M.KUMARASAMY COLLEGE OF ENGINEERING

(An Autonomous Institution and Affiliated to Anna University Chennai)

KARUR – 639 113

UG

CURRICULUM AND SYLLABUS

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION 2018

CURRICULUM AND SYLLABUS

REGULATION 2018

Programme:

B.E. —Electrical and Electronics Engineering

Vision of the Department:

To produce smart and dynamic professionals with profound theoretical and practical knowledge comparable with the best in the field.

Mission of the Department:

M1: Produce hi-tech professionals in the field of Electrical and Electronics Engineering by inculcating core knowledge.

M2: Produce highly competent professionals with thrust on research.

M3: Provide personalized training to the students for enriching their skills.

Programme Educational Objectives (PEOs):

PEO1: Graduates will have flourishing career in the core areas of Electrical Engineering and allied disciplines.

PEO2: Graduates will pursue higher studies and succeed in academic/research careers.

PEO3: Graduates will be a successful entrepreneur in creating jobs related to Electrical and Electronics Engineering /allied disciplines.

PEO4: Graduates will practice ethics and have habit of continuous learning for their success in the chosen career.

Mapping of Programme Educational Objectives with Mission of the Department:

PEOs / Department Mission Statements	M1	M2	M3
PEO1	3	2	2
PEO2	3	2	3
PEO3	3	3	3
PEO4	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Programme Outcomes (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

PSO1: Apply the basic concepts of mathematics and science to analyse and design circuits, controls, Electrical machines and drives to solve complex problems.

PSO2: Apply relevant models, resources and emerging tools and techniques to provide solutions to power and energy related issues & challenges.

PSO3: Design, Develop and implement methods and concepts to facilitate solutions for electrical and electronics engineering related real world problems.

Mapping of Programme Educational Objectives with Programme Outcomes and Programme Specific Outcomes:

PEOs / POs & PSOs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PEO1	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3
PEO2	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3
PEO3	3	3	3	3	3	2	3	2	2	2	3	3	3	3	3
PEO4	3	2	3	2	3	2	2	1	1	1	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Programme Articulation: Semester I

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	18LEH101J	Technical English	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	-	-	✓
I	18MAB101T	Calculus and Linear Algebra	✓	✓	✓	✓	✓	-	-	-	✓	-	-	✓	✓	✓	✓
I	18CYB101J	Chemistry	✓	✓	-	✓		-	-	-	-	-	-	-	✓	-	-
I	18MES101J	Engineering Graphics	✓	✓	✓	✓	✓		✓	✓	✓	✓	-	✓	✓	✓	✓
I	18EES101J	Basic Electrical and Electronics Engineering	✓	✓	✓	✓	✓		✓	✓	✓	✓	-	✓	✓	✓	✓
	18EES101J(R)		✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓	✓
I	18MBH102L	General Aptitude	✓	✓		✓	✓	-	-	-	✓	✓	✓	✓	-	-	✓
I	18LEM101T	Constitution of India	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-
I	18GNM102L	NSS	-	-	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-	-

Programme Articulation: Semester II

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
II	18LEH102J	Professional English	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	-	-	✓
II	18MAB102T	Advanced Calculus and Complex Analysis	✓	✓	✓	✓	✓	-	-	-	✓	-	-	✓	✓	✓	✓
II	18PYB101J	Physics	✓	✓	✓	✓	-	-	-	-	-	-	-		✓	✓	✓
II	18CSS101J / 18CSS101J(R)	Programming for Problem Solving	✓	-	-	-	-	-	-	-	✓	✓	-	✓	✓	✓	✓
II	18MES102J	Basic Civil and Mechanical Engineering	✓	-	✓	-	✓	✓	✓	-	✓	-	-	✓	✓	-	-
II	18MBH101L	Professional Skills and Practices	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	✓
II	18LEM102T	Value Education	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-	✓	✓	-	-
II	18GNM101L	Physical and Mental Health using Yoga	-	-	-	-	-	✓	-	-	-						-

Programme Articulation: Semester III

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
III	18MAB201T	Transforms and Partial Differential Equations	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
III	18EES103T/ 18EES201T	Analog Electronics	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-	-
III	18EEC201T	Electro Magnetic Theory	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	✓	✓
III	18EEC202T	Electrical Machines I	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓
III	18EEC203J	Measurements and Instrumentation	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	-	✓
III	18EEC204T	Electric Power Generation	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
III	18EEC205L	Electrical Machines I Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓
III	18EEC206L	Analog Electronics Laboratory	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	-	✓
III	18EEP201L	Minor Project I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
III	18MBM201L	Competencies in Social Skills	✓	-	-	-	-	-	-	-	✓	✓	-	-	✓	✓	✓
III	18LEM103T	Indian Tradition and Heritage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-	-

Programme Articulation: Semester IV

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
IV	18MAB204T	Statistics and Numerical Methods	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	✓
IV	18EES104J/ 18EES202J	Digital Electronics	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓
IV	18EEC207T	Electrical Machines II	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓
IV	18EEC208T	Transmission and Distribution	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IV	18EEC209T	Control Systems	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	-	-
IV	18EEC210T	Power Electronics and Converters	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓	✓
IV	18EEC211L	Electrical Machines II Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓
IV	18EEC212L	Control System Laboratory	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	-	✓
IV	18EEP202L	Minor Project II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IV	18MBM202L	Critical and Creative Thinking Skills	✓	-	-	-	-	-	-	-	-	✓			✓	✓	✓
IV	18CYM201T	Environmental Science	-	✓	-	✓	-	✓	✓	✓							-

Programme Articulation: Semester V

Semester	Course Code	Course Name	POs											PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
V	18EEC301T	Power System Analysis	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓	✓
V	18EEC302T	Microcontroller and Embedded System	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓
V	18EEC303L	Power Electronics and Converters Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	-	-	✓	✓	✓	✓
V	18EEC304L	Microcontroller and Embedded System Laboratory	✓	✓	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓
V	18EEP301L	Minor Project III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
V	18EEP101N	MOOC I / Industrial Training I	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓
V	18MBM301L	Analytical and Logical Thinking Skills	✓	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-
V	18LEM301T	Indian Art Forms	-	-	-	-	-	✓	✓	✓	✓	✓		✓	-	-	-

Programme Articulation: Semester VI

Semester	Course Code	Course Name	POs											PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
VI	18MBH201T	Management Principles for Engineers	✓	✓	-	-	-	✓	-	-	✓	✓	✓	✓	-	-	-
VI	18EEC305T	Power System Protection and Switchgear	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓
VI	18EEC306T	Solid State Drives	✓	✓	✓	-	-	✓	✓	-	✓	✓	-	✓	✓	-	-
VI	18EEC307L	Power System Simulation Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓	✓	✓	✓
VI	18EEC308L	Solid State Drives Laboratory	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓	✓	-
VI	18EEP302L	Minor Project IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VI	18EEP102N	MOOC II / Industrial Training II	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓
VI	18MBM302L	Employability Skills and Practices	✓	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-
VI	18LEM302T	Self Development and Entrepreneurship	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓	✓		-	-

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Programme Articulation: Semester VII

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
VII	18MBH202T	Social Engineering	✓	✓	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-	-
VII	18EEP401L	Project work I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Programme Articulation: Semester VIII

Semester	Course Code	Course Name	POs												PSOs		
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
VIII	18EEP402L	Project work II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Professional Elective courses - Group 1

Course Code	Course Name	POs												PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
18EEE001T	Power System Operation and Control	✓	✓	✓	✓	✓	-	✓	-	✓	-	✓	-	✓	✓	✓
18EEE002T	Design of Electrical Machines	✓	✓	✓	✓	-	✓	✓	-	-	-	✓	✓	✓	✓	✓
18EEE003T	Electric Power Utilization and Energy Auditing	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18EEE004T	Restructured Power System	✓	✓	✓	✓	-	-	✓	✓	-	-	-	-	-	✓	✓
18EEE005T	Digital Signal Processing	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓
18EEE006T	Advanced Control Systems	✓	✓	✓	-	-	-	-	✓	✓	✓	-	✓	✓	-	✓

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Professional Elective courses - Group 2

Course Code	Course Name	POs												PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
18EEE007T	Wind Energy Conversion Systems	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓
18EEE008T	High Voltage DC Transmission	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓
18EEE009T	High Voltage Engineering	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓	✓
18EEE010T	Communication Engineering	✓	✓	✓	-	-	✓	✓	-	-	-	-	✓	✓	✓	✓
18EEE011T	Electric Vehicles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18EEE012T	Smart Grid	✓	✓	✓	-	✓	-	✓	-	✓	✓	-	✓	✓	✓	✓
18EEE013T	Artificial Intelligence Systems	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	-	✓	✓
18EEE014T	Bio Medical Engineering	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓
18EEE015T	VLSI Design	✓	✓	✓	-	-	✓	✓	-	-	-	✓	✓	✓	✓	✓
18EEE016T	Flexible AC Transmission Systems	✓	✓	✓	✓	✓	✓	-	✓	-	✓	-	✓	✓	✓	✓
18EEE017T	Special Electrical Machines	✓	✓	✓	✓	-	✓	-	-	✓	✓	✓	✓	✓	-	✓
18EEE018T	Power Quality	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓	✓
18EEE019T	Virtual Instrumentation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
18EEE020T	Solar Energy Utilization	✓	✓	-	-	-	✓	✓	-	-	-	✓	✓	✓	✓	✓
18EEE021T	Energy Storing Devices and Fuel Cells	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓	-	-
18EEE022T	Fundamentals of IoT	✓	✓	✓	-	-	✓	✓	-	-	-	-	✓	✓	✓	✓

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Structure of Curriculum

Sl.No.	Category	Credits
1	Humanities and Social Sciences including Management courses (H)	12
2	Basic Science courses (B)	26
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.(S)	21
4	Professional core courses (C)	50
5	Professional Elective courses relevant to chosen specialization/branch (E)	20 / 26
6	Open Electives –Electives from other technical and /or emerging subjects (O)	15 / 9
7	Project work, Minor project and internship in industry or elsewhere (P)	16
8	Mandatory Courses (M) [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	04
	Total Credits	164*

*Minor variation is allowed as per need of the respective disciplines

1. Humanities and Social Sciences including Management courses (H)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18LEH101J	Technical English	2	0	2	3
18LEH102J	Professional English	2	0	2	3
18MBH101L	Professional Skills and Practices	0	0	2	1
18MBH102L	General Aptitude	0	0	2	1
18MBH20IT	Management Principles for Engineers	2	0	0	2
18MBH202T	Social Engineering	2	0	0	2
				Total Credits	12

L-Lecture T-Tutorial P-Practical

2. Basic Science courses (B)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PYB101J	Physics	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB201T	Transforms and Partial Differential Equations	3	1	0	4
18MAB204T	Statistics and Numerical Methods	3	1	0	4
				Total Credits	26

L-Lecture T-Tutorial P-Practical

3. Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc (S)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MES101J	Engineering Graphics	1	0	4	3
18EES101J	Basic Electrical and Electronics Engineering	3	0	2	4
18MES102J	Basic Civil and Mechanical Engineering	3	0	2	4
18CSS101J(R)	Programming for Problem Solving	2	0	2	3
18EES103T	Analog Electronics	3	0	0	3
18EES104J	Digital Electronics	3	0	2	4
				Total Credits	21

L-Lecture T-Tutorial P-Practical

4. Professional core courses (C)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EEC201T	Electro Magnetic Theory	3	0	0	3
18EEC202T	Electrical Machines I	3	0	0	3
18EEC203J	Measurements and Instrumentation	3	0	2	4
18EEC204T	Electric Power Generation	3	0	0	3
18EEC205L	Electrical Machines I Laboratory	0	0	3	1.5
18EEC206L	Analog Electronics Laboratory	0	0	3	1.5
18EEC207T	Electrical Machines II	3	0	0	3
18EEC208T	Transmission and Distribution	3	0	0	3
18EEC209T	Control Systems	3	0	0	3

2. Basic Science courses (B)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18PYB101J	Physics	3	1	2	5
18CYB101J	Chemistry	3	1	2	5
18MAB101T	Calculus and Linear Algebra	3	1	0	4
18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
18MAB201T	Transforms and Partial Differential Equations	3	1	0	4
18MAB204T	Statistics and Numerical Methods	3	1	0	4
				Total Credits	26

3. Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc (S)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18MES101J	Engineering Graphics	1	0	4	3
18EES101J/ 18EES101J(R)	Basic Electrical and Electronics Engineering	3	0	2	4
18MES102J	Basic Civil and Mechanical Engineering	3	0	2	4
18CSS101J/ 18CSS101J(R)	Programming for Problem Solving	1	0	4	3
		2	0	2	3
18EES103T/ 18EES201T	Analog Electronics	3	0	0	3
18EES104J/ 18EES202J	Digital Electronics	3	0	2	4
	Total Credits				21

L-Lecture T-Tutorial P-Practical

4. Professional Core courses (C)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EEC201T	Electro Magnetic Theory	3	0	0	3
18EEC202T	Electrical Machines I	3	0	0	3
18EEC203J	Measurements and Instrumentation	3	0	2	4
18EEC204T	Electric Power Generation	3	0	0	3
18EEC205L	Electrical Machines I Laboratory	0	0	3	1.5
18EEC206L	Analog Electronics Laboratory	0	0	3	1.5
18EEC207T	Electrical Machines II	3	0	0	3
18EEC208T	Transmission and Distribution	3	0	0	3
18EEC209T	Control Systems	3	0	0	3

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18EEC210T	Power Electronics and Converters	3	0	0	3
18EEC211L	Electrical Machines II Laboratory	0	0	3	1.5
18EEC212L	Control System Laboratory	0	0	3	1.5
18EEC301T	Power System Analysis	3	1	0	4
18EEC302T	Microcontroller and Embedded System	3	0	0	3
18EEC303L	Power Electronics and Converters Laboratory	0	0	3	1.5
18EEC304L	Microcontroller and Embedded System Laboratory	0	0	3	1.5
18EEC305T	Power System Protection and Switchgear	3	0	0	3
18EEC306T	Solid State Drives	3	0	0	3
18EEC307L	Power System Simulation Laboratory	0	0	3	1.5
18EEC308L	Solid State Drives Laboratory	0	0	3	1.5
				Total Credits	50

L-Lecture T-Tutorial P-Practical

5. Professional Elective courses relevant to chosen specialization/branch (E)

Course Code	Course Name	Hours / Week			C
		L	T	P	
Professional Elective courses - Group 1					
18EEE001T	Power System Operation and Control	3	1	0	4
18EEE002T	Design of Electrical Machines	3	1	0	4
18EEE003T	Electric Power Utilization and Energy Auditing	3	1	0	4
18EEE004T	Restructured Power System	3	1	0	4
18EEE005T	Digital Signal Processing	3	1	0	4
18EEE006T	Advanced Control Systems	3	1	0	4
Professional Elective courses - Group 2					
18EEE007T	Wind Energy Conversion Systems	3	0	0	3
18EEE008T	High Voltage DC Transmission	3	0	0	3
18EEE009T	High Voltage Engineering	3	0	0	3
18EEE010T	Communication Engineering	3	0	0	3
18EEE011T	Electric Vehicles	3	0	0	3

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18EEE018T	Power Quality	3	0	0	3
18EEE019T	Virtual Instrumentation	3	0	0	3
18EEE020T	Solar Energy Utilization	3	0	0	3
				Total Credits	20

