LIFE PREDICTION [09]

Definitions: Battery management and battery life prediction - Monitoring & measuring - Battery management functions: Charge management, discharge management, safety management and smart battery system - Life Prediction.

UNIT - V TRACTION BATTERIES [09]

Introduction to electric vehicles and hybrid electric vehicles - Battery technology for traction: Lead Acid , Nickel Cadmium, Nickel Metal Hydride, Lithium Ion, Lithium Polymer Batteries, Sodium Nickel Chloride Battery.
Miscellaneous applications of batteries: Tracking Systems, Toll Collection, Oil Drilling, Car Accessories, Oceanography.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Calculate the various parameters of battery and battery pack.
CO2: Interpret the operational factors associated with battery systems.
CO3: Formulate the design procedure for lead acid batteries.
CO4: Identify the requirements of Battery Management System.
CO5: Familiarize different kinds of traction batteries.

Text Books :

1 Davide Andrea , Battery Management Systems for Large Lithium-Ion Battery Packs, Artech House Publishers, London, First edition,2010.
2 M. Broussely, G. Pistoia, Industrial Applications of Batteries From Cars to Aerospace and Energy Storage, Elsevier Publishers, The Netherlands, First edition , 2007.

Reference Books :

1 Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich, Electrochemical power sources: batteries, fuel cells, and super capacitors, John Wiley & Sons, Inc., Hoboken, New Jersey, First edition, 2015.
2 Slobodan Petrovic, Battery Technology Crash Course A Concise Introduction, Springer Nature Switzerland AG, First edition, 2021.
3 Kiehne, H.A. Battery Technology Handbook, Dekker Publishers, New york, Second Revised Edition, 2007.
4 Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, Kindle edition, 2015.

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SEMESTER - VIII

		L	T	P	C
18EE867	**VIRTUAL INSTRUMENTATION (Professional Elective - VI)**	3	0	0	3

Prerequisite:

Objectives:

- *To understand the virtual instrumentation basics and to realize the architecture of VI.*
- *To familiarize with the VI software and learn programming in VI.*
- *To study various data acquisition methods.*
- *To familiarize the distinct interfacing instruments of VI.*
- *To understand various analysis tools of LabVIEW.*

UNIT - I INTRODUCTION TO VIRTUAL INSTRUMENTATION [09]

History of VI – Block diagram and architecture of VI – Conventional and graphical programming – LabVIEW environment: Front panel, controls, block diagram, subVIs – Data types – Data flow program – Introduction to modular programming.

UNIT - II PROGRAMMING TECHNIQUES [09]

Repetition and loops: for and while loops – Arrays – Strings – Clusters – Case and sequence structure – Graph and charts – File I/O – Simple arithmetic programs.

UNIT - III INTRODUCTION TO DATA ACQUISITION BASICS [09]

Classification of signals – DAQ hardware configuration – DAQ software architecture – Counters and timers – Interfacing with assistant: DAQ assistant – Analysis assistant – Instrument assistant.

UNIT - IV INTERFACING INSTRUMENTS [09]

RS232 Vs GPIB – Handshaking – GPIB interfacing – RS232 / RS 485 interfacing – VISA – IMAQ vision: Vision basics and analysis – Motion control: Motion controller – Move types – Motion components.

UNIT - V ANALYSIS TOOLS AND APPLICATION OF VI [09]

Fourier transform – FFT – Power spectrum – Correlation methods – Windows and filtering –Development of control system – Industrial communication – Process control applications – LabVIEW FPGA: Introduction – Application development.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Outline the block diagram and architecture of virtual instrumentation.
CO2: Demonstrate the different programming techniques and VI software.
CO3: Explain the various data acquisition methods used in the VI.
CO4: Recall the distinct interfacing instruments of VI and its applications.
CO5: Summarize the tools and applications of the VI.

Text Books :

1 Gary Jonson, LabVIEW Graphical Programming, Tata McGraw Hill, New Delhi, Fourth Edition, 2011.

2 Sanjay Gupta, Joseph John, Virtual Instrumentation using LabVIEW–Principles and Practices of Graphical Programming, TMH, Second Edition, 2010.

Reference Books :

1 Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI publication, Fourth Edition, 2013.

2 John Essick, Hands–on Introduction to LabVIEW for Scientists and Engineers, Oxford university press, Second Edition, 2013.

3 Jeffrey Travis, Jim Kring, LabVIEW for Everyone, Pearson Publication, Third Edition, 2009.

4 Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, LabView: Advanced Programming Techniques, CRC Press, Second Edition, 2007.

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SEMESTER - VIII

		L	T	P	C
18EE868	**ELECTRONIC INSTRUMENTATION (Professional Elective - VI)**	3	0	0	3

Prerequisite: *Electric Circuit Analysis, Analog Electronics, Measurements and Instrumentation*

Objectives:

- *To introduce different types of electronic meters and their applications.*
- *To educate on various Digital instruments and its applications.*
- *To provide knowledge on various types of cathode ray oscilloscopes and signal analyzers.*
- *To impart knowledge about different types of waveform generators.*
- *To give exposure to telemetry, modulation techniques and multiplexing.*

UNIT - I ELECTRONIC INSTRUMENTS [9]

Introduction – Functional elements of a measurement system – Electronic Voltmeter and their advantages – Types: Differential amplifier, rectifier, multirange – True RMS voltmeter – Ohmmeter – Electronic multimeter – Current measurement – Power measurement – Microprocessor based DMM with auto ranging and self-diagnostic features.

UNIT - II DIGITAL INSTRUMENTS [9]

Digital Voltmeter, Types: Ramp, Integrating and Dual slope – Digital Multimeter – Digital Frequency meter – Digital Time Measurement – Digital Tachometer and pH meter – Automation in digital instruments – Microprocessor based instruments.

UNIT - III CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS [9]

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

UNIT - IV WAVEFORM GENERATORS [9]

Wien's bridge and phase shift oscillators – Hartley and crystal oscillators – Square wave and pulse generators – Triangular wave-shape generator – Signal and function generators – Q meter – Electronic Counters.

UNIT - V TELEMETRY [9]

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing.

Total (L=45, T= 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain different types of electronic meters and their applications.

CO2: Describe various Digital instruments and its applications.

CO3: Explain the working of various types of cathode ray oscilloscopes and signal analyzers.

CO4: Discuss the functional operation of different types of waveform generators.

CO5: Outline the principle of telemetry, modulation techniques and multiplexing.

Text Books :

1 Kalsi, H.S., Electronic Instrumentation, Tata McGraw-Hill, New Delhi, Second Edition, 2019.

2 Helfrick, A.D. and Cooper,W.D., Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India Private Ltd., New Delhi, First Edition, 2013.

Reference Books :

1 David A Bell, Electronic Instrumentation and Measurements, Oxford University Press, London,Third Edition, 2013.

2 Prithiwiraj Prukait, Budhaditya Biswas, Santanu Das and Chiranjib Koley, Electrical and Electronics Measurement and Instrumentation, Tata McGraw Hill, New Delhi, First Edition, 2013.

3 J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, Third Edition, 2011.

4 Sawhney, A.K., Electrical, Electronic measurement & Instrumentation, Dhanpat Rai & sons, New Delhi, Eighteenth edition, 2012.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

SEMESTER - VIII

		L	T	P	C
18EE869	**ROBOTICS ENGINEERING (Professional Elective - VI)**	3	0	0	3

Prerequisite: *Engineering Mathematics-I, Engineering Physics*

Objectives:

- *To impact a knowledge of robots and their types.*
- *To learn in detail the power sources, sensors, actuators.*
- *To learn the types of manipulators and grippers.*
- *To Involved with robots kinematics and work practices.*
- *To create more knowledge on robotics applications.*

UNIT - I INTRODUCTION [09]

Definition - Robotics and Automation, Origin of Robotics, Historical Development – Basic structure of Robots - Complete Classification of Robots - Fundamentals about Robot Technology - Asimov's laws of Robotics - Dynamic Stabilization of Robotics - Basic Robot Configurations and their Relative Merits and Demerits.

UNIT - II POWER SOURCES AND SENSORS [09]

Types of Drive Systems - Hydraulic, Pneumatic and Electric Drives Block Diagram Approach -Determination of HP of Motor and Gearing Ratio - Variable Speed Arrangements – Path Determination - Micro Machines in Robotics - Machine Vision - Ranging, Laser, Acoustic, Magnetic, Fiber Optic, Tactile and Intelligent Sensors Definition and Use.

UNIT - III MANIPULATORS AND GRIPPERS [09]

General Description of Robot Manipulator - Construction of Manipulators - Manipulator Motions -Manipulator Dynamics and Force Control - Electronics and Pneumatic Manipulator Control Circuits - End Effectors - Mechanism of Gripping - U Various Types of Grippers – Design Considerations.

UNIT - IV KINEMATICS AND PATH PLANNING [09]

Robot kinematics - Kinematic Equations, Forward and Inverse Kinematics - Solution of Inverse Kinematics Problem - Multiple Solution Jacobian Work Envelope - Hill Climbing Techniques - Robot Programming Languages.

UNIT - V APPLICATIONS [09]

Selection of Robot - Robot Applications in Industry - Design a Modern Robot for Manufacturing and Non-Manufacturing Industry - Robot Cell Design - Future Applications and Challenges, Case study.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the robot technology as their fundamental principles, laws and robot configurations.
CO2: Illustrate the various drive systems, power sources and the concepts of sensors to control the robots.
CO3: Outline the design configurations of manipulators, grippers and end effector mechanism in robots.
CO4: Outline the robot kinematics, programming language and the concepts of path planning for robotics.
CO5: Interpret the wide range of robotic application of manufacturing and non-manufacturing sector.

Text Books :

1 Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, Industrial Robotics: Technology, Programming and Applications, Tata McGraw Hill, New Delhi, Second Edition, 2012.

2 Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, First Edition, 1999.

Reference Books :

1 Deb S.R., Robotics Technology and Felxible Automation, John Wiley, USA, Second Edition, 2017.

2 Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering - An Integrated Approach, Prentice Hall of India, New Delhi, First Edition, 2006.

3 Asfahl C.R., Robotics and Manufacturing Automation, John Wiley, USA, Second Edition, 1992.

4 Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, PHI, Second Edition, 2011.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

SEMESTER - VIII

		L	T	P	C
18EE871	**DESIGN AND INSTALLATION OF SOLAR AND WIND POWER CONVERSION SYSTEM (Professional Elective - VI)**	3	0	0	3

Prerequisite: *Power Plant Engineering, Power Electronics and Renewable Energy Systems*

Objectives:

- To know the operation of distinct PV-Thermal energy systems.
- To know the design and installation of Solar-Wind hybrid power generation system.
- To understand the concept, design and implementation of building integrated PV systems.
- To study the concept and integration of solar system with the grid.
- To gain the knowledge on design of floating PV energy systems and Canal PV Systems.