L-Lecture T-Tutorial P-Practical

6. Open subjects –Electives from other technical and /or emerging subjects (O) (Any 5 Courses)

Course Code	Course Name	Hours / Week			C
		L	T	P	
Department of Computer Science Engineering					
18CSO001T	Data Structures and Algorithm	3	0	0	3
18CSO002J	Python programming	1	0	4	3
18CSO003J	Web Programming	1	0	4	3
18CSO004J	Mobile Application Development	1	0	4	3
18CSO005T	Agile Methodology	3	0	0	3
Department of Mechanical Engineering					
18MEO001T	Industrial Safety Engineering	3	0	0	3
18MEO002T	Energy Engineering	3	0	0	3
18MEO003T	Automobile Engineering	3	0	0	3
18MEO004T	Nanotechnology	3	0	0	3
18MEO005T	Product Design and Development	3	0	0	3
Department of Information Technology					
18ITO001J	Problem Solving Techniques Using Python	1	0	4	3
18ITO002J	Java Programming	1	0	4	3
18ITO003J	Game Design and Development	1	0	4	3
18ITO004J	Web Design	2	0	2	3
18ITO005J	Data Structures	2	0	2	3
Department of Civil Engineering					
18CEO001T	Building Services	3	0	0	3
18CEO002T	Disaster Preparedness, Planning and Management	3	0	0	3
18CEO003T	Environmental Impact Assessment	3	0	0	3
18CEO004T	Remote Sensing and GIS	3	0	0	3
18CEE022T/ 18CEO005T	Metro System and Engineering	3	0	0	3

18EEE012T	Smart Grid	3	0	0	3
18EEE013T	Artificial Intelligence Systems	3	0	0	3
18EEE014T	Bio Medical Engineering	3	0	0	3
18EEE015T	VLSI Design	3	0	0	3
18EEE016T	Flexible AC Transmission Systems	3	0	0	3
18EEE017T	Special Electrical Machines	3	0	0	3
18EEE018T	Power Quality	3	0	0	3
18EEE019T	Virtual Instrumentation	3	0	0	3
18EEE020T	Solar Energy Utilization	3	0	0	3
18EEE021T	Energy Storing Devices and Fuel Cells	3	0	0	3
18EEE022T	Fundamentals of IoT	3	0	0	3
				Total Credits	20/26*

* Credits based on open elective choice L-Lecture T-Tutorial P-Practical

6. Open Elective offered by Other Department (O)

Course Code	Course Name	Hours / Week			C
		L	T	P	
Department of Computer Science Engineering					
18CSO001T	Basics of Data Structures and Algorithms	3	0	0	3
18CSO002J	Fundamentals of Python Programming	2	0	2	3
18CSO003J	Fundamentals of Java Programming	2	0	2	3
18CSO004J	Mobile Application Development	2	0	2	3
18CSO005T	Software Development using Agile	3	0	0	3
Department of Mechanical Engineering					
18MEO001T	Industrial Safety for Engineers	3	0	0	3
18MEO002T	Energy Engineering	3	0	0	3
18MEO003T	Automobile Technology	3	0	0	3
18MEO004T	Advances in Nanotechnology	3	0	0	3
18MEO005T	Product Design and Development	3	0	0	3

Department of Information Technology					
18ITO001J	Problem Solving Techniques Using Python	1	0	4	3
18ITO002J	Java Programming	1	0	4	3
18ITO003J	Game Design and Development	1	0	4	3
18ITO004J	Web Design	2	0	2	3
18ITO005J	Data Structures	2	0	2	3
Department of Civil Engineering					
18CEO001T	Building Services	3	0	0	3
18CEO002T	Disaster Preparedness, Planning and Management	3	0	0	3
18CEO003T	Environmental Impact Assessment	3	0	0	3
18CEO004T	Remote Sensing and GIS	3	0	0	3
18CEO005T	Metro System and Engineering	3	0	0	3
Department of Electronics and Instrumentation Engineering					
18EIO001T	Basics of Automation	3	0	0	3
18EIO002T	Automotive Electronics	3	0	0	3
18EIO003T	Programmable Logic Controllers	3	0	0	3
18EIO004T	Introduction to MEMS	3	0	0	3
18EIO005T	Smart Sensor Technology	3	0	0	3
Department of Electronics and Communication Engineering					
18ECO001T	Microcontrollers and Embedded systems	3	0	0	3
18ECO002T	Internet of Everything	3	0	0	3
18ECO003T	Wireless Mobile Communication	3	0	0	3
18ECO004T	Medical Engineering	3	0	0	3
18ECO005T	Signal and Image Processing	3	0	0	3

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Open Electives Offered to Other Departments by Electrical and Electronics Engineering Department (O)					
18EEO001T	Basics of Internet of Things	3	0	0	3
18EEO002T	Fundamentals of Smart Grid	3	0	0	3
18EEO003T	Robotics	3	0	0	3
18EEO004T	Energy Storing Devices	3	0	0	3
18EEO005T	Fundamentals of Electric Vehicles	3	0	0	3

L-Lecture T-Tutorial P-Practical

7. Project work, minor project and internship in industry or elsewhere (P)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EEP101N	MOOC I / Industrial Training I	0	0	2*	1
18EEP102N	MOOC II / Industrial Training II	0	0	2*	1
18EEP201L	Minor Project I	0	0	2	1
18EEP202L	Minor Project II	0	0	2	1
18EEP301L	Minor Project III	0	0	2	1
18EEP302L	Minor Project IV	0	0	2	1
18EEP401L	Project work I	0	0	2	2
18EEP402L	Project work II	0	0	16	8
				Total Credits	16

* Can be Conducted as non-Contact hours L-Lecture T-Tutorial P-Practical

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8. Mandatory Courses (M)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18LEM101T	Constitution of India	1	0	0	Nil
18LEM102T	Value Education	1	0	0	Nil
18GNM101L	Physical and Mental Health using Yoga	0	0	2	Nil
18GNM102L	NSS	0	0	2	Nil
18MBM201L	Competencies in Social Skills	0	0	2	1
18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
18CYM201T	Environmental Science	1	0	0	Nil
18LEM103T	Indian Tradition and Heritage	1	0	0	Nil
18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
18MBM302L	Employability Skills and Practices	0	0	2	1
18LEM301T	Indian Art Forms	1	0	0	Nil
18LEM302T	Self Development and Entrepreneurship	1	0	0	Nil
				Total Credits	4

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9. One Credit Courses (X)

Course Code	Course Name	Hours / Week			C
		L	T	P	
18EEX001J	Embedded System Using Arm Controllers	2	0	1	1
18EEX002J	Lab VIEW Programming	1	0	2	1
				Total Credits	3*

* Maximum of 3 Credit can be availed

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TCS one credit course approved in 9th BOS meeting of CSE.

Regulation 2016:

Course Code	Course Name	Credit
16CSY10	Data Center and Cloud Basics	1

Regulation 2018:

Course Code	Course Name	Credit
18CSX005T	Data Center and Cloud Basics	1

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Approved By
Board of Computer Science On
27 OCT 2020
KARUR - 639 113

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BOARD OF STUDIES (VIRTUAL MEETING)

DATE: 27.10.2020 **MEETING.NO : 09**

TIME : 11.30 AM

Minutes of the Meeting

9.1 Highlights of the Institution is presented by the board chairman.

9.2 Highlights of the Department is presented by the board chairman.

9.3 Confirmation of the minutes of 8thBOS Meeting held on 11.03.2019

- The minutes of 8th Board of Studies Meeting held on 11.03.2019 was confirmed

9.4 Discussion on – Agile Methodology – TCS recommended Industry Elective course

- Syllabus content framed and offered by TCS end, is presented in the discussion forum.
- The members felt that the content is well framed and the students will really get an exposure on project development using 'Jile'.

9.5 Discussion on one credit courses offered by the department and the one credit course offered by TCS – Data Center and Cloud Basics

- The following one credit courses presented are verified and suggested to offer for computer science and engineering students(Curriculum- R2018).
  - ✓ Animations
  - ✓ Problem Solving using C++
  - ✓ ReactJS
  - ✓ Statistical Analysis using R
  - ✓ Data Center and Cloud Basics
  - ✓ Ethics in Cyber Security
  - ✓ MongoDB
- Data Center and Cloud Basics content framed by TCS is presented and is recommended by all members to offer as an one credit course (Curriculum- R2016 and R2018) for Computer Science and Engineering and other Engineering stream students also.

9.6 Discussion on B.E – CSE – Regulation 2018 – Syllabus for 5th to 8th Semester Courses

- The members verified the syllabus from 5th semester to 8th semester courses of regulation 2018

Curriculum :

Semester I						
Category	Course Code	Course Name	Hours / Week			Credits
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J	Engineering Graphics / Programming for Problem Solving	1	0	4	3
	18CSS101J		1	0	4	
	18CSS101J(R)		2	0	2	
S	18MES102J / 18EES101J/ 18EES101J(R)	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

Semester II						
Category	Course Code	Course Name	Hours / Week			Credits
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J	Engineering Graphics/ Programming for Problem Solving	1	0	4	3
	18CSS101J		1	0	4	
	18CSS101J(R)		2	0	2	
S	18MES102J / 18EES101J 18EES101J(R)	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

I to VIII Semester Curriculum

Semester I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

Semester II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J / 18CSS101J (R)	Engineering Graphics / Programming for Problem Solving	1	0	4	3
			2	0	2	
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

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I to VIII Semester Curriculum

Semester I						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	Technical English	2	0	2	3
B	18MAB101T	Calculus and Linear Algebra	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J	Engineering Graphics / Programming for Problem Solving	1	0	4	3
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM101T	Constitution of India	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

Semester II						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	Professional English	2	0	2	3
B	18MAB102T	Advanced Calculus and Complex Analysis	3	1	0	4
B	18PYB101J / 18CYB101J	Physics / Chemistry	3	1	2	5
S	18MES101J / 18CSS101J	Engineering Graphics / Programming for Problem Solving	1	0	4	3
S	18MES102J / 18EES101J	Basic Civil and Mechanical Engineering / Basic Electrical and Electronics Engineering	3	0	2	4
H	18MBH101L / 18MBH102L	Professional Skills and Practices / General Aptitude	0	0	2	1
M	18LEM102T	Value Education	1	0	0	Nil
M	18GNM101L / 18GNM102L	Physical and Mental Health using Yoga / NSS	0	0	2	Nil
					Total Credits	20

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Curriculum

Semester III						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB201T	Transforms and Partial Differential Equations	3	1	0	4
S	18EES103T/ 18EES201T	Analog Electronics	3	0	0	3
C	18EEC201T	Electro Magnetic Theory	3	0	0	3
C	18EEC202T	Electrical Machines I	3	0	0	3
C	18EEC203J	Measurements and Instrumentation	3	0	2	4
C	18EEC204T	Electric Power Generation	3	0	0	3
C	18EEC205L	Electrical Machines I Laboratory	0	0	3	1.5
C	18EEC206L	Analog Electronics Laboratory	0	0	3	1.5
P	18EEP201L	Minor Project I	0	0	2	1
M	18MBM201L	Competencies in Social Skills	0	0	2	1
M	18CYM201T/ 18LEM103T	Environmental Science / Indian Tradition and Heritage	1	0	0	Nil
					Total Credits	25

Semester IV						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB204T	Statistics and Numerical Methods	3	1	0	4
S	18EES104J/ 18EES202J	Digital Electronics	3	0	2	4
C	18EEC207T	Electrical Machines II	3	0	0	3
C	18EEC208T	Transmission and Distribution	3	0	0	3
C	18EEC209T	Control Systems	3	0	0	3
C	18EEC210T	Power Electronics and Converters	3	0	0	3
C	18EEC211L	Electrical Machines II Laboratory	0	0	3	1.5
C	18EEC212L	Control System Laboratory	0	0	3	1.5
P	18EEP202L	Minor Project II	0	0	2	1
M	18MBM202L	Critical and Creative Thinking Skills	0	0	2	1
M	18CYM201T/ 18LEM103T	Environmental Science / Indian Tradition and Heritage	1	0	0	Nil
					Total Credits	25

Curriculum :

Semester V						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC301T	Power System Analysis	3	1	0	4
C	18EEC302T	Microcontroller and Embedded System	3	0	0	3
C	18EEC303L	Power Electronics and Converters Laboratory	0	0	3	1.5
C	18EEC304L	Microcontroller and Embedded System Laboratory	0	0	3	1.5
E	18EEEXXXT	Professional Elective - G 1	3	1	0	4
E	18EEEXXXT	Professional Elective - G 1	3	1	0	4
O	18ZZO00YT/J	Open Elective - 1	3	0	0	3
P	18EEP301L	Minor Project III	0	0	2	1
P	18EEP101N	MOOC I / Industrial Training I	0	0	2*	1
M	18MBM301L	Analytical and Logical Thinking Skills	0	0	2	1
M	18LEM301T/ 18LEM302T	Indian Art Forms / Self Development and Entrepreneurship	1	0	0	Nil
					Total Credits	24

Semester VI						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH20IT	Management Principles for Engineers	2	0	0	2
C	18EEC305T	Power System Protection and Switchgear	3	0	0	3
C	18EEC306T	Solid State Drives	3	0	0	3
C	18EEC307L	Power System Simulation Laboratory	0	0	3	1.5
C	18EEC308L	Solid State Drives Laboratory	0	0	3	1.5
E	18EEEXXXT	Professional Elective - G 2	3	0	0	3
E	18EEEXXXT	Professional Elective - G 2	3	0	0	3
O	18ZZO00YT/J	Open Elective - 2				3
P	18EEP302L	Minor Project IV	0	0	2	1
P	18EEP102N	MOOC II / Industrial Training II	0	0	2*	1
M	18MBM302L	Employability Skills and Practices	0	0	2	1
M	18LEM301T/ 18LEM302T	Indian Art Forms / Self Development and Entrepreneurship	1	0	0	Nil
					Total Credits	23

* Can be Conducted as non-Contact hours

Curriculum :

Semester VII						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH202T	Social Engineering	2	0	0	2
E	18EEEXXXT	Professional Elective - G 2	3	0	0	3
E	18EEEXXXT	Professional Elective - G 2	3	0	0	3
O	18ZZO00YT/J	Open Elective -3				3
P	18EEP401L	Project work I	0	0	2	2
					Total Credits	13

Semester VIII						
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E / O	18EEEXXXT/ 18ZZO00YT/J	Professional Elective - G2 / Open Elective - 4				3
E / O	18EEEXXXT/ 18ZZO00YT/J	Professional Elective - G2 / Open Elective - 5				3
P	18EEP402L	Project work II	0	0	16	8
					Total Credits	14

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Regulation 2018		Semester I	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH101J	TECHNICAL ENGLISH	2	0	2	3

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Analyze the importance of communication in personal, professional contexts. Identify proper English pronunciation
CLR-2	Strengthen vocabulary and grammar. Enhance listening and writing comprehension. Review films and documentaries
CLR-3	Writing brief paragraphs using appropriate techniques. Enhance their English fluency in speaking
CLR-4	Write effective essays, stories. Experience workplace communication aspects
CLR-5	Research on a topic and write a comprehensible academic project reports. Make effective presentations

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify types, modes, channels and barriers of communication. distinguish different speech sounds, pronounce correctly
CO2	Identify, rectify the errors in the use of grammar and vocabulary. Improve listening and writing skills
CO3	Develop a topic idea into a cohesive paragraph with examples. Improve the fluency of speaking skills
CO4	Develop ideas into logical and coherent essays. Understand better the workplace culture
CO5	Identify the steps involved in writing an academic project report. List and practice skills need for making a presentation

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO2	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO3	1	3	1	3	3	2	1	3	3	3	-	3	-	-	-
CO4	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO5	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO (Avg)	1	3	1	3	3	2.8	1	3	3	3	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	COMMUNICATION	6

Definition, Process of communication - (Filling in-Class Worksheets) - Verbal and Non-Verbal Communication(Individual and Group Activities - Role play)-Other Types of Communication: General-Technical-Formal, Informal- External, Internal (Write upon a selected type of communication)- Listening, Speaking, Reading, Writing(Group activity (Newspaper) – Discussion and Feedback)- Communication and Language Barriers(Individual Activity- Sharing of Personal Experiences)-Body language(Mime).

UNIT II	VOCABULARY AND GRAMMAR	7

Words with Foreign Roots, Word Formation – Inflectional, Derivational Prefixes, Suffixes(Quiz - Identifying the Borrowed roots and Their Meanings-Worksheet Exercise)-Synonyms and Antonyms and Standard Abbreviations(Context Based Activity / Learner Compiling Standard Abbreviations from Core Subject)-Homonyms and Homophones(Fun Activities – Worksheets- Cross Words)-Articles, Tenses(Exercise through Worksheets- Individual Activity -Peer Correction- Open Discussion)- Noun-Pronoun Agreement and Subject-Verb Agreement(Identifying and Learning through Error Analysis – Worksheets)-Misplaced Modifiers - Prepositions- Prepositional verbs and Phrasal verbs(Learn through Practice – Placing Same Modifier in Different Places in a Sentence)-Prepositions- Prepositional Verbs and Phrasal Verbs(Filling in-Class Worksheets)

UNIT III	DISCOURSE TECHNIQUES	7

Sentence Structure, Phrases and Clauses(Exercise: Worksheet, Identifying Phrases, Clauses, Compound, Complex Sentences)-Developing Ideas into Paragraphs –Cohesion Markers(Identify Topic sentence in a Paragraph; Writing a Paragraph Based on a Topic)- -Inputs on Writing Precisely, Redundancies, Wordiness-Repetition-Clichés(Error Analysis and Editing)-Defining, Describing Technical Terms(Writing Definitions-Product and Process Description)-Inputs on Classifying/Categorising and Sequencing Ideas with Relevant Diagrams(Writing a Passage on the Given hints, Tree Diagram, Classification Table and Flow Chart)-Importance of Punctuation – Miscommunication –(Fun Activities - Worksheets for Appropriate Punctuation – Written)- Errors in Punctuation(Fun Activities - Worksheets for Appropriate Punctuation – Written)

UNIT IV	WORKPLACE COMMUNICATION	6

Reading Comprehension, Guidelines questions (Referential, Critical,Interpretative)(Practice Excercise) - Précis-writing Guidelines(Practice Excercise) - Summarising(Group Activity (Oral/Written) on the Given Passages)-Essay Writing Guidelines: Introduction, Elaboration and Conclusion with Examples(Individual Activity (Written) on the Given Topic)-Organisational Report Writing - Progress Report- Guidelines(Writing a Progress Report)-Interview Skills(Mock Interview).

UNIT V	PROJECT WRITING	5

Topics for Project Writing(Discussion)- Collection of Data – Avoiding Plagiarism-Authenticity and Credibility of Data(Collection of Data for Verification)- Guidelines for Writing: Outline- Objectives-Background- Methodology-Discussion-Documentation(Drafting an Outline & Preparing References)-Discussion Using Sample Project(Writing the First Draft on the Selected Topic)-Checklist for Project Format (PPT)(Self-Verification and Submission of Final Draft).

LIST OF EXPERIMENTS	14

1. Often Mispronounced sounds (Audio Visual Material - Listening to minimal pairs and reproducing)
2. Barriers of communication Language barriers – videos (Identifying the Language Barriers of communication –Written)
3. Short Biographical Account on Famous Personalities –Video(Oral Paraphrasing of the Content Shown)
4. Listening to Long Conversations, Daily Life (Identify Various Communication Contexts and Answering Questions – Collocation)
5. Introduction to Englishes -British and American –Videos (Discussion on Difference between British

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	and American Words) 6. Speaking - Practice Activity – Brain Storming – Mind Mapping (Just a Minute) 7. Describing a Scene or Event –Videos (String Narration – Describing an Event or a Scene) 8. Technical Communication – Interpreting Data (Group Activity - Interpretation of Data - Oral Presentation) 9. Sample Case Studies for Work Ethics – Videos (Debate on the Videos Shown) 10. Learning Interview Techniques through Models (Mock Interview) 11. Guidelines for Preparing a PPT; Presentation Techniques (Preparing PPT on the Topic of Learners' Choice) 12. Formal Presentation
Text Book (s)	
1	Abirami K ,Technical English –, R.K.Publishers, Coimbatore.
Reference (s)	
1	Swan, Michael. Practical English Usage. OUP, 1995
2	Kumar Sanjay and PushpaLata. Communication Skills. OUP, 2011
3	CIEFL, Hyderabad. Exercises in Spoken English. Parts I-III. OUP
4	Anbazhagan K, Cauveri B, Devika M.P., English for Engineers. Cengage, 2016
5	www.mmm.english.com
6	www.onlinewriting.com/purdue
7	www.ieee.org/index.html

Regulation 2018		Semester I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB101T	CALCULUS AND LINEAR ALGEBRA	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Apply the Matrices in problems of Science and Engineering
2	Utilize Taylor series, Maxima minima and Jacobian in solving real- time application problems
3	Utilize the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering
4	Apply the concept of Differential Equations in problems of Science and Engineering
5	Applications of Sequences and Series in all problems involving Science and Engineering

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Apply Matrices, Eigenvalues and Eigen Vectors and Reduction of Quadratics form in Science and Engineering problem solving
CO2	Apply Maxima and Minima, Jacobian, and Taylor series to solve problems in Science and Engineering
CO3	Identify Radius, Centre, envelope and Circle of curvature and apply them in the problem solving
CO4	Solve the different types of Differential Equations in Science and Engineering applications
CO5	Apply convergence and divergence of series using different tests and apply sequences and Series in the problem solving

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	3	-	-	3	-	-	-
CO2	3	-	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	3	-	-	3	-	-	-
CO4	-	3	-	-	-	-	-	-	3	-	-	3	-	-	-
CO5	-	3	3	-	-	-	-	-	3	-	-	3	-	-	-
CO (Avg)	3	3	3	3	3	-	-	-	3	-	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	EIGEN VALUE PROBLEMS	9 + 3
Characteristic equation- Cayley-Hamilton theorem (excluding proof)- Eigen values and Eigen vectors of a real matrix – Properties- Orthogonal transformation of a symmetric matrix to diagonal form-Quadratic form-Reduction of quadratic form to canonical form by orthogonal transformation.		
UNIT II	FUNCTIONS OF SEVERAL VARIABLES	9 + 3
Partial derivatives-Euler's theorem for homogenous functions-Total derivatives-Differentiation of implicit functions-Jacobians-Taylor's expansion-Maxima and Minima-Method of Lagrangian multipliers.		
UNIT III	APPLICATIONS OF DIFFERENTIAL CALCULUS	9 + 3
Curvature and Radius of curvature – Circle of curvature and Centre of curvature-Envelope- Evolute as Envelope of Normals.		
UNIT IV	DIFFERENTIAL EQUATIONS OF SECOND ORDER	9 + 3
Second order linear differential equations with constant coefficients- Particular Integrals for x^n, e^{ax}, cosax/sinax, e^{ax}cosbx/e^{ax}sinbx - Method of variation of parameters-Cauchy and Legendre's linear equation-Simultaneous first order linear equations with constant coefficients.		
UNIT V	SEQUENCES AND SERIES	9 + 3
Sequences: Definition and examples-Series : Types and Convergence - Series of positive terms-Test of convergence: Comparison test, D'Alembert's ratio test, Integral test, Rabee's Root test and Log test-Alternating series-Leibnitz's test-Series of positive and negative terms(Alternating series)-Absolute and Conditional convergence.		
Text Book (s)		
1	B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.	
2	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.	
Reference (s)		
1	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008	
2	N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008	
3	G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson,Reprint, 2002	
4	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010	

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Regulation 2018		Semester I /Semester II	Total Hours			90
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18CYB101J	CHEMISTRY	3	1	2	5

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- Apply the basic principles of chemistry at both atomic and molecular levels in understanding the concepts related to the engineering field.
- Integrate the chemical principles in their projects undertaken in their respective fields
- Enhance the quality of a materials used in the product from the technological aspects for societal applications

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Identify the suitable polymeric materials fabrication processes in various application
CO2	Apply the basic principle of inorganic chemistry at the atomic and molecular levels
CO3	Apply the various thermodynamic and kinetics concepts to real system
CO4	Assemble a battery through the understanding of electrochemical principles
CO5	Catagorize the Engineering materials for their applications

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	3.00	-	-	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENGINEERING ORGANIC MATERIALS	9*+3*

Polymer – Introduction- classification(based on molecular weight, structure and usage)- types of polymerization(Addition, Condensation and Copolymerisation)-crystallinity, melting point and glass transition temperature-mechnism of polymerization(free radical addition polymerization)-elastomer- structure and curing(vulcanization)- Fabrication and molding of polymers(Injection molding and blow molding)- Engineering plastics – PE, PVC, PMMA, Phenol formaldehyde resin , urea formaldehyde resin(Preparation, properties and uses)- Industrial applications of polymers.

UNIT II	COORDINATION AND ORGANOMETALLIC COMPOUNDS	9*+3*

Co-ordination compounds – Introduction- nomenclature- types of ligands (mono, di and poly dendate ligands)- isomerism(structural and stereo isomerism) – theories of bonding(Werner and Sidgwick Pouvell theory(EAN rule)) – applications – EDTA titration – Organometallic compounds - synthesis(organo zinc, organo Lithium and Organo magnesium) – Applications (18 electron rule, Ziegler Natta Catalyst and Hydroformylation)

UNIT III	THERMODYNAMICS AND KINETICS	9*+3*

Introduction- first and second law of thermodynamics – Gibbs –Helmholtz equation – Clausius clapeyron equation – Maxwell relations – Vant hoff isotherm and Isochore (problems also)- Kinetics- Introduction- types of reactions(opposing, consecutive and parallel reactions)- chain reactions (HBr and HCl formation)- Applications of kinetics and thermodynamics.

UNIT IV	ENGINEERING ELECTROCHEMISTRY	9*+3*

Introduction- Conductors and its types - cells (Electrolytic and Electrochemical cells) – Standard electrode potential- Nernst equation of an electrode- types of electrodes (SHE and Calomal electrode)- Batteries –Types (Primary, Secondary, Flow and reserve battery)- Examples (Lead acid battery, Ni-Cd battery, Lithium battery, Lithium sulphur battery and Hydrogen- Oxygen fuel cells)- Graphene.

UNIT V	INDUSTRIAL APPLICATIONS OF CHEMISTRY	9*+3*

Cement (Types, manufacture and properties) – Paints (constitutions and functions)- Lubricants- types- mechanism – properties-abrasives – types –Diamond, Corundum, emery, garnet, quartz, Silicon carbide, carborundum-boron carbide, alundum (preparation, properties and uses) –applications – Basics of biosensor and biochips.

LIST OF EXPERIMENTS	30

1. Determination of total , permanent and temporary hardness of water sample (EDTA method)
2. Determination of alkalinity in water sample- Indicator method
3. Determination of chloride content of water sample by Argentometric method(Mohr's method)
4. Determination of dissolved oxygen content of water sample by winkler's method
5. Conductometric titration of strong acid with strong base
6. Conductometric titration of mixture of acids

7. Determination of strength and amount of Hydrochloric acid- pH metry 8. Estimation of strength and amount of ferrous ion by potentiometric method 9. Determination of molecular weight of a polymer by viscometry method 10. Estimation of ferrous ion by colorimetry. 11. Cement analysis

Text / Reference (s) books:	
1	B.L.Tembe, Kamaluddin and M.S.Krishnan , "Engineering chemistry"
2	S.S. Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd, New Delhi (2009).
3	P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., NewDelhi (2012).
4	Shashi Chawla, Engineering Chemistry: Dhanpat Rai &Co., 3rd Edition, 2015
5	www.nptel.ac.in

Regulation 2018		Semester I /Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18MES101J	**ENGINEERING GRAPHICS (EEE)**	1	0	4	3

Course Objective (s):

1. Construct ellipse, Parabola, hyperbola, cycloid and involutes.
2. Sketch the projection of points, straight lines and plane surfaces.
3. Sketch the Projection of simple solids like prisms, pyramids, cylinder and cone
4. Sketch the sectional solids and developing the lateral surfaces of simple solids
5. Understand the three dimensional drawing of simple solid by isometric projection and perspective projection, and convert isometric projection to orthographic projection.

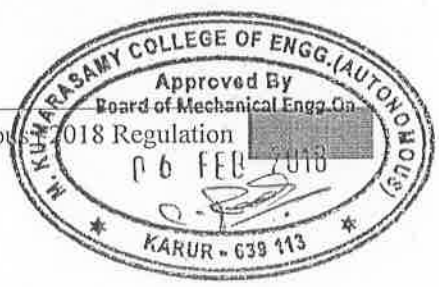
Course Outcome (s) (COs):

CO1	Apply engineering graphic fundamentals to draw/evaluate engineering curves.
CO2	Draw the graphics of engineering parts with point, line and plane projections
CO3	Draw projection of solid objects like prisms, cylinders, pyramids and cones used in engineering objects
CO4	Develop the lateral surfaces of the sectional solids.
CO5	Create 3D part models using isometric and perspective projection.

CO-PO Mapping

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2	PS O3
CO1	3	2	2	2	2	-	2	3	2	2	-	3	1	-	1
CO2	3	2	3	2	2	-	1	2	3	2	-	3	2	1	2
CO3	3	2	3	2	3	-	1	2	3	2	-	2	1	-	1
CO4	3	2	3	2	3	-	1	2	3	2	-	2	1	-	1
CO5	3	2	2	2	2	-	1	2	2	2	-	3	-	1	2
CO (Avg)	3	2	2.6	2	2.4	-	1.2	2.2	2.6	2	-	2.6	1.25	1	1.4

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**



UNIT I	PLANE CURVES	9
Principles of Engineering Graphics - Lettering - dimensioning - Curves used in engineering practices: Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method -- Construction of cycloid – construction of involutes -- Drawing of tangents and normal to the above curves.		
UNIT II	PROJECTION OF POINTS, LINES AND PLANE SURFACES	9
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations. Projection of polygonal surface and circular lamina inclined to both reference planes.		
UNIT III	PROJECTION OF SOLIDS	9
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.		
UNIT IV	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	9
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other -- Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.		
UNIT V	ISOMETRIC PERSPECTIVE AND ORTHOGRAPHICS PROJECTIONS	9
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method. Isometric to orthographic multi-view.		

Text Book (s)	
1	K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2010).
2	K. Venugopal& V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 15th edition (2018).
Reference (s)	
1	1. K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications, 2010.
2	2. R. L Jhala "Engineering Graphics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2015.
3	3. DhananjayA.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, 2008.
4	4. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.
5	5. M.S. Kumar, "Engineering Graphics", D.D. Publications, 2009.

List of Expertiments.