UNIT - I PV-THERMAL ENERGY SYSTEMS [09]

PV-Thermal air heating: PV Integrated with air collector, Double-pass PV-Thermal solar air collector, PV-Thermal water heating: temperature-dependent PV module performance, PV module efficiency and output power as a function of the operating temperature, Overall Thermal and Electrical Efficiency, Market potential of PV-Thermal systems

UNIT - II SOLAR WIND POWER GENERATION SYSTEMS [09]

Introduction and need of solar-wind conversion systems, Concept, design and installation of Solar-Wind hybrid systems, Electrical output of the hybrid system, site and resources assessment for the installation of Solar-Wind energy systems, Interaction of grid with solar-wind power generation systems, limitation of the Solar-Wind generation: cost, technology and environmental issues. Economics and market scenario of these systems.

UNIT - III BUILDING INTEGRATED PV (BIPV) SYSTEMS [09]

Concept, design and Implementation of BIPV systems, Classification of BIPV system and their application, Cell and module design for BIPV systems, Rooftop and Facade based systems, Different parameters of building integrated PV systems, Electrical and thermal analysis, International standards and test conditions, Total energy generation, Performance Issues and limitations of BIPV, Life cycle assessment studies of BIPV modules current scenario and market trend.

UNIT - IV GRID INTEGRATION OF SOLAR SYSTEM [09]

Grid and solar power generation, Integration of solar thermal and photovoltaic systems, Matching of voltage, phase and frequency, smart grid technology and challenges, Grid power control and power management, type of electrical power grids, Impact of smart grid on solar power generation.

UNIT - V ADVANCED DESIGNED POWER SYSTEMS [09]

Floating PV energy systems: Concept and commercial designs of Floating Solar System, Economical analysis, Comparison between floating V_s land based PV systems, Environmental impacts, Challenges or Issues of floating PV system, Canal top solar PV systems: concept, design and installation criteria, Effect of water evaporation rate, Environmental issues and limitations, techno-economic feasibility studies of these systems.

Total (L= 45, T = 0) = 45 Periods

Course Outcomes : On Completion of this course, the student will be able to

CO1: Explain the operation of different types of PV-Thermal energy systems.
CO2: Discuss the design and installation of Solar-Wind hybrid power generation system.
CO3: Describe the concept, design and Implementation of building integrated PV systems.
CO4: Explain the procedure to be followed for the integration of solar system with the grid.
CO5: Describe the floating PV energy system and Canal top solar PV systems.

Text Books :

1 Gevorkian, P., Grid-connected photovoltaic power generation, Cambridge University Press, United Kingdom, First Edition, 2017.
2 Prasad, D. and Snow, M., Designing with solar power: a source book for building integrated photovoltaics (BiPV), Routledge, London, First Edition, 2014.

Reference Books :

1 Khartchenko, N.V. and Kharchenko, V. M., Advanced Energy Systems, CRC Press, New York, Second Edition, 2013.
2 Mukund R. Patel, Beik, O., Wind and Solar Power Systems: Design, Analysis and Operation, CRC Press, New York,Third Edition, 2021.
3 Russell, C. T. and Vaisberg, O., The interaction of the solar wind with Venus, Priroda, pp. 873-940, 1983.
4 Kalogirou, S. A. (2001). Use of TRNSYS for modelling and simulation of a hybrid PV–thermal solar system for Cyprus, Renewable Energy, Vol. 23, Issue 2, pp. 247-260, 2001.

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		L	T	P	C
18AU769	**INTELLIGENT VEHICLES TECHNOLOGY**				
	(Open Elective)	3	0	0	3

Prerequisite: *NIL*

Objectives:

- *To become familiar with various driver assistance systems.*
- *To comprehend the telematics in automotive systems.*
- *To recognize the automotive safety and security systems.*
- *To study about the comfort systems.*
- *To acquire the knowledge in various adaptive control systems.*

UNIT – I DRIVER ASSISTANCE SYSYTEMS [9]

Introduction, driver support systems – driver information, driver perception, driver convenience, driver monitoring. Vehicle support systems – general vehicle control, vehicle status monitoring and automated highway systems.

UNIT – II TELEMATICS [9]

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition and application of Internet of Things (IoT) in automotive industry.

UNIT – III SAFETY SYSTEMS & SECURITY SYSTEMS [9]

Airbags, seat belt tightening system, collision avoidance and warning systems, child lock, antilock braking systems. Anti-theft technologies, smart card system and number plate coding.

UNIT – IV COMFORT SYSTEMS [9]

Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tiltable steering column and power windows.

UNIT – V ADAPTIVE CONTROL SYSTEMS [9]

Adaptive cruise control, adaptive noise control, anti-spin regulation, traction control systems and cylinder cut- off technology and autonomous driving.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

C01: Identify the various systems involved in driver support systems and their working principle.

C02: Familiarize with global positioning systems, geographical information systems and navigation systems.

C03: Comprehend the constructional and working features of safety systems and security systems

C04: Recognize about the various comfort systems.

C05: Acquire about the various adaptive control systems.

Text Book :

1 Ljubo Vlacic, Michel Parent and Fumio Harashima, Intelligent Vehicle Technologies, Butterworth-Heinemann publications, Oxford, 2001.

2 Ronald K Jurgen, Navigation and Intelligent Transportation Systems – Progress in Technology, Automotive Electronics Series, SAE, USA, 1998.

Reference Books :

1 Richard Bishop, Intelligent Vehicle Technology and Trends, Artech House, London, 2005.

2 William B Riddens, Understanding Automotive Electronics, Butterworth-Heinemann, Woburn, Eighth Edition, 2017.

3 Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Ninth Edition, 2014.

4 Bechhold, Understanding Automotive Electronics, SAE, 1998.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18AU415	**AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS**				
	(Open Elective)	3	0	0	3

Prerequisite: Basics of Electrical and Electronics Engineering

Objective:

- *To be familiar with the fundamentals, operating principles of batteries.*
- *To illustrate the functionality of stator motor and charging systems.*
- *To comprehend the concepts of ignition systems*
- *To acquire the knowledge about wiring, lighting and fuel supply systems.*
- *To demonstrate the instruments and sensors used in vehicles.*

UNIT – I TYPES OF BATTERIES [9]

Principle and construction of lead acid battery, Nickel-Cadmium battery, Lithium ion battery, Nickel metal hydride battery, Sodium sulphur battery and Aluminium air battery. Characteristics of battery, battery rating, capacity and efficiency, various tests on battery, Battery – charging techniques, maintenance of batteries.

UNIT – II ELECTRICAL COMPONENTS [9]

Requirements of starter motor, starter motor types, construction and characteristics, starter drive mechanisms, starter switches and solenoids, charging system components, Integrated alternator-starter. Generators and alternators - types, construction and characteristics, voltage and current regulation, charging circuits.

UNIT – III IGNITION SYSTEMS [9]

Components and working of battery coil and magneto–ignition system, electronic ignition system, capacitive discharge ignition system, distributor less ignition system, digital ignition system, direct ignition system, ignition triggering devices, centrifugal and vacuum advance mechanisms. Spark plug – Construction, working and types.

UNIT – IV WIRING, LIGHTING AND FUEL SUPPLY SYSTEMS [9]

Automotive wiring, insulated and earth return system, negative earth systems, head lamp and Indicator lamp details, anti-dazzling and dipper details, electrical feed pump, electronic fuel injection systems.

UNIT – V INSTRUMENTS AND SENSORS [9]

Theory and constructional details of dash board instruments and their sensors like Speedometer, odometer, fuel level Indicator, oil pressure and coolant temperature indicators, horns and wiper mechanisms. Introduction to modern driver information systems. Types of sensors – oxygen sensor, hotwire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

C01: Demonstrate the working principle, charging techniques and maintenance of batteries.
C02: Explain about the various basic electrical components of vehicles.
C03: Describe the various ignition systems used in the vehicles.
C04: Illustrate the different wiring, lighting and fuel supply systems.
C05: Identify instruments and sensors for various applications in vehicle control systems.

Text Book :

1 Young, A.P. and Griffith, S.L., Automobile Electrical Equipment, ELBS and New Press, London 1999.
2 Kholi .P.L., Automotive Electrical Equipment, Tata McGraw-Hill Company ltd, New Delhi, First Edition, 2004.

Reference Books :

1 Crouse W.H., Automobile Electrical Equipment, Tata McGraw Hill Education, NewYork, 2010.
2 Judge A.W, Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 2004.
3 Robert Bosch, Automotive Handbook, Bently Publishers, Cambridge, Ninth Edition, 2014.
4 Tom Denton, Automotive Electrical and Electronic Systems, Routledge, India, Fifth Edition, 2017.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18CE091	**BASIC CIVIL AND MECHANICAL ENGINEERING (Open Elective)**	3	0	0	3

Prerequisite: *Nil*

Objective(s):

- *To introduce surveying and civil engineering materials.*
- *To illustrate building components and structures.*
- *To describe the various types of power plants and its working principles.*
- *To provide knowledge on types of IC Engines and its working principles.*
- *To illustrate refrigeration and air conditioning systems.*

UNIT - I SURVEYING AND CIVIL ENGINEERING MATERIALS [9]

Surveying: Objects – Types – Classification – Principles – Measurements of Distances – Angles – Levelling – Determination of Areas – Illustrative Examples.
Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel Sections.

UNIT - II BUILDING COMPONENTS AND STRUCTURES [9]

Foundations: Types, Bearing Capacity – Requirement of Good Foundations- Superstructure – Types of Bridges and Dams - Brick Masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering – Mechanics – Internal and External Forces – Stress – Strain – Elasticity.

UNIT - III POWER PLANT ENGINEERING [9]

Introduction, classification of power plants – working principles of steam, Gas, Diesel, Hydro-electric and Nuclear power plants – merits and demerits- pumps and Turbines – working principles of Reciprocating pumps (single acting and double acting) – Centrifugal pump.

UNIT - IV IC ENGINES [9]

Internal combustion engine as automobile power plant – working principle of Petrol and Diesel Engines – Four stroke and Two stroke cycles – comparison of four stroke and two stroke engines.

UNIT - V REFRIGERATION AND AIR CONDITIONING SYSTEM [9]

Terminology of Refrigeration and Air Conditioning, principle of vapour compression and absorption system – layout of typical domestic, refrigerator – Window and Split type room Air Conditioner.

Total (L: 45 T: 0) = 45Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: *Calculate the areas, volumes and relative positions of the object and to gain knowledge about the various materials used in construction.*

CO2: *Describe construction practices and the components of the structures.*

CO3: *Identify the working principle of various types of power plants, pumps and turbines.*

CO4: *Summarize the various classification and terminologies of engines, such as two stroke and four stroke petrol and diesel engines.*

CO5: *Demonstrate refrigeration process and also the working principle of various types of Air Conditioners.*

Text Books :

1 Ramesh Babu V., Basic Civil and Mechanical Engineering, VRB Publishers, Chennai, First Edition, 2017.

2 Shanmugam G and Palanichamy M S., Basic Civil and Mechanical Engineering, Mc Graw Hill Education Private Ltd, First Edition, Chennai, 2018.

Reference Books :

1 Ramamrutham S., Basic Civil Engineering, Dhanpatrai Publishing Co.(P) Ltd., New Delhi, Third Edition, 2013.

2 Venugopal K and Prahu Raja V., Basic Mechanical Engineering, Nibras Publishers, First Edition, Chennai, 2018.

3 Shantha Kumar S.R.J., Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai, First Edition, 2016.

4 https://nptel.ac.in/courses/105/102/105102088/

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18CE313	**FLUID MECHANICS (Open Elective)**	3	0	0	3

Prerequisite: -

Objective(s):

- *To describe fluid properties and behavior under various conditions.*
- *To imbibe basic laws and equations used for analysis of static and dynamic fluids.*
- *To inculcate the importance of fluid flow measurement and determine the losses in a flow system, flow through pipes*
- *To explain boundary layer concept.*
- *To do model studies and similitude distorted models.*

UNIT – I FLUID PROPERTIES AND FLUID STATICS [9]

Fluid – Definition, Distinction between Solid and Fluid – Units and Dimensions – Properties of Fluids – Density, Specific Weight, Specific Volume, Specific Gravity, Temperature, Viscosity, Compressibility, Vapour Pressure, Capillarity and Surface Tension – Fluid Statics: Concept of Fluid Static Pressure, Absolute and Gauge Pressure – Pressure Measurements by Manometers and Pressure Gauges – Forces on Planes – Centre of Pressure – Buoyancy and Floatation.

UNIT – II FLUID KINEMATICS AND DYNAMICS [9]

Fluid Kinematics – Flow Visualization – Lines of Flow – Type of Flow - Velocity Field and Acceleration – Continuity Equation (1,2 & 3D forms) – Equation of Streamline – Stream Function – Velocity Potential Function – Circulation – Flow Net. Fluid Dynamics – Equations of Motion – Euler's Equation along a Streamline – Bernoulli's Equation – Application – Venturi Meter, Orifice Meter and Pitot Tube. Linear Momentum Equation and its Application.

UNIT – III FLOW THROUGH PIPES [9]

Viscous Flow – Shear Stress, Pressure Gradient Relationship – Laminar Flow between Parallel Plates – Laminar Flow Through Circular Tubes (Hagen Poiseuille's) – Hydraulic and Energy Gradient – Flow Through Pipes – Darcy – Weisbach's Equation – Pipe Roughness – Friction Factor – Moody's Diagram – Major and Minor Losses of Flow in Pipes – Pipes in Series and in Parallel.

UNIT – IV BOUNDARY LAYER [9]

Boundary Layer – Definition – Boundary Layer on a Flat Plate - Thickness and Classification – Displacement, Energy and Momentum Thickness – Boundary Layer Separation and Control - Drag in Flat Plate – Drag and Lift Coefficients.

UNIT – V DIMENSIONAL ANALYSIS AND MODEL STUDIES [9]

Fundamental Dimensions – Dimensional Homogeneity – Rayleigh's Method and Buckingham Pi -Theorem – Dimensionless Parameters – Similitude and Model studies – Distorted Models.

Total (L: 45 T: 0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: *Solve problems involving fluid properties.*
CO2: *Derive and apply general governing equations for various fluid flows.*
CO3: *Determine velocity and fluid flow rates, major and minor losses in pipe flow.*
CO4: *Analyse the concept of boundary layer theory and flow separation.*
CO5: *Analyse the model and its prototype.*

Text Books :

1 Bansal, R.K., A Textbook of Fluid Mechanics and Hydraulics Machines, Laxmi Publications Pvt. Ltd., New Delhi, Tenth Edition, 2018.
2 Modi, P.N and Seth, S.M., Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, Twenty First Edition, 2017.

Reference Books :

1 Yunus, A.C., Fluid Mechanics, McGraw Hill Education India Private Limited, Bengaluru, Eighth Edition, 2018.
2 Subramanya, K., Fluid Mechanics and Hydraulic Machines, McGraw Hill Education, India Private Limited, New Delhi, First Edition, 2018.
3 White, F.M., Fluid Mechanics, McGraw Hill Education India Private Limited, New Delhi, Eighth Edition, 2017.
4 https://nptel.ac.in/courses/112/104/112104118/

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

18CE867	MUNICIPAL WASTE AND MANAGEMENT (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: *Environmental Engineering II*

Objective(s):

- *To provide comprehensive overview of municipal waste and management.*
- *To learn about on-site storage and processing of solid waste.*
- *To provide knowledge on collection and transportation of waste.*
- *To impart knowledge about the processing of municipal solid waste.*
- *To impart knowledge about safe disposal of municipal solid waste.*

UNIT - I SOURCES AND TYPES OF MUNICIPAL SOLID WASTES [9]

Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes-characteristics – methods of sampling and characterization- Effects of improper disposal of solid wastes – public health effects- Principle of solid waste management – social & economic aspects - Public awareness-Role of NGOs- Legislation.

UNIT - II ON-SITE STORAGE & PROCESSING [9]

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

UNIT - III COLLECTION AND TRANSFER [9]

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions – Usage GPS in route optimization – Application of GIS in collection and transfer of waste.

UNIT - IV OFF-SITE PROCESSING [9]

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

UNIT - V TREATMENT &DISPOSAL [9]

Dumping of solid waste, Building Demolition and Construction Waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Total (L: 45 T: 0) = 45Periods

Course Outcomes: ***On Completion of this course, the student will be able to***

CO1: *Characterize the solid waste based on source, type and composition and also emphasize the effects of its improper disposal.*

CO2: *Identify and suggest suitable on-site processing methods.*

CO3: *Identify the suitable method for collection, segregation and transportation of solid waste.*

CO4: *Select and adopt the suitable off-site processing techniques according to Indian conditions.*

CO5: *Identify and suggest appropriate disposal methods for solid and wastes.*

Text Books :

1. Tchobanoglous, G. and Frank Kreith., Hand Book of Solid Waste Management, McGraw-Hill, Inc, New Delhi, Second Edition, 2002.
2. Ramachandra, T. V., Management of Municipal Solid Waste, TERI Press, New Delhi, First Edition, 2009.

Reference Books :

1. Worrell, William A. and AarneVesilind, P., Solid Waste Engineering, Cengage Learning Asia PTE Limited, Singapore, Second Edition, 2012.
2. Rao, M.N, Sultana, Razia Kota, and Sri Harsha., Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann, Burlington, First Edition, 2016.
3. John Pichtel., Waste Management Practices: Municipal, Hazardous, and Industrial, CRC Press, Florida, Second Edition, 2014.
4. Freeman, H. M., Standard Handbook of Hazardous Waste Treatment and DisposalII, McGraw-Hill, Inc, Noida, Second Edition, 1997.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18CE866	**ARCHITECHTURE PLANNING ASPECTS** (**Open Elective**)	3	0	0	3

Prerequisite: -

Objective(s):

- *To emphasis on architectural and functional aspects with respect to planning and design of building.*
- *To provide fundamental knowledge about natural and built environment.*
- *To explain the need and importance of building services.*
- *To describe various stages of planning techniques and management.*
- *To illustrate building construction techniques, construction planning and management.*

UNIT - I FUNDAMENTALS OF ARCHITECHTURE [9]

Architect and Civil engineer – Definitions – Architecture – aesthetic – planning – Designing – Creating – Erecting – Constructing – Executing – Integrated approach in the design of building – Construction to architecture – History of designed architecture – understanding Basic elements or Primary elements – form – Ordering principles of design.

UNIT - II ENVIRONMENTAL PLANNING AND DESIGN [9]

Ecosystem - natural and man-made ecosystem - Ecological principles - Concepts of Environmental Impact Analysis - Environmental considerations in planning and design - Thermal comfort, ventilation and air movement - Principles of lighting and illumination - Climate responsive design - Solar architecture - Principles of architectural acoustics - Green Building-Concepts and Rating – ECBC - Building Performance Simulation and Evaluation - Environmental pollution- types, causes, controls and abatement strategies.

UNIT - III SERVICES, INFRASTRUCTURE AND TRANSPORTATION [9]

Building Services - Water supply; Sewerage and drainage systems - Sanitary fittings and fixtures - Plumbing systems - Principles of internal and external drainage system - Principles of electrification of buildings - Intelligent Buildings - Elevators and Escalators – standards and uses - Air-Conditioning systems - Firefighting Systems - Building Safety and Security systems.

UNIT - IV PLANNING TECHNIQUES AND MANAGEMENT [9]

Tools and techniques of Surveys – Physical, Topographical, Land use and Socioeconomic Surveys - Methods of non-spatial and spatial data analysis - Graphic presentation of spatial data - Application of G.I.S and Remote Sensing techniques in urban and regional planning - Decision support system and Land Information System.

UNIT - V CONSTRUCTION AND MANAGEMENT [9]

Building construction techniques - methods and details - Building systems and prefabrication of building elements - Principles of Modular Coordination - Estimation, specification, valuation, professional practice - Construction planning and equipment - Project management techniques – PERT - CPM.

Total (L: 45 T: 0) = 45Periods

Course Outcomes: On successful completion of the course, the student will be able to

CO1: *Describe the fundamentals of architecture, basic elements of design and methods of visual composition.*

CO2: *Analyze various design strategies of building for different types of climatic zones by assessing the effects of site, sun and wind in building response.*

CO3: *Demonstrate plumbing systems; and architectural considerations and their coordination with other services and architectural designs and fire safety measures.*

CO4: *Develop complete knowledge on planning techniques and management.*

CO5: *Discuss building construction techniques, the application of modularization and prepare project schedule through identification of critical tasks and path in a project.*

Text Books :

1. Francis D.K. Ching., Architecture-Form, Space and Order, Van Nostrand Reinhold Company, New York, First Edition, 2007.
2. Hirasakar G. K., The Great Ages of World Architecture, Dhanpat Rai Publications, New Delhi, Twenty Second Edition, 2018.