1	Spiral and involutes using bspline or cubic spline
2	Plan of residential building
3	Simple steel truss
4	Isometric projection of simple objects
5	Creation of 3D model
6	Orthographic projection of given 3D object
7	Projection of planes with inclination to reference plane
8	Solids with inclination to one reference plane
9	Section view of simple solids
10	Development of solids

Regulation 2018		Semester - I / Semester - II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18EES101J(R)	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	2	4

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Gain the knowledge about D.C and A.C circuits.
2	Impart the fundamentals of electrical machines.
3	Study the fundamentals of semiconductor devices
4	Study the working concepts of measuring instruments.
5	Know about digital logic concepts and operational amplifier.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Apply the concepts of ohm's law and Kirchhoff's law in DC and AC circuits
CO2	Explain the basic concepts of DC motor, DC generator, Transformer and Induction motor.
CO3	Summarize the nature of semiconductor devices.
CO4	Interpret the concept of measuring devices like PMMC, MI, energy meter and wattmeter.
CO5	Infer the concept of electronics devices and conversion techniques

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	1	1	-	1	3	1	1
CO2	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO3	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO4	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO5	3	-	1	1	1	-	-	-	1	1	-	1	3	1	1
CO (Avg)	3	2	1	1	1	-	-	-	1	1	-	1	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ELECTRICAL CIRCUITS	9

Electrical quantities: Resistors, Inductors, Capacitors - Ohm's Law - Kirchoff's Laws -Series and Parallel circuits - Analysis of DC circuits: Mesh & Nodal analysis, Thevenin's Theorem, Norton's Theorem & Maximum Power Transfer Theorem, Star delta Transformation, RL & RC Transient Analysis. Introduction to AC Circuits: Waveforms and RMS Value – Power and Power factor- Introduction to three phase systems – Types of connections, Relationship between line and phase values.

UNIT II	ELECTRICAL MACHINES	9

Faraday's laws- Construction, Principle of Operation, Basic Equations of DC Generators, DC Motors – Two Point & Three Point Starter – Construction, Working and EMF Equation of Single Phase Transformer – Construction and Working of AC Generator – Three Phase Induction Motor: Construction and Working of Squirrel Cage and Slip Ring Induction Motor – Single Phase Induction Motor (Split Phase, Capacitor Start Induction Motor).

UNIT III	ELECTRONIC DEVICES	9

Intrinsic and Extrinsic Semiconductors – PN junction diode , Zener diode and its Characteristics – Operation of Half Wave, Full Wave and Bridge Type Rectifiers – Bipolar Junction Transistor: Configurations and Characteristics of CB, CE, CC – Construction and Operation of JFET, MOSFET.

UNIT IV	MEASUREMENTS	9

Basic Principles and Classification of Instruments – Construction and Working of PMMC, MI Instruments (Attraction & Repulsion type) – Principle of Operation of Dynamometer Type Wattmeter, Induction Type Energy Meter – Instrument transformer – CRO – Megger.

UNIT V	DIGITAL & INTEGRATED CIRCUITS	9

Number Systems – Boolean Theorems– Logic Gates – Half Adder and Full Adder Circuit – Flip-Flops: RS, JK, T and D – A/D Converter (Successive Approximation Type) – D/A Converter (Binary Weighted Type) – Op-Amp : Functional Block and Types (Inverting , Non-Inverting & Differential Amplifier).

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LIST OF EXPERIMENTS	15

1. Verification of Ohm's & Kirchoff's Laws
2. Types of Wiring (Fluorescent Lamp & Staircase)
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Characteristics of PN Junction Diode
6. Characteristics of Common Base Configuration.
7. Characteristics of Common Emitter Configuration.
8. Measurement of Ripple Factor: Half Wave & Full Wave Rectifier.
9. Study of AC and DC Machines
10. Verification of Logic Gates
11. Study of PMMC and MI Meters

Text Book (s)	
1	R. Muthusubramanian, S. Salivahanan,"Basic Electrical and Electronics Engineering," Tata McGraw-Hill, 2012
2	Sawhney, A.K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2011.

Reference (s)	
1	Dash.S.S, Subramani.C, Vijayakumar.K, "Basic Electrical Engineering", Vijay Nicole, 1st Edition, 2013.
2	Jegatheesan.R, "Analysis of Electric Circuits", Tata McGraw-Hill, 2014.
3	Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", PHI Learning Private Ltd, 2nd Edition, 2010.

Regulation 2018		Semester I/ Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH102L	GENERAL APTITUDE	0	0	2	1

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR1	Recapitulate fundamental mathematical concepts and skills
CLR2	Hone critical thinking skills by analyzing the arguments with explicit and implicit premises
CLR3	Sharpen logical reasoning through skillful conceptualization
CLR4	Identify the relationships between words based on their function, usage and characteristics
CLR5	Nurture passion for enriching vocabulary
CLR6	Acquire the right knowledge, skill and aptitude to face any competitive examination.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Build a strong base in the fundamental mathematical concepts
CO2	Identify the approaches and strategies to solve problems with speed and accuracy
CO3	Gain appropriate skills to succeed in preliminary selection process for recruitment
CO4	Collectively solve problems in teams and groups
CO5	Build vocabulary through methodical approaches
CO6	Enhance lexical skills through systematic application of concepts and careful analysis of style, syntax, semantics and logic

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO2	-	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO3	-	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO4	1	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO5	-	3	-	3	2	-	-	-	3	3	1	3	-	-	-
CO6	-	3	-	3	2	-	-	-	3	3	-	3	-	-	-
CO (Avg)	1	3	-	3	2	-	-	-	3	3	1	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I		6
Types of numbers, Divisibility tests -Introduction to Significance of Verbal Aptitude in Competitive Examinations - LCM and GCD -Vocabulary enrichment techniques - Unit digit, Number of zeroes, Factorial notation - Vocabulary enrichment Techniques.		
UNIT II		**6**
Square root, Cube roots, Remainder - Identities - Contextual Vocabulary Exercise - Synonyms Fractions and Decimals, surds -Contextual Vocabulary Exercise -Antonyms		
UNIT III		**6**
Percentage Introduction - Sentence Completion Basic Level Exercises : Single Blank - Percentage Problems - Sentence Completion Basic Level Exercises : Double Blank - Profit and Loss - Cloze Test		
UNIT IV		**6**
Discount -Reading Comprehension – Introduction -Simple Interest - Reading Comprehension -- Summary & Main Idea - Compound Interest, Installments - Reading Comprehension -- Summary & Main Idea		
UNIT V		**6**
Logarithms Intro - Grammar Rules :A comprehensive Introduction - Logarithms Rules - Sentence Completion – Grammar - Linear Equations - Spotting Errors		

Text Book (s)

1	Nil

Reference (s)

1	Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Random House Reference, 2002
2	Merriam Webster's Vocabulary Builder, Merriam Webster Mass Market, 2010
3	Norman Lewis, How to Read Better and Faster, Goyal, 4th Edition
4	Franklin GRE Word List, 3861 GRE Words, Franklin Vocab System, 2014
5	Wiley's GMAT Reading Comprehension Grail, Wiley, 2016
6	Manhattan Prep GRE : Reading Comprehension and Essays, 5th Edition
7	Martin Hewings, Advanced Grammar in Use. Cambridge University Press, 2013
8	Nishit K. Sinha, The Pearson Guide to Quantitative Aptitude and Data Interpretation for the CAT
9	Dinesh Khattar-The Pearson Guide to QUANTITATIVE APTITUDE for competitive examinations

Regulation 2018		Semester I	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM101T	CONSTITUTION OF INDIA	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Utilize the citizen's rights
CLR-2	Utilize the basic citizen's fundamental rights of freedom of speech, expression, equality, religion and privacy
CLR-3	Identify the Indian constitutional framework with union parliament, government and their functions and citizen's rights
CLR-4	Utilize the States functionality and provisions for the betterment of the individual and society
CLR-5	Identify the emergency provisions, the functions of election and public service commissions, identify the tax system
CLR-6	Utilize the rights of a citizen both individual and as a society by understanding the constitutional provision and rights

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify the basic provisions in the Indian constitution
CO2	List the fundamental rights, rights to equality, freedom, religion, culture, education and the right against exploitation
CO3	Identify the fundamental duties of the Union of India, President, Vice-President, Union Ministers and Parliament functions
CO4	Identify the power of states, its legislature, Governors role and the state judiciary
CO5	List the special provisions and functionality of election commission, public service commission, individual tax and GST
CO6	Build knowledge on the various aspects in the Indian Constitution, its provisions and right of a citizen and the society

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	2	3	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO4	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO5	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO6	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-
CO (Avg)	-	-	-	-	-	-	2	3	3	3	2	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INDIAN CONSTITUTION	3
Meaning of the Constitution law and Constitutionalism- Historical perspective of the Constitution of India- Salient features and characteristics of the Constitution of India Citizenship- Scheme of the fundamental rights- Scheme of the Fundamental Duties and its legal status		
UNIT II	**FUNDAMENTAL RIGHTS**	**3**
The Directive Principles of State Policy- Scheme of the Fundamental Right to Equality- Scheme of the Fundamental Right to certain Freedom under Article 19- Scope of the Right to Life and Personal Liberty under Article 21- Union Government, Union Legislature (Parliament)- LokSabha and RajyaSabha (with Powers and Functions), Union Executive		
UNIT III	**POWERS AND FUNCTIONS OF CENTRAL GOVERNMENT**	**3**
President of India (with Powers and Functions)- Prime Minister of India (with Powers and Functions) - Union Judiciary (Supreme Court)- Jurisdiction of the Supreme Court - State Government, Legislature, Legislative Assembly, Legislative Council- Powers and Functions of the State Legislature, State Executive- Governor of the State (with Powers and Functions)		
UNIT IV	**POWERS AND FUNCTIONS OF STATE GOVERNMENT**	**3**
The Chief Minister of the State (with Powers and Functions)- State Judiciary (High Courts) Union Territory, Panchayat, Municipality- Scheduled and Tribal Areas- Co-operative Societies Consumer Rights - Consumer Protection Act		
UNIT V	**POWERS AND FUNCTIONS OF ELECTION AND SERVICE COMMISSION**	**3**
Local Self Government – Constitutional Scheme in India-Emergency Provisions : National, President Rule, Financial Emergency - Election Commission of India (with Powers and Functions) - The Union Public Service Commission (with Powers and Functions) - Amendment of the Constitutional Powers and Procedure -Income Tax, Goods and Services Tax		

Text Book (s)

	NIL

Reference (s)

1	DurgadasBasu, Introduction to the Constitution of India,Lexis- Nexis, 2015
2	Subash C Kashyap, Our Parliament, National Books Trust, 2011
3	Kaushal Kumar Agarwal, India's No 1 book on Tax : Simple Language Advanced Problems: Income Tax, Kindle, 2017
4	Vivek K R Agarwal, GST Guide for students: Making GST – Good and Simple Tax, Neelam Book House, 2017

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Regulation 2018		Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18LEH102J	PROFESSIONAL ENGLISH	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Develop team spirit and stress management skill
CLR-2	Demonstrate the interpersonal skills of the learners
CLR-3	Make learners perform well in interviews
CLR-4	Enable them to listen well and express their ideas, opinions effectively in official contexts
CLR-5	Sharpen their reading comprehension skill
CLR-6	Strengthen their official written communication skill.

Course Outcome (s) (COs):

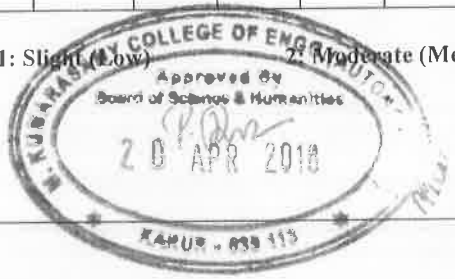
At the end of this course, learners will be able to:

CO1	Work in a team under any situation.
CO2	Practice interpersonal relationships in workplace
CO3	Face interviews confidently and successfully
CO4	Participate and excel in role plays, presentations and formal conversations.
CO5	Read and infer the meanings of technical and aesthetic passages.
CO6	Draft official letters, reports, memos, emails, etc.,

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO2	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO3	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO4	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO5	1	3	1	3	3	3	1	3	3	3	-	3	-	-	-
CO6	1	1	3	3	3	3	1	3	3	3	-	3	-	-	-
CO (Avg)	1	2.66	1.33	3	3	3	1	3	3	3	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	SOFT SKILLS	7
Introduction to Soft Skills(MCQ on Soft Skills)-Leadership Skills(Handling a Team) -Optimism & Business Etiquettes(Presentations on How to Handle Situations Effectively)-Team Management (Motivational Videos on Positive Thinking)- Time Management(Discussion on Real Time Hardships) -StressManagement(Handling Criticism)-Organizational Communication - Channels of Communication(Case Study).		
UNIT II	LISTENING	7
Listening Skills: Active Listening, Passive Listening(Classroom Listening Activities)-Methods for improving Listening Skills, Listening and its process – Barriers to Listening(Innovative Practices and Strategies for Better Listening) – Listening to Pre-Recorded video/audio (Listening to Famous Motivational Speeches)- Listening to Reading in the Class - for Vocabulary - for Complete Understanding – for Better Pronunciation(Read aloud a Story or an Article to Listen and Complete the Task) - Listening for General Content – Listening to fill up Information(Listening –fill in the Form Activity) – Intensive Listening for Specific Purpose-Listening to Monologues(Listening to Announcements) -Extensive Listening(Listening to Business News).		
UNIT III	SPEAKING	5
Defining Presentation and its Purpose; Audience & Local; Organizing Contents; Preparing Outline(Mini presentation)- Audio-Visual Aids; Nuances of Delivery; Body Language;(PPT Presentation) - Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice(Voice Modulation Practice)-Interviews &Its Types-Role Play(Mock Interview) -Group Discussion-Oral Presentations -Formal Conversations(Group Discussion Practice) .		
UNIT IV	READING	5
Reading & Its Types- Techniques for Good Comprehension, Reading Comprehension(Reading Comprehension Exercises) - Cloze Test ,Reading Newspaper- Editorials & Business Articles (Cloze Test Exercises)- Inferring Meaning- Improving Comprehension Skills(Reading for Meaning) - Skimming and Scanning– Structure of the Text – Structure of Paragraphs(Skimming and Scanning Exercises) - Interpreting Visual Communication(Graphs, Charts, Tables)(Interpreting the Graphical images).		
UNIT V	WRITING	5
Writing Official Letters(Invitation Letter (Accepting & Declining),Quotation, Ordering, Complaining, Seeking Clarification)(Business Letter Writing Exercises), Writing Official Letters(Permission – In-Plant Training)- Writing CV (Job Application)(Job Application Letter Exercise)- Essay Writing-Email Writing - Writing Reports & Proposal(Writing a Business Report)- Writing Circulars, Memos, Agenda & Minutes(Exercises on Writing Circulars, Memos, Agenda & Minutes).		
	LIST OF EXPERIMENTS	16

1. Videos on Stress Management (Stress Management Activities)
2. Videos on Team Spirit (Team Activities)
3. Listening to TED Talks(Listening to Business Interviews)
4. Listening to Business Presentation (Listening to Business Interviews)
5. Telephonic Conversation (Organizing a Meeting)
6. Product Launch (Persuasive Speech)
7. Business Conversations
8. Business Role Play Activities
9. Reading for Pleasure(Intensive Reading)
10. Extensive Reading(Briefing Favourite Self Help Books)