Reference Books :

1. Paul Alan Johnson., The Theory of Architecture – Concepts and themes, Van Nostrand Reinhold Co, New York, First Edition, 1994.
2. YatinPandya, Elements of Space making, Mapin Publishing Pvt Ltd, Ahmedabad, First Edition, 2014.
3. Peter Gossel., Modern Architecture A-Z, Taschen GmbH Publisher, Cologne, Illustrated Edition, 2015.
4. https://nptel.ac.in/courses/124/107/124107011/

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18CE664	**REMOTE SENSING AND GIS (Open Elective)**	**3**	**0**	**0**	**3**

Prerequisite: -

Objective(s):

- *To provide background knowledge on basic principles of remote sensing,*
- *To explain the concepts of Geographical Information System.*
- *To illustrate the Image processing techniques using in real time applications, motivates towards innovations in the relevant fields.*
- *To study about analysis and interpretation of GIS result.*
- *To know the advancements and applications of remote sensing and GIS in Civil Engineering.*

UNIT - I PRINCIPLES OF REMOTE SENSING [9]

Definition - Components of Remote sensing - EMR Spectrum - EMR interactions with atmosphere - EMR interactions with Earth - Spectral signature curves of Earth surface features - Platforms and Sensors: Evolution of different types of satellites and their characteristics - Sensor types and properties - Resolution concepts.

UNIT - II GEOGRAPHICAL INFORMATION AYSTEM [9]

Definition and Components of GIS - GIS Data Types - Non spatial data: Field and statistical data, Spatial data: Maps and Map projection methods, Aerial photographs and satellite data - Vector and Raster data types - Merits and demerits - Hard ware: Data entry, Scanners and Digitizers, Commonly available GIS Software- Open source.

UNIT - III GIS DATA PROCESSING AND MANAGEMENT [9]

Digital Image- Characteristics - Image pre-processing techniques - Image Enhancements techniques - Classification methods - Database concepts - Data structures: Run Length Encoding, Block encoding, Chain encoding and Quad tree, Topology - Data storage formats: BIL, BSQ and BIP, Topology - Data compression techniques - File formats.

UNIT - IV GIS DATA ANALYSIS AND INTERPRETATION [9]

Data Retrieval: Querying - Raster data analysis: Spatial analysis - Reclassification - Vector data analysis: Overlay, Buffer and Network analysis –Modeling surfaces: TIN, DTM, DEM, Slope model: Slope, Aspect, Hill shades - Types of Data products - Image Interpretation: Visual Interpretation keys and techniques.

UNIT - V ADVANCEMENTS AND APPLICATIONS OF REMOTE SENSING AND GIS [9]

LIDAR and Microwave Remote sensing with its applications, Basics of Hyper spectral Remote sensing - Fields of Applications and case studies: LIS and Cadastral mapping - Urban and Regional planning - Natural resources management - Climate studies and Disaster monitoring (Natural and Manmade) - Ocean studies- Concept of Online GIS and Mobile GIS.

Total (L:45T:0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Make use the principles of EM spectrum to categories the earth features in an image and the sensor properties for various applications of remote Sensing.

CO 2: Recommend suitable GIS elements for storing and analyzing different remote sensing dataset.

CO 3: Apply the data pre-processing techniques to remove the errors and recommend suitable GIS database for different remote sensing imageries.

CO 4: Perform raster and vector data analyses on different remote sensing images.

CO 5: Familiarize and maximize the fields of applications of remote sensing and GIS with the recent advancement techniques.

Text Books :

1. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications, Hyderabad, Fourth Edition, 2019.
2. Lillisand. and Kiefer, Chipman., Remote Sensing and Image Interpretation, Willey Publications, London, Sixth Edition, 2011.

Reference Books :

1 Joshi, D. C.,Remote Sensing and GIS Applications, Scientific Publishers, Jodhpur, First Edition, 2019.
2 Ialn H., Woodhouse, Introduction to Microwave Remote Sensing, Taylore and Francise Group, Abingdon, First Edition, 2006.
3 Burrough, P.A. and Mc Donell, Rachel A., Principles of Geographical Information Systems, Oxford Publication, London, First Edition, 2004.
4 Todd, D.K. and Larry W. Mays., Remote Sensing and GIS John Wiley and Sons, Sankalp Publication, Mumbai, Third Edition, 2020.

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

		L	T	P	C
18CS871	**M – COMMERCE (Open Elective)**	3	0	0	3

***Prerequisite*:** *Basic knowledge of Mobile Communications Systems.*

Objectives:

- *To learn basics of mobile commerce.*
- *To impart knowledge on communication systems, and cellular technology.*
- *To study the concepts of mobile access technology.*
- *To explore various mobile products.*
- *To educate about mobile security and legal aspects.*

UNIT – I FUNDAMENTALS OF MOBILE COMMERCE [9]

Introduction to M-Commerce: Scope – Principles – Benefits and Limitations – Frameworks – Business models – E-Commerce Vs M-Commerce – M-commerce Services: Types M-Commerce Services – NTT DoCoMo i-Mode – Mobile Portal – M-Commerce applications.

UNIT – II MOBILE COMMUNICATION AND CELLULAR TECHNOLOGY [9]

Wireless and Mobile Communication: Communication systems – Wireless communication – Satellite communication – Mobile communication system – Cellular communication – Digital Cellular Technology: Cellular communication – Cellular networks – Mobile phone cellular networks.

UNIT– III MOBILE ACCESS TECHNOLOGY AND DEVICES [9]

Mobile communication standards – Evaluation of mobile communication system. Mobile Devices: Types – Mobile Computers – Mobile Internet Device – Personal Digital Assistant – Mobile Service Providers.

UNIT – IV MOBILE PRODUCTS [9]

Mobile banking: Models – Technologies – Services – Advantages – Challenges and Applications. Mobile ticketing: process – Applications – Privacy and Security Issues – Apps and Providers. Mobile payment: Characteristics – Models – Types – Issues and Service Providers – Challenges of mobile computing – Mobile computing software platforms.

UNIT– V SECURITY AND LEGAL ASPECTS [9]

Security and privacy issues: Concepts – Mechanism – Network security – Information security – Device security – Application security – Mobile security management. Legal Aspects: mobile device related laws – Case study: Mobile shopping – Mobile business intelligence.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On completion of this course, the student will be able to

CO1: Outline the concept of M-commerce Services and applications.
CO2: Acquire knowledge on mobile communication and cellular technology.
CO3: Identify different evaluation of mobile communication system.
CO4: Aware of various mobile products and mobile payments.
CO5: Impart the knowledge of Security and Legal Aspects.

Text Book :

1 Karabi Bandyopadhyay, Mobile Commerce, PHI Learning private limited, Delhi, Fourth Edition, 2013.
2 E.Brian Mennecke, J.Troy Strader, Mobile Commerce: Technology, Theory and Applications, Idea Group Inc., IRM press, USA. First Edition, 2003

References :

1 Ravi Kalakota, B.Andrew Whinston, Frontiers of Electronic Commerce, Pearson Education, Delhi, Fourth Edition, 2007.
2 P. J. Louis, M-Commerce Crash Course, McGraw- Hill Companies, Europe, First Edition, 2001.
3 Paul May, Mobile Commerce: Opportunities, Applications, and Technologies Of Wireless Business Cambridge University Press, England, Second Edition, 2017.
4 textofvideo.nptel.iitm.ac.in/106105084/lec35.pdf

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2018**

18CS514 **COMPUTER NETWORKS** L T P C

(Open Elective) 3 0 0 3

Prerequisite: -

Objectives:

- *To realize the basic concepts and functions of Networking.*
- *To acquire the knowledge of various functionalities of data link layer.*
- *To enumerate the addressing scheme and routing algorithm in network layer.*
- *To study, analyze and implement the design of a network using TCP and UDP.*
- *To be familiar with the protocols of application layer and how they can assist in various network applications.*

UNIT – I DATA COMMUNICATIONS [9]

Data Communications – Networks – Topology – Network Types – Protocol Layering – TCP/IP Suite – OSI Model – Multiplexing (FDM, WDM, TDM) – Guided Media – Unguided Media – Connecting Devices.

UNIT – II DATA LINK LAYER [9]

Introduction – Link Layer Addressing – Error Detection and Correction – Block Coding – Cyclic Codes – Checksum – Hamming Code – Data Link Control (DLC) – DLC Services – Data Link Layer Protocols – Medium Access Control – Wired LANs: Ethernet – Standard Ethernet – Fast Ethernet – Gigabit Ethernet – Wireless LAN – IEEE 802.11.

UNIT – III NETWORK LAYER [9]

Network Layer Services – Packet Switching – Internet Protocol (IP) – Forwarding of IP Packets – IPv4 Addressing – IPv6 Addressing – Mobile IP – Link State Routing – Distance Vector Routing – RIP – OSPF – BGP –Multicast – IGMP.

UNIT – IV TRANSPORT LAYER [9]

Introduction – Transport layer Protocol: Stop and Wait Protocol – Go Back N Protocol – Selective Repeat Protocol – Piggybacking – User Datagram Protocol: Datagram – Services – Applications – Transmission Control Protocol: Services – Features – Segment – Connections – Congestion control –Timers.

UNIT – V APPLICATION LAYER AND NETWORK MANAGEMENT [9]

DNS – FTP – E-MAIL (SMTP, MIME, POP3, IMAP, Web Mail) – TELNET – SSH – WWW and HTTP – SNMP.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Demonstrate the key concepts and functions of physical layer.
CO2: Analyze the various flow and error control techniques and identify the best method for data transmission.
CO3: Design the network layer packet delivery using appropriate routing algorithms.
CO4: Apply transport layer services using TCP or UDP protocols.
CO5: Identify the suitable network services for the given network applications.

Text Books :

1 Behrouz A.Forouzan, Data Communications and Networking, TATA McGraw Hill Education, USA, Fifth Edition, 2013.
2 William Stallings, Data and Computer Communications, Pearson Education, Delhi, Eighth Edition, 2012.

References :

1 Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Morgan Kauffmann Publishers Inc., United States, Fifth Edition, 2012.
2 Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall, Delhi, Fifth Edition, 2011.
3 James F. Kurose, Keith W. Ross, Computer Networking, Pearson Education, Delhi, Sixth Edition, 2013.
4 http://nptel.ac.in/syllabus/106105081/

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18CS513	WEB PROGRAMMING (Open Elective)	L	T	P	C
		3	0	0	3

Prerequisite: *Basic knowledge about internet concepts.*

Objectives:

- *To know the technologies in internet.*
- *To learn the basic web design ideas.*
- *To get the knowledge of web application.*
- *To familiarize various concepts of application development using JSP.*
- *To facilitate students to connect databases using JDBC.*

UNIT – I BASIC CONCEPTS OF WEB PROGRAMMING [9]

Internet and History – Protocol –TCP and IP– DNS – URL – HTTP – Websites – Web Application – Servers – Browsers – Website – Code editors – Version Control – Git – Front end – Back end.

UNIT –II USER INTERFACE [9]

HTML: Basics – Elements – Semantic – Attributes – Headings – Paragraph – Styles – Formatting – Quotations – Computer Code – Comments & Colours – CSS – Links – Images – Lists – Blocks – Classes – Layout – Responsive – iframes. CSS: Introduction – Syntax – Colours – Backgrounds – Borders – Padding – Height/Width – Gradients – Shadows –Text – Fonts – 2D Transforms – 3D Transforms – Links – Lists – Tables – Box Model. Bootstrap: Introduction – Grids –Themes – Bootstrap CSS – Bootstrap JS.

UNIT – III CLIENT SIDE SCRIPTING [9]

Javascript: Scope – Events – Strings – Numbers – Math – Arrays – Boolean – Comparisons – Conditions – Switch – Loops – Type Conversion – RegExp – Errors – Debugging – Hoisting – Strict Mode – Functions – Objects – Forms – HTML DOM – BOM. Jquery: Introduction – Syntax – Selectors – Events – Effects – HTML – Traversing – AJAX & Misc.

UNIT – IV SERVER SIDE SCRIPTING [9]

NODE: Getting started – Node Core – Modules – File System – Debugger – Automation and Deployment. Servlet: Servlet API – Interface – Classes – Life cycle – Servlet Request – Request dispatcher – Send Redirect – ServletConfig – ServletContext – Attribute – Session tracking. JSP: Introduction – Life cycle of JSP – Scriptlet – Expression – Declaration – Implicit Objects – Directive Elements – JSP Exceptions – Action Elements.

UNIT–V WEB SERVICES AND DATABASE [9]

AJAX: Introduction – XMLHttp – Request – Response – AJAX XML File. JSON: Introduction –Syntax – JSON vs XML – Data types – Objects – Arrays. JDBC: Introduction – Drivers – Driver Manager – Connection – Statement – ResultSet. Mongodb: Introduction – Advantage – Database – Collection – Data Types.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Recognize the technologies around the internet

CO 2: Describe the idea of web designing at user interface.

CO 3: Acquire the knowledge of data processing on client and server side

CO 4: Create the web oriented responses at server side.

CO 5: Design and handle the online database and services.

Text Books :

1 Randy Connolly and Ricardo Hoar, Fundamentals of web development, Pearson Education, New Delhi, First Edition 2016.

2 Paul Deitel, Harvey Deitel and Abbey Deitel Internet & World Wide Web - How to program, Pearson Education, New Delhi, Fifth Edition, 2012.

References :

1 Chris Bates Web Programming, Building Internet Applications, John Wiley & Sons Ltd, USA, Second Edition 2007.

2 John Dean, Web Programming With HTML5, CSS and JavaScript, Jones and Bartlett Publishers, Inc, United States, Third Edition, 2018.

3 Jon Duckett, Beginning Web Programming with HTML, XHTML, and CSS, Wily Publishing Inc, India, Second Edition, 2008.

4 www.tutorialspoint.com

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18CS002	**JAVA PROGRAMMING**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite: *Fundamentals of C programming concepts*

Objectives:

- *To know the fundamentals of Java programming language.*
- *To equip students with comprehensive knowledge on core concepts of java like overloading.*
- *To gain knowledge in interfaces and exception handling*
- *To get idea on threads and multithreaded programming*
- *To study the I/O operations and string manipulations and concepts of database connectivity.*

UNIT – I JAVA FUNDAMENTALS [9]

The Java Buzzwords – Data Types – Variables – Arrays – Operators – Control Statements – Class Fundamentals – Declaring Objects – Methods – Method Overloading – Objects as Parameters – Returning Objects – Recursion –this keyword – Garbage Collection.

UNIT – II CONSTRUCTORS AND INHERITANCE [9]

Constructors – Constructor Overloading–Access Control – static – final – Nested and Inner Class – Inheritance : Basics –Super – Multilevel – Hierarchical – Method Overriding – Abstract class –Final with Inheritance.

UNIT–III PACKAGES, INTERFACES AND EXCEPTION HANDLING [9]

Packages – Access Protection – Importing Packages – Interfaces – Default Interface Methods – Static Methods in Interface – Exception Handling Fundamentals – Types – Uncaught Exceptions –Try and Catch – Multiple Catch – Nested Try – Throw – Throws – Finally –Array List-Wrapper Classes.

UNIT – IV MULTITHREADED PROGRAMMING AND I/O OPERATIONS [9]

Java Thread Model – Main Thread – Creating a Thread – Creating Multiple Threads – isAlive and join Methods – Thread Priorities - Synchronization – Interthread Communication – Suspending, Resuming, and Stopping Threads – Obtaining a Thread's State – Using Multithreading – I/O Basics – Reading Console Input – Writing Console Output – The PrintWriter Class – Reading and Writing Files – Automatically Closing a File – Scanner class.

UNIT – V STRING AND DATABASE CONNECTIVITY [9]

The String Constructors – String Length – Character Extraction – String Comparison – Searching Strings – Modifying a String – Data Conversion using valueOf method – Methods in StringBuffer – JDBC Product Components – JDBC API – JDBC Driver Manager – JDBC Test Suite – JDBC-ODBC Bridge – JDBC Architecture – Establishing Connection – Handling SQL Exceptions.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

CO1: Apply java programming fundamentals to solve real world problem.
CO2: Implement the concept of overloading and inheritances.
CO3: Examine important features of java like packages, interfaces and exception handling.
CO4: Illustrate the features of multithreaded programming and I/O operations.
CO5: Demonstrate the concepts of string manipulations and database connectivity.

Text Books :

1 Herbert Schildt, Java - The Complete Reference, Oracle Press, McGraw-Hill Education, New Delhi, Tenth Edition, 2018.
2 Cay S. Horstmann, Core Java Volume 1 - Fundamentals, Prentice Hall, US, Tenth Edition, 2015.

References :

1 Herbert Schildt, Java - A Beginner Guide, Oracle Press, McGraw-Hill Education, New Delhi, Sixth Edition, 2014.
2 Joshua Bloch, Effective Java: A Programming Language Guide, Addison-Wesley Professional, US, Third Edition, 2018.
3 Allen B. Downey and Chris Mayfield, Think Java: How to Think Like a Computer Scientist, O'Reilly, California, First Edition, 2016.
4 https://onlinecourses.nptel.ac.in/noc19_cs07/preview

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		L	T	P	C
18CS003	**OPERATING SYSTEMS (Open Elective)**	3	0	0	3

Prerequisite: *Basic knowledge of computer architecture.*

Objectives:

- *To gain the knowledge about the basics of operating systems concepts.*
- *To know the various process, threads and CPU scheduling operations.*
- *To solve deadlocks and memory management problems.*
- *To study the virtual memory concepts and file sharing interface.*
- *To learn the file systems, disk structure and I/O Systems concepts.*

UNIT – I OPERATING SYSTEMS CONCEPTS [9]

Introduction to Operating Systems – Computer System Architecture: Single Processor Systems – Multiprocessor Systems – Clustered Systems – Operating System Structure – Operating System Services – System Calls: Types of System Calls – System Programs – Process: Process Concept – Process Scheduling – Operation on Processes – Cooperating Process – Inter Process Communication.

UNIT –II THREADS AND CPU SCHEDULING [9]

Threads: Overview – Multithreading Models – Thread Issues – CPU Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms: FCFS – SJF – Priority – Round Robin – Process Synchronization: Critical Section Problem – Peterson's Solution – Synchronization Hardware – Semaphores – Classic Problems of Synchronization.

UNIT – III DEADLOCK AND MEMORY MANAGEMENT [9]

Deadlock : System Model – Deadlock Characterization – Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock – Memory Management: Background –Swapping – Contiguous memory Allocation – Segmentation – Paging – Structure of the Page Table.

UNIT –IV VIRTUAL MEMORY AND FILE SHARING INTERFACE [9]

Virtual Memory: Demand Paging – Copy-on-Write – Page Replacement – Allocation of Frames – Thrashing – File Concepts: Access Methods – Directory Structure – File System Mounting – File Sharing – Protection.

UNIT –V FILE SYSTEM STRUCTURE AND STORAGE STRUCTURE [9]

File System Structure – File System Implementation: Directory Implementation – Allocation Methods – Free space Management – Mass Storage Structure: Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management – RAID structure – I/O Systems: I/O Hardware – Kernel I/O Subsystem.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Identify the components and their functionalities in the operating system.

CO2: Determine the efficiency of CPU scheduling algorithms.

CO3: Examine the performance of various memory management techniques.

CO4: Summarize the virtual memory concepts and file access methods.

CO5: Evaluate the performance of disk management and file system.

Text Books :

1 Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Ninth Edition, 2013.

2 Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall, Third Edition, 2007.

References :

1 D. M. Dhamdhere, Operating Systems, Tata McGraw-Hill Education India, Second Edition, 2006.

2 Paul J. Deitel and David R. Choffnes, Operating Systems, Prentice Hall, United States, Third Edition, 2003.

3 Richard Fox, Linux with Operating System Concepts, Taylor & Francis Limited, United States, Second Edition, 2014.

4 http://nptel.ac.in/courses/106108101.

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		L	T	P	C
18CS869	**INTERNET OF THINGS**				
	(Open Elective)	3	0	0	3

***Prerequisite*:** *Basic knowledge of Microprocessors and Microcontrollers.*

Objectives:

- *To study basic concepts of Internet of things.*
- *To know IoT platform design methodology.*
- *To learn IoT physical devices and endpoints.*
- *To gain knowledge in ARDUINO for IoT.*
- *To get the idea of Hadoop and MapReduce*

UNIT – I BASICS OF INTERNET OF THINGS [9]

Definition – Characteristics – Physical design of IoT– Logical design of IoT– IoT Enabling Technologies – IoT Levels and deployment templates – Domain specific IoT: Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Life style.

UNIT – II IoT PLATFORM DESIGN METHODOLOGY [9]

IoT and M2M:M2M – Difference between IoT AND M2M – SDN and NFV for IoT.IoT System management – Need for system management – SNMP – Network operator requirements – NETCONF –YANG – IoT systems management with NETCONF-YANG – IoT design methodology – Case study: Weather Monitoring.

UNIT– III IoT PHYSCIAL DEVICES [9]

IoT device – Raspberry Pi Board – Linux on Raspberry Pi – Raspberry Pi interfaces – Programming Raspberry Pi with python – Other IoT devices – Cloud storage models and communication APIs: WAMP – Xively cloud for IoT– Django – designing RESTful web API.

UNIT – IV IoT WITH ARDUINO [9]

Arduino Basics: Hardware Requirements – Software Requirements – Arduino Programming. Internet Connectivity: Arduino Uno Wired Connectivity – Arduino Uno Wireless Connectivity – Arduino Yun Wireless Connectivity. Communication Protocols: HTTP – MQTT.