11. Reading Newspaper articles(Reading Business Reports) 12. Reading Business Legends Success Formula(Read Between the Lines) 13. Writing an Advertisement (Writing Slogans for Products) 14. Error Correction Exercises (Formal Language expressions) 15. Business Vocabulary (Writing Official E-mails) 16. Writing Business Proposals (Writing Permission Letters)	
Text Book (s)	
1*	Abirami K, "Professional English", First Edition, R.K.Publishers, Coimbatore, 2019.
Reference (s)	
1	LinaMuhkopadhyay, et al., "English for Jobseekers" ,Cambridge University Press, New Delhi,2013
2	Brook Hart Guy , Business Benchmark Advanced Personal Study Book for BEC and BULATS, Cambridge
3	Mascull , Bill. Business Vocabulary in Use, Third Edition, Nov 2017
4	Emerson Paul, Business English Handbook ,Advanced, Macmillan
5	www.Business English Site.com
6	www.businessenglishpod.com

Regulation 2018		Semester II	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB102T	ADVANCED CALCULUS AND COMPLEX ANALYSIS	3	1	0	4

Prerequisite Course (s)

Calculus and Linear Algebra

Course Objective (s):

The purpose of learning this course is to:

1	Evaluate Double and triple Integral and apply them in problems in Engineering Industries
2	Evaluate Surface, Volume Integral and applications of Gauss theorem, Stoke's and Green's theorem in Engineering fields
3	To know the properties of Complex functions and apply them in all the Engineering fields
4	Evaluate improper integrals involving complex functions using Residue theorem and apply them in Engineering fields
5	Transform engineering problems into ODE, PDE and Integrals and solve them using Laplace / complex analytic methods

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Evaluate multiple integrals using change of variables
CO2	Apply techniques of vector calculus in problems involving Science and Engineering.
CO3	Apply complex analytic functions and its properties in solving problems
CO4	Evaluate improper integrals using Residue theorem involving problems in Science and Engineering
CO5	Apply techniques of Laplace Transforms and inverse transform for problems in Science and Engineering and Solving Ordinary Differential Equations

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	-	-	-	3	-	-	3	-	-	-
CO2	3	-	-	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	3	-	-	3	-	-	-
CO4	-	3	3	-	-	-	-	-	3	-	-	3	-	-	-
CO5	-	3	-	-	-	-	-	-	3	-	-	3	-	-	-
CO (Avg)	3	3	3	3	3	-	-	-	3	-	-	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	MULTIPLE INTEGRALS	9 + 3
Evaluation of double integration in cartesian and polar Coordinates - Evaluation of double integral by changing of order of integration - Area as a double integral (Cartesian and Polar) - Conversion from Cartesian to Polar in double integrals - Triple integration in Cartesian Coordinates - Volume as triple integral in Cartesian, Polar and Spherical Coordinates.		
UNIT II	**VECTOR CALCULUS**	**9 + 3**
Gradient,Divergence,Curl,Solenoidal,Irrotational fields - Directional derivative - Line integrals - Surface integrals - Volume Integrals - Green's theorem (excluding proof) :Applications in evaluating Line and Region - Gauss divergence theorem (excluding proof):Applications to cubes and parallelopipeds - Stoke's theorem (excluding proof):Applications to cubes and parallelopipeds.		
UNIT III	**ANALYTIC FUNCTION**	**9 + 3**
Definition of Analytic function – Cauchy Riemann equations- Properties of Analytic function - Determination of Analytic function using Milne's Thomson method-Conformal mapping (w=c+z, w=cz, w= $\frac{1}{z}$) - Bilinear transformation.		
UNIT IV	**COMPLEX INTEGRATION**	**9 + 3**
Cauchy's integral theorems (without proof) - Cauchy's integral formulae - Taylor's expansions with simple problems - Laurent's expansions with simple problems - Singularities - Poles and their types - Residues - Cauchy's residue theorem (without proof)- Contour integration: unit circle and semicircle.		
UNIT V	**LAPLACE TRANSFORMS**	**9 + 3**
Laplace Transforms of standard functions- Transforms properties- Transform of derivatives and integrals - Initial & Final value theorems (without proof) and Verification for some problems- Inverse laplace transforms using Partial fractions and Shifting theorem- Convolution theorem- Periodic functions- Solution of linear second order ODE equations with constant coefficients.		

Text Book (s)

1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

Reference (s)

1	B. H. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2	Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008
3	Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
4	G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002

Regulation 2018		SemesterI/Semester II	Total Hours			90
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18PYB101J	PHYSICS	3	1	2	5

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Identify the applications of electric field on materials
CLR-2	Identify the applications of magnetic field on materials
CLR-3	Identify the significance of quantum theory
CLR-4	Create insights to the concepts of optical effects
CLR-5	Analyze the working principle of lasers and optical fibers

Course Outcome (s) (Cos):
At the end of this course, learners will be able to:

CO1	Identify the effect of charge dynamics
CO2	Analyze electromagnetic induction
CO3	Apply quantum mechanics to basic physical problems
CO4	Apply ray propagation and optical effects
CO5	Identify the applications of lasers and optical fiber

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	3.00	3.00	3.00	-	-	-	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ELECTROSTATICS AND DIELECTRIC MATERIALS	9+3

Del-divergence-curl and gradient operations in vector calculus-Gauss-divergence and Stoke's theorem-Electric field and electrostatic potential for a charge distribution-Gauss' law and its applications-Laplace's equations for electrostatic potential-Poisson's equations for electrostatic potential-Solving Problems-Concepts of electric current-Continuity equation-Laws of magnetism-Faraday's law-Ampere's law-Maxwell's equations-Solving Problems-Polarizations, permeability and dielectric constant -Polar and non-polar dielectrics -Types of polarization-Frequency and temperature dependence-Internal field in a field-Clausius-Mossotti equation-Solving Problems.

UNIT II	MAGNETIC AND SUPERCONDUCTING MATERIALS	9+3

Magnetization, permeability and susceptibility-Classification of magnetic materials-Ferromagnetism-Concepts of ferromagnetic domains –Hysteresis-Solving Problems -Properties and applications of ferromagnetic materials -Hard and soft magnetic materials -Ferrimagnetic materials - Magnetic bubbles – Ferrites- Solving Problems-Superconductivity -Properties of superconductivity -Type I & Type II superconductors-High Tc superconductors – SQUID – CRYOTRON-MAG LEV-Solving Problems.

UNIT III	QUANTUM PHYSICS	9+3

Introduction to Quantum mechanics-Explanation of wave nature of particles-Black body radiation-Compton effect-Solving Problems-Photoelectric effect-de Broglie hypothesis for matter waves - Physical Significance of wave function -Time independent Schrödinger's wave equation -Time dependent Schrödinger's wave equation -Solving Problems-Particle in a 1 D box -Normalization - Born interpretation of wave function -Properties of Matter waves-Verification of matter waves-G.P. Thomson Experiment-Solving Problems.

UNIT IV	WAVE OPTICS	9+3

Introduction to interference-Introduction to diffraction-Fresnel diffraction-Fraunhofer diffraction-Fraunhofer diffraction at single slit-Fraunhofer diffraction at double slit-Solving Problems-Fraunhofer diffraction at multiple slit-Diffraction grating-Characteristics of diffraction grating-Applications of diffraction grating-Polarization by reflection-Polarization by double refraction-Solving Problems -Scattering of light-Circular polarization-Elliptical polarization-Optical activity-Fresnel's relation -Brewster's angle--Solving Problems.

UNIT V	LASER AND FIBER OPTICS	9+3

Absorption and emission processes-two level-Einstein's theory of matter radiation A and B coefficients-Characteristics of laser beams-Amplification of light by population inversion-Threshold population inversion-Essential components of laser system and pumping mechanisms-Solving Problems-Nd: YAG laser-Semiconductor laser-CO_2laser Vibrational modes- CO_2 laser-energy level-Optical fiber-physical structure-Total internal reflection-Solving Problems-Numerical aperture - Acceptance angle-Losses associated with optical fibers-Classification of optical fibers-Optical fiber communications system-Optical sensors-Solving Problems.

LIST OF EXPERIMENTS	30

1. Basics of experimentation
2. Determine dielectric constant of the sample
3. Calibrate Ammeter using Potentiometer
4. Calibrate voltmeter using Potentiometer
5. Determine the energy loss of magnetic materials using B-H curve experiment
6. Determine Planck's Constant
7. Study of I-V characteristics of a light dependent resistor (LDR)
8. Determine wavelength of monochromatic light by Newton's ring
9. Determine particle size using laser
10. Determine wavelength of using diffraction grating
11. Determine wavelength for a given laser source
12. Study of numerical aperture and acceptance angle of optical fiber
13. Mini project

Text books/ References:

1	David Jeffery Griffiths, Introduction to Electrodynamics, Revised edition, Pearson, 2013
2	Ajay Ghatak, Optics, Tata McGraw Hill Education, 5th edition, 2012
3	David Halliday, Fundamentals of Physics, 7th edition, John Wiley & Sons Australia, Ltd, 2004
4	Berg and Resnick, Quantum Physics: Of Atoms, Molecules, Solids, Nuclei and Particles, 2nd Edition, 1985

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20 APR 2018
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EEE

Regulation 2018		Semester I / Semester II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18CSS101J(R)	PROGRAMMING FOR PROBLEM SOLVING	2	0	2	3

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CO1	Learn programming using a structured programming language
CO2	Provide exposure on C programming.
C03	Introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Apply the problem solving techniques for solving numeric and string problems
CO2	Solve basic numeric problems using control statements in C
CO3	Develop the C program using the concepts of array and string.
CO4	Apply the concept of function prototypes and pointers.
CO5	Compare the performance of structures and union in memory management.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PSO1	PSO1	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-
CO2	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-
CO3	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-
CO4	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-
CO5	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-
CO (Avg)	3	-	-	-	-	-	-	-	2	1	-	3	-	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Board of Information Technology On
25 MAR 2019
KARUR-639 113.

UNIT I	INTRODUCTION	6
Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems– Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.		
UNIT II	**C PROGRAMMING BASICS**	**6**
Structure of a 'C' program – Tokens – Data Types – Operators –Input and Output operations – Decision Making and Branching – Looping statements.		
UNIT III	**ARRAYS AND STRINGS**	**6**
Arrays: Declaration – Initialization – One dimensional and Two dimensional arrays – String: String Declaration and Initialization–String Functions.		
UNIT IV	**STRUCTURES AND POINTERS**	**8**
Introduction to Structures-Need for Structure Data type – Structure: Definition, Declaration – Structure vs Union. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays –Null Pointer – Pointer to Structures.		
UNIT V	**FUNCTIONS**	**4**
Function – Definition of function – Declaration of function – Function Prototype – Pass by value – Pass by reference.		
LIST OF EXPERIMENTS		**15**

1. Programs on Operators
2. Programs on Control statements
3. Programs on one Dimensional Array
4. Programs on Two Dimensional Array
5. Programs on String Handling
6. Programs on Function using Call by Value
7. Programs on Function using Call by Reference
8. Programs on Pointers
9. Programs on Structures
10. Programs on Union

Text Book (s)

1	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2	PradipDey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009

Reference (s)

1	Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
2	Dromey R.G., "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007.
3	Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
4	Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

Regulation 2018		Semester I / II	Total 3ours			75
Category	Course Code	Course Name	3ours / Week			C
			L	T	P	
S	18MES102J	BASIC CIVIL AND MECHANICAL ENGINEERING (EEE)	3	0	2	4

Prerequisite Course (s)

Nil

Course Objective (s):

- Select building materials and identify the components of a building
- Identify the various transportation systems, bridges, dams and water supply system
- Apply the concept of Harnessing energy from various energy sources
- Know the working of IC engines and identify the sub system requirements
- Apply manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding

Course Outcome (s) (COs):

CO1	Identify the building materials and its applications
CO2	Identify different transportation system, water supply system and its applications
CO3	List the basic components and analyze the working of major power plants
CO4	Identify the working of IC engines and understand the need of various auxiliary systems
CO5	Identify manufacturing processes; casting, forming. List machining operations; lathe, drilling. Identify process of welding

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	-	-	3	3	-	-	-	-	3	-	-	-
CO2	3	-	3	-	3	3	3	-	3	-	-	3	-	-	-
CO3	3	-	-	-	-	-	3	-	-	-	-	-	3	-	-
CO4	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3		3		3	3	3		3			3	3		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (high)

UNIT I	BUILDING MATERIALS	9
Introduction to Civil Engineering, Building Materials, History, Disciplines in Civil Engineering, Early constructions and development over time, Ancient Monuments: Peruvudaiyar or Brihadeeswarar Temple, Kallanai dam Grand Anicut, Taj Mahal, Golconda fort, Angkor Wat, Pyramids of Giza, Colosseum Development of various materials, Methods of Construction, Building Materials - Stone – Classification of Rocks, Quarrying, Dressing, Properties and Uses of Stone Mortar, Plain and Reinforced Cement, Concrete Grade and properties and uses, Necessity of Special Concrete, Self Compacting Concrete, Construction Chemicals (Plasticizers), Recycling: construction, demolition wastes, Buildings, Classification of Buildings, Selection of site for a building, Components of Buildings, Soil, General types of soil, Bearing Capacity, Factors affecting bearing capacity, Foundations: Functions, General types of, foundation, Shallow foundations		
UNIT II	TRANSPORTATION AND WATER SYSTEM	9
Cement concrete flooring, Marble flooring, Granite flooring, Ceramic tile flooring, Roofs: Types of roofs, Madras terrace roof, Reinforced concrete roofs, Trussed roof, Roof Coverings: Types, Weathering course: Types, Mode of Transportation - Highways - Classification of Roads, Cross section details of flexible pavements, Railways – Zone and Headquarters, Permanent way and its requirement, Components of Permanent way, Bridges: Components of Bridge, Types, Dams: Purpose, Classification, Gravity dams - Advantages and Disadvantages, Elements of protected Water Supply system, Objective, Quantity of water, Design period, Per-capita demand, Factor affecting per capita demand, Sources of Water Supply, Standards of Drinking water, Drinking Water Treatment: Objectives, Treatment plant process, Sewage: Method of collection, Sewage treatment and disposal		
UNIT III	POWER PLANTS	9
Coal based thermal Power Plant: layout, components description,working, advantages, disadvantages, Hydro Electric power plant: layout, components description, working, advantages and disadvantages, Nuclear power plant: Nuclear fission and fusion reactions, Nuclear reactor, components description, Layout, working, merits and demerits of boiling water reactor , Layout, working, merits and demerits of pressurized water reactor, Gas turbine power plants:componentsdescription,working and types gas turbines, methods to improve performance, Layout and working of open cycle plant with intercooling, reheating, regeneration, Solar Thermal power plant: layout of Flat plate collector based plant, central receiver type plant, advantages, disadvantages, Wind energy conversion system – wind turbine types, Working, advantages and disadvantages, Ocean Thermal Energy Conversion system: layout of open cycle , Layout of closed cycle, advantages, disadvantages		
UNIT IV	INTERNAL COMBUSTION ENGINES	9
Engine: Classification,operations of 2 stroke & 4 stroke, Comparison of SI & CI engines, Fuel supply system and Battery ignition system, Magneto ignition system of SI engine, Working of a simple carburetor, GDI, MPFI, CRDI, Lubrication system of an engine, Functions and Working of mist and forced feed lubrication system, Cooling system of an engine – Working of air cooled (fins), Water cooled engines (forced circulation), Alternate fuels for IC Engines. Liquid fuels: methanol, ethanol, vegetable oil, Biodiesel, Gaseous fuel: Hydrogen, CNG, LPG, properties, advantages, disadvantages, Emissions from engine – Emission standards – Euro, BS. Emission control measures – Catalytic converter, Exhaust gas recirculation, Introduction to electric vehicles, Hybrid and autonomous vehicles		
UNIT V	CASTING AND FORMING PROCESS	9
Casting introduction and history, Expandable mold casting process , Production steps in a typical sand-casting process, terms including patterns and core, Other expendable mold casting: shell molding, vacuum molding, expanded polystyrene process, Investment casting, Permanent mold casting: hot chamber and cold chamber die casting & Permanent moldcasting:Semi centrifugal and centrifuge casting, Metal forming introduction and its classification, metals and alloys, Bulk deformation: hot, cold forging processes, hot rolling processes,cold rolling processes, Rolling mill classification, hot and cold extrusion processes		

processes, Sheet metal working, applications. Cutting operations: shearing, blanking, punching, cutoff, parting, slotting, perforating, notching, trimming, shaving, fine blanking, Bending operations: V-bending, edge bending, flanging, hemming,seaming, curling, spring back effect, Drawing operations, its defects, coining, embossing, ironing, lancing, twisting	
Text Book (s)	
1	Dr.V.Rameshbabu,"Basic Civil and Mechanical Engineering", VRB Publishers pvt ltd, 2017
Reference (s)	
1	SeropeKalpakjian, Steven Schmid," Manufacturing Processes for Engineering Materials", Pearson, 2016
2	Drbal, Larry F. Boston, Patricia G. Westra, Kayla L. Black, Veatch, "Power Plant Engineering", Kluwer Academic Pub., 1995
3	Andy Walker, "Solar Energy", John Wiley & Sons, 2013
4	John B. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw Hill Education, 2017
5	Kumar. T, Leenusjesu Martin and Murali. G, "Basic Mechanical Engineering", Suma Publications, Chennai, 2007.