UNIT– V DATA ANALYTICS FOR IoT [9]

Apache Hadoop – Hadoop MapReduce for batch data analysis – Apache Oozie – apache spark – Apache storm – Real time analysis using Apache storm. Tools for IoT: Chef – Puppet.

Total (L: 45 T:0) = 45 Periods

Course Outcomes: On completion of this course, the student will be able to

CO 1: Comprehend the technologies and applications of IoT.
CO 2: Construct IoT platform using design methodology.
CO 3: Develop IoT device using Raspberry Pi Board.
CO 4: Build up IoT device using Arduino Board.
CO 5: *Familiarize with data analytics for IoT*

Text Book:

1 Arsdeep Bahga and Vijay Madisetti, Internet of Things – Hands on approach, university press India private Limited, First Edition, 2015.

References:

1 Dieter Uckelmann et.al, Architecting the Internet of Things, Springer, United States, First Edition, 2011.
2 David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, New York, First Edition, 2010.
3 Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things - Key applications and Protocols, Wiley, United States. Second Edition, 2012.
4 http://nptel.ac.in/courses/106105081/

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		L	T	P	C
18CS312	**COMPUTER ORGANIZATION AND ARCHITECTURE (Open Elective)**	3	0	0	3

Prerequisite: *Digital Electronics*

Objectives:

- *To know the basic structure and implementation of fixed-point and floating point arithmetic unit.*
- *To get the idea of basic processing unit of computers.*
- *To study the concepts of pipelining.*
- *To gain knowledge of hierarchical memory system including cache and virtual memories.*
- *To learn the different ways of communication with I/O devices.*

UNIT – I **BASIC STRUCTURE OF COMPUTERS** **[9]**

Functional Units – Basic Operational Concepts – Performance – Instruction Set Architecture: Instructions and Instruction sequencing – Addressing Modes – RISC and CISC – Fixed Point and Floating Point Operations.

UNIT – II **BASIC PROCESSING UNIT** **[9]**

Fundamental Concepts – Instruction Execution – Hardware Components – Instruction Fetch and Execution Steps – Hardwired Control – Micro Programmed Control – Nano Programming.

UNIT – III **PIPELINING** **[9]**

Basic Concepts – Pipeline Organization – Pipelining Issues – Data Dependencies – Memory Delays – Branch Delays – Resource Limitations – Performance Evaluation – Superscalar Operation.

UNIT – IV **MEMORY SYSTEM** **[9]**

Basic Concepts – Semiconductor RAM Memories – Read Only Memories – Memory Hierarchy – Cache Memories – Performance Considerations – Virtual Memory – Memory Management Requirements – Secondary Storage Devices.

UNIT –V **I/O ORGANIZATION** **[9]**

Accessing I/O Devices – Programmed I/O – Interrupt Initiated I/O – Direct Memory Access – Buses – Bus Arbitration – Interconnection Standards: SCSI – USB – SATA – I/O Devices and Processors.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Demonstrate the instruction sets with various addressing modes.

CO2: Outline the execution of instructions and working of hardwired control and micro programmed control.

CO3: Summarize pipelining concepts and superscalar operation.

CO4: Evaluate the performance of memory in commercial processor.

CO5: Analyze the organization of I /O devices.

Text Books :

1 Carl Hamacher, ZvonkoVranesic, SafwatZaky and Naraig Manjikian, Computer Organization and Embedded Systems, McGraw Hill, US, Sixth Edition, 2012.

2 M.Morris Mano, Computer System Architecture, McGraw Hill, US, Third Edition, 2012.

References :

1 William Stallings, Computer Organization and Architecture - Designing for Performance, Prentice Hall, US, Eighth Edition, 2010.

2 David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software interface, University of California, Berkeley, Fifth Edition, 2014.

3 Carpinelli, Computer Systems Organization & Architecture, Pearson Education, India, First Edition, 2001.

4 www.nptel.ac.in/courses/106102062.

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18EC662 **MEDICAL ELECTRONICS** L T P C

(Open Elective) 3 0 0 3

Prerequisite: -

Objectives:

- *To learn the methods of recording various bio-potentials.*
- *To understand the design and working of various diagnostic equipments.*
- *To be familiar with the design and working of various therapeutic equipments.*
- *To expose the principles and working behind various imaging techniques.*
- *To gain knowledge about the recent trends in medical instrumentation.*

UNIT - I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING [9]

The origin of bio-potentials - Bio-potential electrodes - Carrier, chopper and isolation amplifiers -Transducers for biomedical applications: Strain gauge, piezoelectric transducer, thermocouple, thermistor, biosensors - ECG, EEG, EMG, PCG, ERG and EOG: Lead systems, recording methods, typical waveforms and signal characteristics.

UNIT – II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT [9]

Blood gas analyzers - Electrophoresis - Colorimeter & Photometer - Auto analyzer - Blood flow meter - Cardiac output - Respiratory measurement - Blood pressure measurement - Temperature measurement - Pulse measurement -Blood cell counters: Coulter counters.

UNIT – III THERAPEUTIC EQUIPMENTS [9]

Cardiac pacemakers - DC defibrillator - Dialyzers - Surgical diathermy - Physiotherapy and electrotherapy equipment - Oxygenators - Heart lung machine.

UNIT – IV MEDICAL IMAGING [9]

X-Ray - Computer Axial Tomography - Positron Emission Tomography - MRI and NMR - Ultrasonic Imaging systems.

UNIT –V RECENT TRENDS IN MEDICAL INSTRUMENTATION [9]

Thermograph - Endoscopy unit - LASER in medicine - Biomedical telemetry - Radio-pill - Cardiac catheterization laboratory - Electrical safety of medical equipment.

Total (L: 45) = 45 Periods

Course Outcomes: On the successful completion of the course, students will be able to

CO 1: Describe the recording methods of various bio-potentials.

CO 2: Interpret the working of various equipment that deal with bio-chemical and non-electrical parameter measurement.

CO 3: Illustrate different types of therapeutic equipment.

CO 4: Demonstrate the principles of various medical imaging modalities.

CO 5: *Describe the recent trends in medical instrumentation.*

Text Books :

1 R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, Noida, Third Edition, 2014.

2 Leslie Cromwel, Fred J.Weibel, Erich A.Pfeiffer, Biomedical Instrumentation and Measurements, Pearson/Prentice Hall India, Delhi, Second Edition, 2011.

References :

1 John G.Webster, Medical Instrumentation Application and Design, John Wiley & Sons Inc,United States, Fourth Edition, 2010.

2 Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley &Sons,United States,Fourth Edition, 2008.

3 M. Arumugam, Biomedical Instrumentation, Anuradha Publications, Chennai, Second Edition, Reprint 2009.

4 R.L. Reka & C. Ravikumar, Biomedical Instrumentation/ Medical Electronics, Lakshmi Publications, Chennai, Second Edition, Reprint 2010.

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		L	T	P	C
18IT673	**VIDEO ANALYTICS (Open Elective)**	3	0	0	3

Prerequisite: *-*

Objectives:

- *To understand the need for video analytics.*
- *To learn the concepts of foreground extraction algorithms in videos*
- *To explore about the various classification algorithms.*
- *To gain knowledge* on *security aspects of video analytics*
- *To get exposed to the various applications of video analytics*

UNIT – I VIDEO ANALYTIC COMPONENTS [9]

Need for Video Analytics – Video Analytics – Foreground Extraction – Feature Extraction – Classifier – Preprocessing – Edge Detection – Smoothening – Feature Space – PCA – FLD – SIFT Features

UNIT – II FOREGROUND EXTRACTION [9]

Background Estimation – Averaging – Gaussian Mixture Model – Optical Flow based – Image Segmentation– Region Growing – Region Splitting – Morphological Operations – Erosion – Dilation – Tracking in a multiple camera environment

UNIT – III CLASSIFIERS [9]

Neural Networks (Back Propagation) – Deep Learning Networks – Fuzzy Classifier– Bayesian Classifier – HMM Based classifier

UNIT – IV VIDEO ANALYTICS FOR SECURITY [9]

Abandoned Object Detection – Human Behavioral Analysis – Human Action Recognition – Perimeter Security – Crowd Analysis and Prediction of Crowd Congestion

UNIT– V APPLICATIONS OF VIDEO ANALYTICS [9]

Customer Behavior Analysis – People Counting – Traffic Rule Violation Detection– Traffic Congestion Identification for Route Planning – Driver Assistance– Lane Change Warning – Forensic Video Analysis

Total : 45 periods

Course Outcomes: On completion of this course, the student will be able to

CO1: Explain about the various components of video analytics.
CO2: Expose on foreground extraction techniques.
CO3: Apply various classifier algorithms on for the given target application.
CO4: Use security principles for business intelligence.
CO5: Demonstrate on various applications of video analytics.

Text Books:

1 Graeme A. Jones, Nikos Paragios, Carlo S. Regazzoni, Video– Based Surveillance Systems: Computer Vision and Distributed Processing , Springer, United States, First Edition, 2002.
2 Nilanjan Dey , Amira Ashour and Suvojit Acharjee, Applied Video Processing in Surveillance and Monitoring Systems, IGI Global, Pennsylvania, First Edition, 2016.

Reference Books:

1 Zhihao Chen, Ye Yang, Jingyu Xue, Liping Ye, Feng Guo, The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, Createspace Independent Publication, California, First Edition, 2014.
2 Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, Video Analytics for Business Intelligence, Springer, United States, First Edition, 2012.
3 Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, Cambridge, First Edition, 2012.
4 Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley– IEEE Press, United States, First Edition, 2011.

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		L	T	P	C
18IT771	**MOBILE APPLICATION DEVELOPMENT (Open Elective)**	3	0	0	3

Prerequisite: *Java Programming*

Objectives:

- *To understand system requirements for mobile applications.*
- *To generate suitable design using specific mobile development frameworks.*
- *To develop mobile application design.*
- *To implement the design using specific mobile development frameworks.*
- *To deploy the mobile applications in marketplace for distribution.*

UNIT – I INTRODUCTION [9]

Introduction to mobile applications – Embedded systems – Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and Validation for mobile applications

UNIT – II BASIC DESIGN [9]

Introduction – Basics of embedded systems design – Embedded OS – Design constraints for Mobile applications both hardware and software related – Architecting Mobile applications – User interfaces for mobile applications – touch events and gestures–Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT – III ADVANCED DESIGN [9]

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing Environment – Design patterns for mobile applications.

UNIT – IV TECHNOLOGY I ANDROID [9]

Introduction – Establishing the development environment – Android Architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi Integration with social media applications.

UNIT–V TECHNOLOGY II IOS [9]

Introduction to Objective C – IOS features–UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi –iPhone marketplace.