LIST OF EXPERIMENTS

Total: 30hours

1.	Study about Brick, Stone & Cement: Types, Uses, Structural steel, Timber properties and uses
2.	Study about Water Supply, Distribution System, Water Treatment Plant, Sewerage System
3.	Study about basics of Casting, processes, Equipment's, To make the mould using stepped flange
4.	Basics of Metal Arc welding operations, Equipment's, Tools, Butt joint of two metal plates using arc welding process
5.	Welding-Lap joint of two metal plates overlapping on one another using arc welding process.
6.	Basics of fitting practice, tools and method of producing models, Tools, Step fitting of two metal plates using fitting tools
7.	Half Round, Vee fitting of two metal plates using fitting tools
8.	Basics of Carpentry operations, Equipment's, Tools, Cross halving joint of two wooden pieces at perpendicular direction
9.	To make duster from wooden piece using carpentry tools.
10.	Basics of Sheet metal operations, Equipment's, Tools and demonstration of producing models, To make geometrical shape like frustum
11.	Sheet metal operations - To make geometrical shape like square tray, rectangulat tray
12.	Sheet metal operations - To make geometrical shape like Cone , Funnel
13.	Study the basics of moulding and processes, Equipment's, To make plastic models using injection moulding of simple part
14.	Basics of Plumbing practices for G.I and P.V.C., Tools and demonstration of producing models
15.	Plumbing of bathroom/ kitchen fittings using G.I. fittings, P.V.C. fittings

Regulation 2018		Semester I/Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH101L	PROFESSIONAL SKILLS AND PRACTICES	0	0	2	1

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Equip students with different aspects of Presentation
CLR-2	Train students to use appropriate language for publics peaking.
CLR-3	Help students better understand basic leadership qualities and personality traits
CLR-4	Train the students to face interview confidently.
CLR-5	Make students understand how setting goals in life is important.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Make presentation in a formal way.
CO2	Speak with clarity and confidence, thereby enhancing their employability skills.
CO3	Enable students to understand different aspects of leadership and evaluate in their own strengths.
CO4	Clear the job interview successfully.
CO5	Realize that selecting goal is a fundamental component to long- term success of an individual.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO2	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO3	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO4	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO5	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-
CO(Avg)	-	-	-	-	-	3	2	3	3	3	2	3	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	PRESENTATIONS	5
Tips and Techniques for an Effective Presentation - Effective presentation structure - Types of Presentation - Verbal aspect of a presentation - Non-verbal aspect of a presentation – body language - Stress management during a presentation		
UNIT II	**PUBLIC SPEAKING**	**5**
Importance of Public Speech - Dealing with fear and Anxiety - Tips and Techniques for Public Speaking - Informative Speech - Delivering a Persuasive Speech - Dealing with audience questions		
UNIT III	**LEADERSHIP SKILLS**	**5**
Communication – Motivation – Delegating – Creativity – Responsibility - Commitment		
UNIT IV	**INTERVIEW SKILLS**	**5**
Preparing for a Job Interview - The Interview Process - Telephone Interviews - Interview Techniques - Mock Interview - Mock Interview		
UNIT V	**GOAL SETTING**	**5**
Types of goals - Reasons for goal setting - Goal Setting Process - S.M.A.R.T. goals - Tips and Techniques for Goal Setting - Trouble in Setting Goals		
LIST OF EXPERIMENTS		**5**
1. Make a presentation on a general topic 2. Give a persuasive speech 3. Exhibit your leadership qualities 4. Mock interview 5. Share your realistic short term and long term goals and the ways to attain them.		

Text Book (s)

	NIL

Reference(s)

1	Aruna Koneru, Professional Communication, Tata McGraw-Hill Publishing Company Limited, New Delhi
2	Professional Skills and Practice, Oxford University Press
3	https://www.skillsyouneed.com
4	https://www.Business English Site.com

Regulation 2018		Semester I&II	Total Hours			30
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18GNM101L	Physical and Mental Health using Yoga	0	0	2	0

Prerequisite Course (s) Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	provide deeper insight into the curriculum of Yogic Sciences along with the practical applications of Yoga
CLR-2	intend that students should get familiar with the poses of Yogasanam.
CLR-3	Promote positive health in the Student through Yoga and enabling and imparting skill in them to practice and apply Yogic
CLR-4	practice for Health to general public and teach Yoga for Total personality development and spiritual evolution.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	increase the muscle strength
CO2	improve respiration, energy and vitality.
CO3	maintain a balanced metabolism and weight reduction.
CO4	maintain cardio and circulatory health.
CO5	improve athletic performance and protection from injury.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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	Introduction:	**6**
▪ Human Body- Meaning and its Importance in Yoga ▪ Definition of Anatomy and Physiology ▪ Cell: Structure & Function		
	General information, Different parts, Structure, Function and Effect of Yogic Practices.	**24**
▪ Tissues: Types, Structure & Function. ▪ Musculo-Skeletal System ▪ Digestive system ▪ Excretory system ▪ Respiratory system ▪ Circulatory system ▪ Nervous System ▪ Endocrinal system		

Text / Reference (s) books:

1.	Shirley Telles - A Glimpse of the Human Body The structure anf Functions, Swami Vivekananda Yoga Prakashana, Bangalore.
2.	Makarand Madhukar Gore - Anatomy and Physiology of Yogic Practices, Motilal Banarsidass, New Delhi, 2007
3.	Anne Waugh, Allison Grant - Ross and Wilson Anatomy and Physiology in Health & Illness, Churchill Livingstone; 2010

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Board of Science & Humanities
29 MAY 2019
KARUR - 639 113

Regulation 2018		Semester II	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM102T	VALUE EDUCATION	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Connect the learners to their potential, identify their potential to create a new positive world
CLR-2	Analyze the merits and demerits of different educational systems. Identify the different systems of education
CLR-3	Draw attention towards the weaknesses they are susceptible to and inspire them through positive models
CLR-4	Instill a sense of professional ethics which help them develop a safe comfortable and prosperous society
CLR-5	Cultivate a spirit of willing accommodation in an increasingly diverse world

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Equipped with an awareness of their positive energy and power
CO2	Identify the meaning of 'education'; have a clearer and better understanding in taking education to the masses
CO3	Assess their weaknesses; understand risks involved and rectify them through learning from positive and negative instances
CO4	Realize their professional responsibilities
CO5	Acquire the required values in an expanding pluralistic world not be swept off their feet due to the rapid changes

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	2	3	-	3	3	3	-	3	-	-	-
CO2	2	3	2	-	3	3	2	2	3	3	-	3	-	-	-
CO3	2	-	-	-	2	3	2	2	3	3	-	3	-	-	-
CO4	3	2	-	-	3	3	3	3	3	3	-	3	-	-	-
CO5	2	-	-	-	3	3	3	3	3	3	-	3	-	-	-
CO (Avg)	2	2.33	2	-	2.6	3	2.5	2.6	3	3	-	3	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	VISIONS FOR YOUTH	6
Introduction (Quiz) - Two speeches by great personalities (Oral presentations) - Quotes, proverbs relating to the power and potential of youth, Excerpts: Wings of Fire (Collecting proverbs highlighting the potential of youth) - Two news articles highlighting the initiatives for social causes by youth (Role play in a similar context) - One song exhibiting the positive energy of youth (Discussion on the song)		
UNIT II	**YOUTH AND EDUCATION**	**6**
Meaning and the significance of education (Brainstorming) - Overview of different (traditional, modern) educational systems (Debate) - Role of youth in education, Urban and Rural set up, dissemination (Student presentations) - Designing and framing educational curriculum and materials (Students' Presentation based on write ups) -The pressing challenges in current educational system (Collage Design)		
UNIT III	**YOUTH AND SOCIETY**	**6**
Need for social values in the present context (Poem – "Where the mind is without fear" , Write up on various instances from real life) - Individual and group behaviour, respect for others (Case study on recent happenings) - Civic sense, bullying-substance abuse, uses of expletives (Case study on recent happenings) - Hero worship, gender insensitivity moral policing (Case study on recent happenings) - Positive contribution by youth in promoting social welfare (Short videos followed by discussions)		
UNIT IV	**YOUTH AS PROFESSIONALS**	**6**
Introduction to professional values (Brainstorming through visual cues) - Engineering societies in India (Quiz) - Challenges to be addressed by Engineers in India (Case Study) - Challenges in different sectors: agriculture (Case Study) - Challenges in different sectors: urban development, environment (Group activity (oral and written)) - Challenges in different sectors: sustainable development, cyber security (Case Study – from Newspapers)		
UNIT V	**YOUTH IN PLURALISTIC SOCIETY**	**6**
Introduction to pluralistic society, forces of globalization (Group Discussion) - Science and technology intercultural proximity (Narration of stories from various religions to illustrate the oneness of humanity) - Positive, Negative impact: religion, politics, gender, economic status, aesthetics (Discussion on "To Kill a Mocking Bird") - Values required to live in a global society (Poster presentation on festivals of various religions) - Learning the etiquettes of various societies (Poster presentation on festivals of various religions) - Success of pluralistic society, enliven the society, religious harmony through literary (Writing the aspects of pluralistic society based on the text).		

Text Book (s)	
	Nil
Reference (s)	
1	Kalam, APJ Abdul. Wings of Fire: AN Autobiography of APJ Abdul Kalam. Ed. Sangam Books Ltd., 1999
2	"Banaras Hindu University Speech" and "To Students". The Voice of Truth. General Editor Shriman Narayan. Navajivan Publishing House. pp. 3-13 and pp. 425-30. www.mkgandhi.org
3	Piroda, Sam. "Challenges in Science and Technology". www.nfdindia.org/loc19.htm

4	Thomas A Address to VTU Students by Narayana Murthy. https://www.karnataka.com/personalities/narayana-murthy/vtu-address-2006/
5	World Economic forum. "India's top 7 challenges from skills to water scarcity"

Regulation 2018		Semester III	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB201T	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to B.E Mech, EEE, Civil & EIE)	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Develop the skills of the students in the areas of Transforms and Partial differential Equations
2	Apply for the effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory.
3	Serve as a prerequisite for post graduate and specialized studies and research.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Expand a function in terms of Fourier Series and apply it for solving engineering problems.
CO2	Gain knowledge on Fourier Transforms
CO3	Model and solve higher order partial differential equations
CO4	Apply the methods of solving PDE in practical problems
CO5	Handle problems in Z transforms and apply it to solve difference equations

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	-	2	-	2
CO2	3	3	1	1	-	-	-	-	-	-	-	-	2	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	-	2	1	2
CO5	3	3	2	3	-	-	-	-	-	-	-	-	1	1	1
CO (Avg)	3	3	1.8	1.4	-	-	-	-	-	-	-	-	1.8	1	1.4

2: Moderate (Medium) 3: Substantial (High)

UNIT I	**FOURIER SERIES**	9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series — Parseval's identify – Harmonic Analysis.		
UNIT II	**FOURIER TRANSFORMS**	9+3
Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem– Parseval's identity.		
UNIT III	**PARTIAL DIFFERENTIAL EQUATIONS**	9+3
Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second order with constant coefficients.		
UNIT IV	**BOUNDARY VALUE PROBLEMS**	9+3
Classification of second order partial differential equations-Solutions of one dimensional wave equation – One dimensional equation of heat conduction –Solution of two dimensional equation of heat Equation in Cartesian coordinates.		
UNIT V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS**	9+3
Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem -Formation of difference equations – Solution of difference equations using Z-transform.		

Text Book (s)

1	Grewal.B.S, *'Higher Engineering Mathematics'* 40th Edition, Khanna publishers, Delhi, (2007)

Reference (s)

1	Bali.N.P and Manish Goyal *'A Textbook of Engineering Mathematics'*, Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2	Ramana.B.V. *'Higher Engineering Mathematics'* Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3	Glyn James, *'Advanced Modern Engineering Mathematics'*, Third edition-Pearson Education (2007).
4	Erwin Kreyszig *'Advanced Engineering Mathematics'*, Eighth edition-Wiley India (2007).

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18EES103T/ 18EES201T	ANALOG ELECTRONICS	3	0	0	3

Prerequisite Course (s)

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Objective (s):

1	Expose the students to study the different application of PN junction diode circuits and transistors.
2	Analyse the frequency of different oscillator circuits and understand the operation of multivibrators
3	Introduce the basic building blocks of linear integrated circuits
4	Learn the concepts of converters using operational amplifier
5	Acquire the basic knowledge of special function IC

Course Outcome (s) (COs):

CO1	Apply and analyze the principle of operation of transistor as an amplifier,diode in the rectifiers, multipliers, clipper & clamper circuits &
CO2	Determine the frequency and gain value of various types of oscillators and Analyze the various switching circuits with its waveforms.
CO3	Design amplifier circuit for electronic application
CO4	Design application based circuit using IC741
CO5	Design timer circuit , voltage regulator and waveform generator using analog IC

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	1	-	-	2	2	2	2	2	-	-
CO2	3	3	2	3	1	1	-	-	2	2	2	2	2	-	-
CO3	3	3	3	2	1	1	-	2	2	2	-	2	2	-	-
CO4	3	3	3	2	1	1	-	2	2	2	-	2	2	-	-
CO5	3	3	3	2	1	1	-	2	2	2	-	2	2	-	-
CO (Avg)	3	3	2.6	2.4	1.4	1	-	2	2	2	2	2	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	FUNDAMENTAL APPLICATION OF DIODE & TRANSISTORS	9
Series clipping circuits, Shunt Clipping circuits, Clamping circuits, DC voltage multipliers & Muti-stage voltage multipliers, Two stage circuit with Emitter follower output, DC Feedback Pair, Differential Amplifier Configuration, CMRR, Tuned Circuit Amplifier, Feedback topologies in negative feedback amplifier, Characteristics of negative feedback, Voltage Series, Voltage Shunt, Current Series, Current Shunt, Input & Output Impedance, Gain		
UNIT II	**OSCILLATORS AND SWITCHING CIRCUITS**	**9**
Introduction, Operation of oscillators, Frequency stability of oscillators, Types of transistor oscillators, LC oscillators, Colpitts oscillator, Hartley Frequency of oscillator, Clapp oscillator, Frequency of oscillator, Crystal Oscillator, RC oscillators, Wein bridge oscillators, RC Phase Shift Oscillator, MultiVibrators, Free Running Multivibrators, Single Shot Multivibrators, Bistable or Flipflop Multivibrators		
UNIT III	**OPERATIONAL AMPLIFIER FUNDAMENTALS**	**9**
Introduction to op-amp (block diagram, pin diagram, equivalent circuit), Ideal characteristics of op-amp, DC characteristics (input bias current, input offset current, input offset voltage, thermal drift), AC characteristics (frequency response, frequency compensation, slew rate), inverting amplifier, non-nverting amplifier, differential amplifier.		
UNIT IV	**BASIC APPLICATION OF OPERATIONAL AMPLIFIER**	**9**
Voltage follower, summing amplifier, subtractor, instrumentation amplifier, voltage to current converter, current to voltage converter, peak detector, clipper, clamper, differentiator, integrator.		
UNIT V	**ANALOG IC AND ITS APPLICATION**	**9**
Series op-amp regulator, IC voltage regulator- fixed voltage series regulator IC, fixed regulator used as adjustable regulator, boosting IC regulator output current, IC723 general purpose regulator-low voltage, high voltage, current limit protection, current fold back, current boosting, switch mode power supply, description of functional diagram IC555 –astable multivibrator, monostable multivibrator, Schmitt trigger.		

Text Book (s)

1	J B Gupta, "Electronic devices and Circuits", S K Kataria & Sons,2015
2	D Choudhury Roy, Sheil B.Jani, "Linear Integrated Circuits" 4th Edition, New Age International, 2014.

Reference (s)

1	Mottershed A, "Electronic devices and circuits", Prentice Hall Of India,(Higher Edition)
2	Robert L.Boylestad Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson, 2016.
3	S Salivahanan, V S Kanchana Bhaaskaran, "Linear Integrated Circuits", 2nd Edition, McGraw-Hill Education, 2014.

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC201T	ELECTRO MAGNETIC THEORY	3	0	0	3

Prerequisite Course (s)

Calculus and Linear Algebra, Advanced Calculus and Complex Analysis, Semiconductor Physics

Course Objective (s):

1	Understand the concepts of electrostatics, electrical potential, energy density and their applications..
2	Understand the concept of conductors, dielectrics, capacitance and boundary conditions in electrostatic field
3	Understand the concepts of magnetostatics, magnetic flux density and their applications..
4	Understand the concept of and boundary conditions in magnetostatic field and nature of magnetic material
5	Analyze the concept of static and time varying fields and Poynting theorem.

Course Outcome (s) (COs):

CO1	Explain the basic concepts of electric field lines in and around the space, potential distribution due to various charges and its applications using gauss law.
CO2	Apply the properties of conductors, dielectrics and capacitance in various applications and basic concepts of Poisson's and Laplace equations.
CO3	Interpret the concept of magnetic field lines, density and intensity by using Biot- Savart law and Ampere's circuital law.
CO4	Summarize the nature of magnetic materials, magnetism boundary conditions, force and torque concept using Lorentz force equation, inductance and mutual inductance
CO5	Infer the concept of Maxwell's equation in static and time varying fields, applications of Poynting theorem and also show the relation between circuit equations (Kirchhoff's laws) and Maxwell's equations.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1
CO2	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1
CO3	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1
CO4	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1
CO5	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1
CO (Avg)	3	3	3	2	-	3	1	1	-	2	2	2	3	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	STATIC ELECTRIC FIELDS	9
Introduction- scalar and vector fields-different coordinate systems- Divergence theorem- Stoke's theorem, Coulomb's law - electric field intensity - field due to different types of charges - electric flux density- Gauss law and its applications (infinite line of charge, infinite sheet of charge, co-axial cable, and spherical charge). Electric potential- potential field due to different types of charges (point charge, line charge) - potential gradient- the dipole.		
UNIT II	**CONDUCTORS, DIELECTRICS AND CAPACITANCE**	**9**
Current and current density – continuity of current- properties of conductors and dielectrics. Boundary conditions (between two perfect dielectric and between free space and conductor).capacitance-different types of capacitance (parallel plate capacitors, coaxial cable, spherical capacitor), capacitance of two wire line- Poisson's and Laplace equations.		
UNIT III	**STEADY MAGNETIC FIELDS**	**9**
Biot-Savart law- applications (infinite long straight conductor, circular loop).Ampere circuital law-applications (infinite long straight conductor, coaxial cable), magnetic flux and magnetic flux density- the scalar and vector magnetic potentials.		
UNIT IV	**FORCE, TORQUE AND INDUCTANCE**	**9**
Lorentz force equation- force between differential current elements-the nature of magnetic materials-magnetization and permeability- magnetism boundary conditions- inductance and mutual inductance.(solenoid , toroid).		
UNIT V	**MAXWELLS EQUATIONS AND TIME VARYING FIELDS**	**9**
Maxwell's equations for steady fields in point form and integral form – Faraday's law– Maxwell's equations in point form and integral form for time-varying field– Poynting theorem – application of Poynting vector.		

Text Book (s)

1	William H.Hayt, Jr and John A.Buck., " Engineering Electromagnetics ", Tata McGraw- Hill Publishing Ltd, 7th edition 2006 .
2	Jean G. Van Bladel, " Electromagnetic Fields " A.John wiley & sons, inc., Publication. Second edition 2007.
3	David J. Griffiths, 'Introduction to Electrodynamics' Pearson Education, 4th edition 2014.

Reference (s)

1	Matthew N.O.Sadiku, 'Elements of Electromagnetic", Oxford publications,2014.
2	Muthusubramanian R and Senthil kumar N, " Electromagnetic Field Theory", Anuradha publications,2003.
3	Joseph A. Edminister , " Theory and Problems of Electromagnetics" Schaum's outline series",3th edition, 2010.

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC202T	ELECTRICAL MACHINES I	3	0	0	3

Prerequisite Course (s)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objective (s):

The purpose of learning this course is to:

1	Explain parallel operation , Commutation & Armature Reaction in DC generator
2	Classify different types of DC motors & their characteristics
3	Analyze the performance and test the DC Machines
4	Understand about single, three phase transformer & auto transformers
5	Analyze the performance of transformers

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Illustrate Commutation & Armature Reaction in DC generator
CO2	Describe the starting methods and speed control methods of DC motors
CO3	Analyze the performance of the DC motor by different testing methods
CO4	Describe the working of transformer under no load & loaded condition by Phasor diagram
CO5	Analyze the performance of Transformers by different testing methods

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO2	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO3	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO4	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO5	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO (Avg)	2.00	2.00	2.00	2.00	2.00	-	-	2.00	2.00	1.00	-	1.00	3.00	2.00	1.00

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	DC GENERATORS	10
Introduction of DC generator – Types of DC Generators – Construction & working principle- Characteristics - Commutation –Methods to improve Commutation – Armature Reaction and its effects –Armature conductors and ampere turns(ATd and ATc)– Parallel operation of DC shunt , series & compound generators		
UNIT II	**DC MOTOR**	**8**
Introduction of DC motor – Back EMF & Torque equation – Speed & Torque relation – starting of DC motors– Power relationship in motor – Speed control methods for DC shunt & Series motors – Applications		
UNIT III	**TESTING OF DC MACHINES**	**12**
Losses – Condition for maximum efficiency – Testing of DC machines – Brake test, Swinburne's test & Hopkinson's test – Introduction to electric braking of DC shunt and series motor – Plugging, Dynamic & Regenerative braking (Qualitative treatment only).		
UNIT IV	**TRANSFORMER**	**7**
Construction, Principle of operation — Transformation ratio – Transformer on no-load – Equivalent circuit – Transformer on-load – Auto transformer – Saving of copper –Three phase transformers and their connections.		
UNIT V	**TESTING OF TRANSFORMERS**	**8**
Losses and efficiency in transformers – Condition for maximum efficiency – Testing of transformers – Polarity test – Load test - Phasing out test – open circuit and short circuit test - Sumpner's test – Separation of losses – All day efficiency.		
Text Book (s)		
1	J. Nagrath and D.P. Kothari, "Electric machines" T.M.H. Publishing Co.Ltd., fourth edition New Delhi,2010.	
2	B.L. Theraja, "Electrical Technology Vol.II AC/DC Machines", S. Chand, Publications 2008	
Reference (s)		
1	J.B.Gupta "Theory and Performance of Electrical Machines"	
2	A Fitzgerald, Charles Kingsley, Stephen Umans "ELECTRIC MACHINERY" McGraw Hill Education Seventh Edition.2014	
3	K.Murugeshkumar, "Electrical Machines, Vol I" Vikas publishing house NewDelhi,2010	
4	Battacharya S K, "Electrical Machines", Tata McGraw Hill", NewDelhi . Fourth edition 2014.	

Regulation 2018		Semester III	Total Hours			75
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC203J	Measurements and Instrumentation	3	0	2	4

Prerequisite Course (s)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objective (s):

1	Understand the basic needs of instruments and error present in it.
2	Know the instruments necessary for Analog and Digital measurements.
3	Inculcate knowledge on bridges
4	Elaborate discussion about storage & display devices.
5	Initiate basic knowledge on transducers and electronic instruments

Course Outcome (s) (COs):

CO1	Explain the performance characteristics of functional elements of an instrument, standards and calibration.
CO2	Enumerate the working of Analog and Digital measuring instruments.
CO3	Measuring the R,L,C using bridges.
CO4	Differentiate the functions of various storage and display devices
CO5	Measure electrical and non electrical quantities by transducers

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	2	3	3	3	3	-	3
CO2	3	2	3	3	-	-	-	-	3	3	3	3	3	-	3
CO3	3	3	3	3	-	-	-	-	2	3	3	3	3	-	3
CO4	3	2	2	3	3	-	-	-	2	3	3	3	3	-	3
CO5	3	3	2	2	-	-	-	-	2	3	3	3	3	-	3
CO (Avg)	3	2.4	2.4	2.6	3	-	-	-	2.2	3	3	3	3	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO MEASUREMENTS AND INSTRUMENTATION	8
Functional elements of an instrument - - Classification of instruments – Static & Dynamic characteristics of instruments - Methods of measurement - Statistical evaluation of measurement data- Errors in measurements -Selection of Instruments – Calibration and Traceability of measuring Instruments.		
UNIT II	**ANALOG AND DIGITAL MEASURING SYSTEMS**	**10**
Galvanometers - Ballistic, D'Arsonval galvanometer -Measurement of voltage and current –use of ammeter shunts and voltmeter - Power factor meter – Synchroscope – Frequency meter. Energy meter calibration by direct and phantom loading – Maximum demand indicator – Measurement of reactive power –Trivector meter. Digital voltmeters -digital frequency meter-Multimeter.		
UNIT III	**COMPARATIVE METHODS OF MEASUREMENTS**	**9**
Measurement of low, medium & high resistance: Ammeter, voltmeter method -Wheatstone bridge - Kelvin double bridge - Megger - Earth resistance measurement. A.C bridges: Measurement of inductance, capacitance – Q of coil - Maxwell Bridge, Wein's bridge, Schering bridge, Anderson bridge, Hay's bridge, Owen's bridge.		
UNIT IV	**STORAGE AND DISPLAY DEVICES**	**8**
Printers and plotters - Strip Chart Recorders - Single point and multi point Recorders , X-Y Recorders - Magnetic Tape Recorders - cathode ray oscilloscopes -digital storage oscilloscope - LED, LCD and dot matrix display. 7 Segment Display - Data Loggers		
UNIT V	**TRANSDUCERS AND APPLICATIONS**	**10**
Resistive Transducer – potentiometric, straingauge, resistance thermometer, Thermistor. Inductive Transducer- piezoelectric transducers - measurement of displacement-LVDT, RVDT - Applications - pressure, velocity, acceleration, torque, speed, viscosity and moisture.		

List of Experiment(s)	
1	Study of measurement of displacement and pressure using transducers.
2	AC bridges-Measurement of inductance using Maxwell's bridge
3	AC bridges-Measurement of inductance using-Anderson's bridge
4	AC bridges-Measurement of capacitance using-Schering bridge
5	DC bridges-Measurement of resistance using Wheatsone's bridge
6	DC bridges-Measurement of resistance using Kelvin's bridge
7	Instrumentation amplifiers
8	A/D and D/A converters.
9	Measurement of three phase power and power factor
10	Study of transients.

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Text Book (s)	
1	A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2014.
2	J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
Reference (s)	
1	R.K Rajput, Electrical Measurements and Measuring Instruments, S.Chand & Company LTD, 2009
2	D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015
3	David Bell, 'Electronic Instrumentation & Measurements', Oxford University Press,2013.
4	Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5	Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hallof India, 2003.

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC204T	ELECTRIC POWER GENERATION	3	0	0	3

Prerequisite Course (s)

Basics of Electrical and Electronics Engineering

Course Objective (s):

The purpose of learning this course is to:

1	Understand the concepts of thermal and hydro power generation
2	Illustrate the concepts of and nuclear power generation
3	Understand the concepts of Gas turbine and diesel power generation
4	Understand the electric energy conversion from solar, wind, tidal, ocean, geothermal, biomass plants.
5	Understand the concepts of tariff and economic aspects in power generation

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Describe the working of thermal and hydel power station using single line diagram and state the functions of the major equipment and auxiliaries of it
CO2	Explain the layout, construction and working of the components of nuclear power plants.
CO3	Describe the working of the components of Diesel and Gas Power plants.
CO4	Identify different solar power generation methods & various components of Wind Energy Conversion system.
CO5	Compare various economic aspects of different costs of power generation & types of Tariffs.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1
CO2	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1
CO3	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1
CO4	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1
CO5	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1
CO (Avg)	3	1	2	1	1	2	2	-	1	1	1	1	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	THERMAL AND HYDRO-ELECTRIC POWER STATIONS	9
Thermal :Selection of Site – Main parts and Working – Fuels – Fuel Handling – Combustion Equipments – Ash Disposal and Dust Collection – Draught Systems – Feed Water **Hydro-Electric:** Selection of Site, Classification, General Arrangement and Operation of a Hydro Electric Plant, Construction and Operation of Different Components, Hydro Electric generator.		
UNIT II	**NUCLEAR POWER STATIONS**	**9**
Nuclear Reactions and Materials – Selection of Site – Main Parts of a Reactor – Reactor Control – Nuclear Reactor Classification : Boiling Water Reactor (BWR) , Pressurized Water Reactor (PWR) , Heavy Water Cooled and Moderated Reactor (CANDU) ,Liquid Metal Cooled Reactor, Gas Cooled Reactor, Fast Breeder Reactor, Safety measures for Nuclear Power plants		
UNIT III	**DIESEL AND GAS TURBINE POWER STATION**	**9**
Diesel: Selection of Site – Plant Layout and Main Components – Diesel Plant Efficiency and Heat Balance –Choice of Characteristics of Diesel Engines, Auxiliary Equipments. **Gas-Turbine:** Methods to Improve Thermal Efficiency of Gas turbine, Open and Closed type Gas Turbine, Plant Layout and Main Components of Gas Turbine plant, Advantages of Gas turbine over Steam Plant.		
UNIT IV	**POWER FROM RENEWABLE ENERGY**	**9**
Solar Energy: Solar Thermal Electric Conversion, Solar Photo-Voltaic System: Operating Principle, Types of solar cells, SPV system components and their characteristics – ON –Grid & OFF- Grid solar PV system. Wind Energy: Selection of Site , Basic Components of WECS , Classifications of WECS, Different types of generators used in WECS. Advantages and Disadvantages of WECS.		
UNIT V	**TARIFF AND ECONOMIC ASPECTS IN POWER GENERATION**	**9**
Objective of Tariff –Types of Tariff (Simple, Flat Rate, Block Rate, Two Part , Maximum Demand , Power Factor and Three Part Tariff)- Economics of Power Generation –various factors affecting cost of generation: Load Curves, Load Duration Curves, Connected load, Maximum Load, Peak Load, Base Load and Peak Load Power Plants, Load Factor, Plant Capacity Factor, Plant Use Factor, Demand Factor, Diversity Factor, Cost of Power Plant		

Text Book (s)	
1	A Text book of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, Dhanpat Rai Publication
2	"Non-conversional energy sources" , G.D.Rai, khanna publication, New Delhi.
Reference (s)	
1	Wadhwa, C.L., "Generation Distribution and Utilisation of Electrical Energy", New Age International publishers, 3rd edition, 2010.
2	"Electric Power Generation: Transmission and Distribution", S. N. Singh, PHI Learning,2015.
3	"Renewable Energy Resources", J. Twidell and T. Weir, E & F N Spon Ltd, London, 1999.
4	"Electrical Power ", Uppal, S.L., Khanna publication, New Delhi, 2011.