Total : 45 Periods

Course Outcomes: On completion of this course, the student will be able to

CO1: Describe the requirements for mobile applications
CO2: Explain the challenges in mobile application design and development
CO3: Develop design for mobile applications for specific requirements
CO4: Implement the design using Android SDK
CO5: Deploy mobile applications in Android and iPhone marketplace for distribution

Text Books :

1 Jeff McWherter and Scott Gowell, Professional Mobile Application Development, Wrox Publications, John Wiley, India, First Edition, 2012.
2 Charlie Collins, Michael Galpin and Matthias Kappler, Android in Practice, Dream Tech, Gujarat, First Edition, 2012.

Reference Books :

1 James Dovey and Ash Furrow, Beginning Objective C, Apress, United States, First Edition, 2012
2 David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, Beginning IOS 6 Development: exploring the iOS SDK, Apress, United States, First Edition, 2013.
3 Reto Meier, Professional Android 4 Application Development, Wrox Publications, John Wiley, India, First Edition, 2012.
4 http://developer.android.com/develop/index.html

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18ME413	**THERMAL ENGINEERING**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisite: *Engineering Thermodynamics.*

Objectives:

- *To study the classification, components and working principles of an IC engine.*
- *To analyze the performance of various gas power cycles.*
- *To explore the concepts of flow through nozzles and turbines.*
- *To examine the performance of different types of air compressors.*
- *To appraise the working principles of refrigeration and air conditioning systems.*

UNIT – I INTERNAL COMBUSTION ENGINES [09]

Classification, Components and their functions, Working principles of two stroke and four stroke engine, Comparison-two stroke and four stroke, SI and CI engines, Actual and Ideal valve timing diagram and port timing diagram, Carburettor systems, Fuel injection systems, Lubrication system, Cooling and Ignition System, Combustion phenomena, Octane and Cetane number Pre ignition, Detonation and Knocking, Delay period, Supercharging, Formation of exhaust emission in SI and CI engines.

UNIT – II GAS POWER CYCLES [09]

Introduction, Otto, Diesel, Dual, Brayton cycles, Calculation of work done, mean effective pressure and air standard efficiency and Comparison of gas power cycles.

UNIT - III STEAM NOZZLES AND TURBINES [09]

Steam nozzle – Flow through steam nozzles, shapes of nozzles, effect of friction, critical pressure ratio, Maximum discharge, co-efficient of nozzle, supersaturated flow.
Turbine - Impulse and Reaction principles, compounding methods, velocity triangles, axial and tangential components, speed regulations.

UNIT - IV AIR COMPRESSOR [09]

Classification and working principle of various types of compressors, Work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor with inter cooling, work of multistage air compressor.

UNIT - V REFRIGERATION AND AIR CONDITIONING [09]

Refrigeration-Fundamentals, Refrigeration systems, C.O.P., Air refrigeration system, Vapour compression and Vapour absorption system, Working principles, T-S diagram, Effect of Superheat and Sub-cooling. Air conditioning systems-Classification, Components and its working.

Total=45 Periods

Course Outcomes: Upon completion of this course, the students will be able to

CO1: Explore various components and working principles of SI and CI engine.
CO2: Investigate the processes of various gas power cycles
CO3: Demonstrate the knowledge on flow through nozzles and turbines.
CO4: Analyze the performance of air compressor.
CO5: Evaluate the performances of refrigeration and air conditioning systems.

Text Books:

1. Rajput, R. K., Thermal Engineering, S.Chand Publishers, Mumbai, Second Edition, 2010.
2. Kothandaraman, C.P. Domkundwar, S.Domkundwar, A.V., A Course in Thermal Engineering, Dhanpat Rai & sons , New Delhi, Fifth Edition, 2002.

Reference Books:

1. Arora, C.P., Refrigeration and Air Conditioning, Tata Mc Graw-Hill Publishers, New Delhi, Third Edition, 2014.
2. Ganesan, V., Internal Combustion Engines , Tata Mcgraw-Hill,New Delhi, Fourth Edition, 2012.
3. Rudramoorthy, R.,Thermal Engineering,Tata McGraw-Hill, New Delhi, Fourth Edition, 2003.
4. Singhal, B.L.,Thermal Engineering, Macmillan Publishers India Ltd, Noida, Second Edition, 2011

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18ME664	**INTERNAL COMBUSTION ENGINES**	L	T	P	C
	(Open Elective)	3	0	0	3

Prerequisites: *Thermal Engineering, Thermodynamics.*

Objectives :

- *To study the combustion performance of SI engines.*
- *To acquire the combustion characteristics of CI engines.*
- *To explore the usage of alternate fuels in automobiles.*
- *To improve the performance of IC engines through re engineering*
- *To analyze the emission characteristics of IC engine*

UNIT – I SPARK IGNITION ENGINES [09]

Introduction - mixture requirements - carburetors - fuel injection systems - single point and multi point injection - stages of combustion - normal, abnormal combustion - factors affecting knock - measurement of knock - anti knock agent - types of combustion chambers.

UNIT – II COMPRESSION IGNITION ENGINES [09]

Introduction - states of combustion - direct, indirect injection systems - combustion chambers - fuel spray behaviors - spray structure, spray penetration, evaporation - air motion.

UNIT – III ALTERNATIVE FUELS [09]

Introduction - Methanol, ethanol, hydrogen, natural gas, biogas, bio diesel, liquefied petroleum gas - properties, suitability, engine modifications, merits and demerits as fuels.

UNIT – IV EMERGING ENGINE TECHNOLOGIES [09]

Introduction - Lean burn engines - stratified charge engines - gasoline direct injection engine - homogeneous charge compression ignition - plasma ignition - zero emission vehicle, variable compression ratio engines, and turbocharged engines.

UNIT – V POLLUTANT FORMATION AND CONTROL [09]

Pollutant - sources and types - formation of NOx - hydrocarbon emission mechanism - carbon monoxide formation - particulate emissions - effect of pollutant, emission standards - methods of controlling emissions - catalytic converters, particulate traps.

Total = 45 Periods

Course Outcomes: On completion of this course, the students will be able to

C01: Evaluate the combustion characteristics of SI engines.
C02: Explore the combustion parameters of CI engines.
C03: Suggest the alternate fuels for automobiles.
C04: Enhance the performance of IC engines through design modification
C05: Demonstrate the emission control techniques for IC engines

Text Books :

1. Ganesan, V., Internal Combustion Engines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Fourth Edition, 2015.
2. Gupta, H. N., Internal Combustion Engines, PHI Learning Private Limited, New Delhi, Second Edition, 2012.

Reference Books :

1. Willard, W. Pulkrabek ., Engineering fundamentals of the Internal Combustion Engine, PHI Learning Private Limited, New Delhi, Third Edition, 2008.
2. John, B.Heywood., Internal combustion engines fundamentals, Tata McGraw Hill, New Delhi, Second Edition, 2013.
3. Mathur, R.B.and Sharma R.P., Internal Combustion Engines, NIT, Tiruchirappalli, 2016.
4. Mohanty, R.K., A text book of internal combustion engines, Standard book House, New Delhi, Second Edition, 2015.

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		L	T	P	C
18ME097	**INDUSTRIAL SAFETY ENGINEERING (Open Elective)**	3	0	0	3

Prerequisites : *NIL*

Objectives :

- *To study the importance of personal and industrial safety hazards in industry*
- *To explore the safety aspect of industrial machines.*
- *To demonstrate the Safety measures in welding and gas handling equipments*
- *To apply health and welfare measures during inspection and testing of industrial environment*
- *To estimate the hazardous and risks in industries through various techniques*

UNIT – I INTRODUCTION [09]

Concepts of safety - hazard classification - chemical, physical, mechanical, ergonomics, biological and noise hazards - fire properties - solid, liquid and gases- fire chemistry and its control - first aid - cardio pulmonary resuscitation (CPR) - personal protection.

UNIT – II SAFETY IN MAINTENANCE OF MACHINES [09]

Basic principle of machine guarding during maintenance - machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing - guard construction - guard opening - lathe - drilling - boring - milling - grinding – shaping - sawing – shearing - presses - forge hammer – flywheels – shafts – couplings – gears - sprockets wheels and chains - pulleys and belts - authorized entry to hazardous installations - benefits of good guarding systems.

UNIT – III SAFETY IN WELDING AND GAS CUTTING [09]

Gas welding and oxygen cutting, resistances welding, arc welding and cutting - common hazards -training, safety precautions in brazing, soldering and metalizing - explosive welding, selection, care and maintenance of the associated equipment and instruments - safety in generation, distribution and handling of industrial gases - colour coding - leak detection-pipe line safety- storage and handling of gas cylinders.

UNIT – IV SAFETY IN INSPECTION AND TESTING [09]

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, health and welfare measures in engineering industry.

UNIT – V HAZARD ANALYSIS AND RISK MANAGEMENT [09]

Hazard identification and control - HAZOP, job safety analysis - fault tree analysis - event tree analysis - failure modes and effect analysis - safety audit - safety survey - plant inspection - past accident analysis.

Overall risk analysis - disasters management plan - emergency planning - onsite and offsite emergency planning - risk management.

Total = 45 Periods

Course Outcomes: On completion of this course, the students will be able to

CO1: Identify the safety and hazards risk for personal and industrial environment
CO2: Apply safety aspects to industrial machine functional environments
CO3: Construct the Safety measures in welding and gas handling equipments
CO4: Demonstrate the health and hazardous risk in inspection and testing in industry
CO5: Evaluate hazard and risks using various techniques in industries.

Text Books:

1 Blake, R.P., Industrial Safety, PHI Publications, New Delhi, Second Edition, 2000.
2 Raghavan, K.V. and Khan A.A., Methodologies in Hazard Identification and Risk Assessment Manual by CLRI, Second Edition, 2019.

References:

1 Lees, F.P., Loss Prevention in Process Industries, Butterworth Heinemann, Second Edition, 1996.
2 Health and safety in welding and allied processes, welding Institute Hi tech publishing Limited, UK, 1989.
3 Major hazard control - A practical manual, ILO, Jeneva,1988.
4 Krishnan, N.V., Safety management in industry, Jaico publishing house, Bombay, 1977.

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18HS095	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING (Open Elective)	L	T	P	C
		3	0	0	3

Objectives:

- *To understand the concept of managerial economics for effective management decision making.*
- *To identify the various functions of demand and supply.*
- *To analyze the production and cost functions for estimation of cost.*
- *To evaluate the various determinants of pricing and its methods.*
- *To study the financial analysis for effective decision making in investment.*

UNIT - I INTRODUCTION [9]

Managerial Economics – Relationship with other disciplines – Firms: Types, objectives and goals – Managerial decisions: Types and Process.

UNIT - II DEMAND & SUPPLY ANALYSIS [9]

Demand: Types of demand, Determinants of demand, Demand function, Demand elasticity and Demand forecasting – Supply: Determinants of supply, Supply function and Supply elasticity.

UNIT – III PRODUCTION AND COST ANALYSIS [9]

Production function: Returns to scale, Production optimization, Least cost input and Isoquants – Managerial uses of production function. Cost Concepts: Cost function, Determinants of cost, Short run, Long run cost curves and Estimation of Cost.

UNIT - IV PRICING [9]

Pricing : Meaning, Definition, Determinants of Price , Pricing under different objectives – Market Structures: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly and Price discrimination Pricing methods in practice.

UNIT - V FINANCIAL & CAPITAL (ELEMENTARY TREATMENT) [9]

Balance sheet and related concepts – Profit & Loss Statement and related concepts – Financial Ratio Analysis Investments – Risks and return evaluation of investment decision – Average rate of return – Payback Period – Net Present Value – Internal rate of return.

Total (L: 45 T: 0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Describe the concept and goals of Managerial economics
CO 2: Illustrate the knowledge of forecasting the demand and supply in the management
CO 3: Analyze the price discrimination of the product among the competitors
CO 4: Explain the market structure for determining the pricing methods.
CO 5: Estimate the Financial statements to understand the return on Investment.

Text Books :

1. A. Ramachandra Aryasri and V. V. Ramana Murthy, Engineering Economics and Financial Accounting, Tata Mc-Graw Hill, New Delhi, Fourteenth Reprint,2016.
2. R.L. Varshney and K.L. Maheswari, Managerial Economics, Sultan Chand & Sons, Twenty First Edition, 2015

Reference Books :

1. A. Samuelson Paul and W.D. Nordhaus, Economics, Tata McGraw-Hill, New Delhi, Twenty Edition, 2014.
2. McGuigan, Moyer and Harris, Managerial Economics: Applications, Strategy and Tactics, Thomson South Western, Tenth Edition, 2016.
3. Paresh Shah, Basic Financial Accounting for Management, Oxford University Press, New Delhi, Seventh Edition, 2015.
4. Nordhaus and Samuelson, Economics, Tata McGraw- Hill, New Delhi, Twenty Edition, 2014

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		L	T	P	C
18HS002	**TOTAL QUALITY MANAGEMENT (Open Elective)**	3	0	0	3

Objectives:

- *To explain the basic concepts of total quality management.*
- *To explain the various principles of total quality management.*
- *To describe the various statistical process control concepts.*
- *To discuss the various tools in total quality management.*
- *To explain the different quality systems in manufacturing and service sectors.*

UNIT - I INTRODUCTION [9]

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM implementation steps – Quality council-Importance of leadership and motivation in TQM - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT - II TQM PRINCIPLES [9]

Quality statements - Customer perception of quality – Customer complaints, Customer retention. Employee involvement, Empowerment, Team and Teamwork, Recognition and Reward - Continuous process improvement – Juran trilogy, PDSA cycle, 5s, 8D Methodology - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT - III STATISTICAL PROCESS CONTROL [9]

The seven traditional tools of quality – Measurement of central tendency and dispersion, population and sample, normal curve, control chart (X,R,p) for variable and attributes, process capability - Seven new management tools – Six-sigma Concepts.

UNIT - IV TQM TOOLS [9]

Bench marking – reason , process – Quality circles concepts - FMEA – stages, types– Quality Function Deployment (QFD) – Taguchi quality loss function –TPM – concepts, improvement needs –Performance measures-criteria – Quality Cost.

UNIT - V QUALITY SYSTEMS [9]

Need for ISO 9000 – ISO 9001-2014, ISO 14000 Quality System – elements, implementation, Documentation. Quality auditing – concepts, requirements and benefits, non-conformance report – Case studies of TQM implementation in manufacturing and service sectors.

Total (L: 45 T: 0) = 45 Periods

Course Outcomes: On completion of this course, the student will be able to:

CO 1: Explain the fundamental concepts of total quality management.
CO 2: Illustrate the Various TQM principles for continuous process improvement
CO 3: Classify the statistical tools to control and improve the quality of the products and services.
CO 4: Describe the tools and techniques to improve the quality concept
CO 5: Explain the quality system in manufacturing and service sectors.

Text Books :

1. Dale H.Besterfiled, et at., Total Quality Management, Pearson Education Asia, Indian Reprint, New Delhi, Third Edition, 2016.
2. Janakiraman,B and Gopal, R.K, Total Quality Management – Text and Cases, Prentice Hall (India) Pvt. Ltd., New Delhi, Third Edition, 2015.

Reference Books :

1. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India)Pvt. Ltd.,, New Delhi, First Edition,2014
2. James R. Evans and William M. Lindsay, The Management and Control of Quality, South-Western (Thomson Learning), New Delhi, Ninety Edition, 2015.
3. Subburaj R, Total Quality Management, Tata McGraw Hill, New Delhi, First Edition, 2014
4. Eugence Mckenna and Nic Beach, Total Quality Management, Pearson Education Limited, New Delhi, Second Edition, 2014.

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		L	T	P	C
18HS094	**DISASTER MANAGEMENT (Open Elective)**	3	0	0	3

Objective(s):

- *To understand the students to learn about the aspects of disaster and risk management.*
- *To understand the different types of disaster.*
- *To know the different kinds disaster relief organization*
- *To study the disaster policy in India*
- *To create the awareness about disaster management*

UNIT - I INTRODUCTION ABOUT DISASTER [9]

Introduction, Nature and Dimension of the challenge, Linking Disaster and Development, Sustainable development, Disruption of development by disasters, causes of Disasters – Development opportunities afforded by disasters – Varied impact on states in India. HAZARDS: Definition, principles, Impact of Disasters, Levels of Disaster, Effect of Disasters, Causal factors, Phases of Disaster.

UNIT - II DIFFERENT TYPES OF DISASTERS [9]

Different calamities – Typology of Disasters: Earthquakes, Tsunamis, Volcanoes, Landslides Tropical cyclones, Floods, Environmental pollution, Deforestation – Desertification, Pest Infestations, Epidemics, Chemical and industrial accidents, Trends in climatology, meteorology and hydrology - seismic activity - Case Study.

UNIT – III DISASTER PREVENTION AND CONTROL [9]

United Nations Disaster Relief Coordinator (UNDRO): Disaster relief and management, prevention, preparedness, Stand by capacity – Coordination, cooperation and leadership Continuum from relief to rehabilitation and development – Checklists and reporting formats by UNDMT and international emergency assistance requirement.

UNIT - IV DISASTER MANAGEMENT IN INDIA [9]

Issues – National policy – Historical Framework – Funding mechanisms – Calamity Relief Fund (CRF) – The Disaster management Act 2005 – Indian Agencies for disaster management – National Civil Defense Organization.

UNIT - V DISASTER PREPAREDNESS AND PLANNING [9]

Introduction, Objectives – Disaster planning, Strategies for disaster preparedness and planning – Principles, Myths, Factors influencing disaster risk - Assessing risk in a context of uncertainty - Disaster insurance – use of the media in information dissemination – Types of media and their information needs.

Total (L: 45 T: 0) = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO 1: Explain the nature and causes of disaster
CO 2: Describe the various risk and take steps to mitigate various types of disaster
CO 3: Illustrate the various Disaster prevention and control methods
CO 4: Describe the various policies and act in Management in India
CO 5: Explain recent strategies towards disasters preparedness and planning.

Text Books:

1. Satish Modh, Introduction to Disaster Management, Macmillian publishers India ltd, New Delhi, Second Edition, 2019
2. Pardeep Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, Fourth Edition 2018.

Reference Books:

1. M. Saravanakumar, Disaster Management, Himalaya Publishing House, New Delhi, Second Edition, 2017
2. Singh, Disaster Management: Future Challenges, IK International, New Delhi, Second Edition, 2017.
3. Arvind Kumar Disaster Management – Recent Approaches Anmol Publications, New Delhi, First Edition, 2016.
4. Sathish Modh, Introduction to Disaster Management, Macmillan, New Delhi, Seventh Edition, 2014

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		L	T	P	C
18MA081	**OPERATIONS RESEARCH (Open Elective)**	3	0	0	3

Objective(s):

- *To study the concepts of optimization techniques for decision making problems.*
- *To acquire knowledge in Transportation Problems.*
- *To study the concepts of Assignment problems.*
- *To enumerate the concepts in stock control models.*
- *To study the concepts of project scheduling by network analysis.*

UNIT - I LINEAR PROGRAMMING PROBLEMS [9]

Introduction to applications of operations research in functional areas of management. Definition – Linear Programming Problem - Formulation of Linear Programming Problems - graphical and simplex method using slack variables.

UNIT - II TRANSPORTATION PROBLEMS [9]

Definition - Transportation Models (Minimizing and Maximizing Cases) Definition - Balanced and Unbalanced cases – Definition - Initial Basic feasible solution by North West Corner Rule, Least cost and Vogel's approximation methods. Optimal solution by Modified method.

UNIT - III ASSIGNMENT PROBLEMS [9]

Definition and basic concepts of Assignment Models (Minimizing and Maximizing Cases) – Balanced and Unbalanced Cases. Travelling Salesman Problem

UNIT - IV INVENTORY MODELS [9]

Definition and examples of Inventory Models – EOQ and EBQ Models (with and without shortages), Quantity Discount Models (one price break and two price breaks) and problems.

UNIT - V CPM / PERT ANALYSIS [9]

Definition - Critical path method – Definition - Project Evaluation and Review Techniques (PERT) analysis – Cost consideration in PERT / CPM and problems.

Total :45 Periods

Course Outcomes: On Completion of this course, the student will be able to

CO1: Develop the decision making during the uncertain situations by linear programming approach.

CO2: Solving the optimal solution in Transportation problems.

CO3: Applying the assignment problems to find the minimal assignment cost.

CO4: Apply the techniques of stock control to maximize the profit.

CO5: Develop the network techniques in project scheduling.

Text Books:

1 P.K. Gupta and Man Mohan Problems in Operations Research, S. Chand and Co , New Delhi, Twelfth edition, 2016.

2 Hamdy A.Taha, Introduction to Operation Research, Prentice Hall India, Nineth edition, 2013.

Reference Books :

1 Hira and Gupta, Problems in Operations Research, S.Chand & Co, New Delhi ,Tenth edition, 2015

2 N.D. Vorha, Quantitative Techniques in Management, Tata Mcgraw Hill , fourth Edition, 2013.

3 D. Somasundaram, Optimization Techniques, Narosa Publishing House ,New Delhi, second edition, 2009.

4 A.M.Natarajan, Operations research, Pearson Education , New Delhi , tenth edition, 2012.