5	Renewable Energy Technologies, Solanki, Chetan S. , PHI Learning, New Delhi, 2011

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC205L	Electrical Machines I Laboratory	0	0	3	1.5

Prerequisite Course (s)

Basic Electrical and Electronics Engineering Lab

Course Objective (s):

The purpose of learning this course is to:

1	Understand the characteristics of DC machines
2	Understand the characteristics of Transformers
3	Describe the speed control methods of DC Motors
4	Estimate the efficiency of DC Machines by indirect testing methods
5	Estimate the performance of Transformers by indirect testing methods

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Analyze the performance of Different types DC generators
CO2	Analyze the performance of Different types DC motors
CO3	Estimate the performance of DC Machines by indirect testing methods
CO4	Analyze the speed control methods of DC Motors
CO5	Estimate the performance of Transformers by direct & indirect testing methods

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO2	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO3	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO4	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO5	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO (Avg)	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

1	Load test on DC Shunt motor.
2	Load test on DC Series motor.
3	Load test on DC Compound motor.
4	Speed Control of DC Motor: Field control, Armature control.
5	Swinburne's test in DC Machine.
6	Open circuit and Load characteristics of DC generator (Self and Separately Excited).
7	Load test on DC series generator.
8	Hopkinson's test.
9	Load test on single phase transformer.
10	Open circuit & Short circuit test on single phase transformer.
11	Sumpner's test.

Regulation 2018		Semester III	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC206L	Analog Electronics Laboratory	0	0	3	1.5

Prerequisite Course (s)

Basic Electrical and Electronics Engineering Lab

Course Objective (s): The purpose of learning this course is to

1	Analyze the frequency response oscillators and amplifiers.
2	Learn about PSPICE software and using this to simulate clipper and clamper circuit
3	Design the amplifier using IC741
4	Design the adder and subtractor using IC741
5	Desing the Astable and monostable timer using IC555

Course Outcome (s) (Cos): At the end of this course, learners will be able to

CO1	Determine the frequency and gain value of various types of oscillators and amplifiers.
CO2	Simulate the circuit in PSPICE software
CO3	Explain the operational of inverter and non-inverter amplifier.
CO4	Explain the various application of operational amplifier.
CO5	Explain the operation of Astable and Monostable Timer

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	2	-	-	-	-	2	2	-	-	2
CO2	2	2	2	1	3	1	-	-	-	-	2	2	-	-	2
CO3	2	1	2	1	1	2	-	-	-	-	2	2	-	-	2
CO4	2	2	2	1	1	1	-	-	-	-	2	2	-	-	2
CO5	2	2	2	1	1	1	-	-	-	-	2	2	-	-	2
CO (Avg)	2.2	2	2.2	1	1.6	1.4	-	-	-	-	2	2	-	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

List of Experiment(s)	
1	Design and verify the frequency response of single stage transistor amplifier
2	Design and verify the frequency response of RC Phase shift and Wein bridge oscillator
3	Simulate clipper and clamper circuits using PSPICE software.
4	Verify the V-I characteristic of photo diode
5	Design and test the inverting and non-inverting amplifier using IC741
6	Design and test the integrator and differentiator using IC741
7	Design and implement the adder circuit using IC741
8	Design and implement the subtraction circuit using IC741
9	Timer IC application
	(a)Astable mode
	(b) Mono stable mode
10	Study of digital storage oscilloscope

Regulation 2018		Semester III	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM201L	COMPETENCIES IN SOCIAL SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Sharpen problem solving skill and to improve thinking capability of the students
2	Hone soft skill and analytical ability of students
3	Engage learners in using language purposefully and cooperatively
4	Expertise the writing and presentation skill to fulfill the corporate expectations

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in an effective manner
CO2	Design and deliver information in a proper manner
CO3	Improve their presentation skills individually as well as a team member

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	2	-	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-			

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	Module - 1	6
Aptitude: Coding & Decoding - Direction Sense Test. **Communication:** Self-Introduction and SWOT analysis - Letter writing - types.		
UNIT II	**Module - 2**	**6**
Aptitude: Venn Diagrams - Data Interpretation. **Communication:** Phrasal verbs - Voice of Valluvar.		
UNIT III	**Module - 3**	**6**
Aptitude: Averages. **Communication:** Idioms and Phrases - Skits.		
UNIT IV	**Module - 4**	**6**
Aptitude: Time and Distance - Problems on Trains. **Communication:** Prefix/Suffix - Root words - Adjectives - JAM (Extempore Speech).		
UNIT V	**Module - 5**	**6**
Aptitude: Clocks & Calendars. **Communication:** Homophones - Frame Tales.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester III / Semester IV	Total Hours			60
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18CYM201T	Environmental Science	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- To demonstrate in-depth knowledge within environmental engineering and an awareness of social, economic, political, and environmental impacts of engineering practices.
- To have competence for working with multi-disciplinary teams to arrive at solutions to environmental engineering problems.
- To get solutions which will minimize the negative impact of human activities on the environment and to protect human health

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Improve fundamental knowledge of the inter-relationships between the built environment and natural systems
CO2	Characterize and mitigate man-made hazards like nuclear hazards. Understand the principles involved in the generation of different forms of energy
CO3	Improve the reliability, performance, disaster-management of natural calamities and solid waste and water supplies and treatment processes.
CO4	Understand the source, effects and control measure of various environmental pollution
CO5	Apply information technology in the control of human population and women and child welfare

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	3	3	-	-	-	-	-	-	-	-
CO3	-	2	-	2	-	3	3	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	3	3	2	-	-	-	-	-	-	-
CO5	-	2	-	2	-	3	3	-	-		-	-	-	-	-
CO (Avg)	-	2.00	-	2.00	-	3.00	3.00	2.00	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENVIRONMENT& BIODIVERSITY	3
Definition-types of environment, components of environment, scope-importance of environmental studies- Bio diversity-definition-value of biodiversity-Threats to biodiversity - India a mega diversity nation-endangered and endemic species of India-conservation of biodiversity.		
UNIT II	**ENERGY SOURCES**	**3**
Energy resources- Growing energy needs- Renewable and Nonrenewable energy sources- Use of alternate energy sources - Nuclear Energy- Alternative energy fuels-power alcohol-Bio diesel (preparation, properties &uses)		
UNIT III	**SOCIAL ISSUES AND ENVIRONMENT**	**3**
Environment ethics – Climate change – Global warming – Acid rain – Ozone layer depletion –Nuclear accidents-holocaust. Solid waste management - Rain water Harvesting-watershed management-		
UNIT IV	**ENVIRONMENTAL POLLUTION & ACTs**	**3**
Source, types, effects & control- Air pollution -Water pollution – Soil pollution – Marine pollution and Plastic Pollution -Thc Environment (Protection) Act - Air (Prevention and control of pollution) Act - Water (Prevention and control of pollution) Act- Role of individual in prevention of pollution.		
UNIT V	**HUMAN POPULATION AND ENVIRONMENT**	**3**
Sustainable development – Urban Population growth and distribution – Population explosion – Family Welfare Program –Women and child welfare- Role of information technology in environment and human health- case studies		

Text / Reference (s) books:

1	Dr.J.P.Sharma, " Environmental studies" , Laxmi Publications(p) Ltd, New Delhi.
2	Miller "Environmental Science" 11th Edition, Cengage Learning India Private Limited, New Delhi, (2006).
3	Master. G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt Ltd., (2004)
4	Dr.A.Ravikrishnan " Environmental Science and Engineering " Sri Krishna publications, Chennai(2015)
5	P.Anandan, R.Kumaravelan "Environmental Science and Engineering" Scitech Publication (India) Pvt. Ltd, Chennai, Reprint 2009.

Regulation 2018		Semester III/ Semester IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM103T	INDIAN TRADITION AND HERITAGE	1	0	0	-

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Make students understand the role and impact of culture in human life.
CLR-2	Draw attention towards languages and literatures of ancient period.
CLR-3	Cultivate secularism in students
CLR-4	Equip students with the knowledge of Indian art and architectural evolution over years.
CLR-5	Make students identify Indian culture in abroad.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the meaning of culture, trace the influence and significance of geographical features on Indian culture.
CO2	Develop an awareness of the variety of languages and literatures in India.
CO3	Recognise the characteristics of various religious movements in ancient India.
CO4	Identify the characteristics and various styles of Indian architecture and sculpture at different times.
CO5	Examine various modes through which Indian culture spread abroad.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	2	1	2	2	1	2	-	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-	-
CO4	2	2	2	2	2	2	2	2	2	2	1	2	-	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO (Avg)	**2**	**2**	**2**	**2**	**2**	**1.8**	**1.8**	**1.6**	**1.8**	**1.8**	**1**	**1.8**	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	HISTORY OF INDIAN CULTURE	2
Characteristics of Indian Culture - Significance of Geography on Indian Culture -Society in India through ages- Ancient Period - Varna and Jati, family and marriage in India - Position of women in ancient India- Contemporary period; Caste system and communalism.		
UNIT II	**LITERATURE AND EDUCATION**	**4**
Evolution of script and languages in India : Harappan Script and Brahmi Script, Short History of the Sanskrit Literature: The Vedas, The Brahmanas and Upanishads and Sutras, Epics: Ramayana and Mahabharata&Puranas - History of Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Sangam Literature and Odia Literature.		
UNIT III	**RELIGION AND PHILOSOPHY**	**4**
Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainisim, Indian Philosophy - Vedanta and Mimansa school of Philosophy.		
UNIT IV	**ART AND ARCHITECTURE**	**2**
Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Budhhist Architecture, Medieval Architecture and Colonial Architecture, Indian Painting Tradition, Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Rise of modern theatre and Indian cinema.		
UNIT V	**SPREAD OF INDIAN CULTURE ABROAD**	**3**
Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World through ages.		
Text Book (s)		
	Nil	
Reference (s)		
Chakravarti, Ranabir: Merchants, Merchandise & Merchantmen, in: Prakash, Om (ed.): *The Trading World of the Indian Ocean, 1500-1800* (*History of Science, Philosophy and Culturein Indian Civilization,* ed. by D.P. Chattopadhyaya, vol. III, 7), Pearson, Delhi, 2012.		

Regulation 2018		Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
B	18MAB204T	STATISTICS AND NUMERICAL METHODS (Common to Mech, EEE, Civil, EIE)	3	1	0	4

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

1	Know the various methods of solving algebraic and transcendental equations numerically whereanalytical methods fail to give solution
2	Understand the concept of interpolation
3	Understand the concept of numerical differentiation and integration which is widely applicablewhen the function in the analytic form is too complicated or the huge amount of data are givensuch as series of measurements, observation or some other empirical information

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Analyze and evaluate the accuracy of common numerical methods.
CO2	Apply numerical methods to obtain approximate solutions to mathematical problems.
CO3	Predicts the solution of a given problem and confirm it with its corrector value if it deviates applies the corrector again.
CO4	Understand the problems of Students t test for single mean, difference of means.
CO5	Identify the applications and various design and concepts of experiments numerical integration

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	2	1	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	3	-	-	-	-	-	-	-	-	-	-	3
CO4	3	3	2	1	-	-	-	-	-	-	-	-	1	-	3
CO5	3	3	1	1	-	-	-	-	-	-	-	-	1	-	-
CO (Avg)	3	3	1.8	1.4	-	-	-	-	-	-	-	-	1	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9*+3*
Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method .		
UNIT II	**INTERPOLATION, NUMERICAL DIFFERENTIATION ANDNUMERICAL INTEGRATION**	**9*+3***
Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rule, Simpson's 3/8 rule (Single Integral)		
UNIT III	**NUMERICAL SOLUTION OF ORDINARYDIFFERENTIAL EQUATIONS**	**9*+3***
Taylor's series method – Euler's method - Modified Euler's method - Fourth order Runge- Kutta method for solving first and second order differential equations – Milne's predictor-corrector methods and Adam's Bash Forth Predictor-corrector method for solving first order equations - Finite difference methods for solving second order equation.		
UNIT IV	**TESTING OF HYPOTHESIS**	**9*+3***
Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.		
UNIT V	**DESIGN OF EXPERIMENTS**	**9*+3***
Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.		

Text Book (s)

1	R.A. Johnson and C.B. Gupta, "Miller and Freund"s Probability and Statistics forEngineers", Pearson Education, Asia, 7th edition, 2007.
2	Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 2004.

Reference (s)

1	R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics forEngineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2	M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum"s Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3	Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.

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Approved By
Board of Science & Humanities
29 MAR 2019
KARUR - 639 113

Regulation 2018		Semester IV	Total Hours			75
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
S	18EES104J/ 18EES202J	Digital Electronics	3	0	2	4

Prerequisite Course (s)

Basic Electrical and Electronics Engineering

Course Objective (s):

The purpose of learning this course is to:

1	Study implementation of combinational circuits.
2	Outline the procedures for analysis and design of synchronous sequential circuits
3	Outline the procedures for analysis and design of asynchronous sequential circuits.
4	Illustrate the concept of memories and programmable logic devices.
5	Study the fundamentals VHDL

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Design of combinational logic circuits
CO2	Design and analyze the behaviour of synchronous sequential logic circuits.
CO3	Design and analyze the various behaviours of Asynchronous Sequential Logic Circuits.
CO4	Interpret different memory devices, programmable logic devices and digital logic families.
CO5	Design of combinational circuits using VHDL

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	2	3	2	2	2	3	3	3
CO2	3	3	2	2	2	-	-	2	3	2	2	2	3	2	3
CO3	2	2	2	2	2	-	-	2	3	2	2	2	3	2	2
CO4	3	2	2	2	2	-	-	2	2	2	2	2	2	2	3
CO5	3	2	2	2	2	-	-	2	3	2	2	2	2	2	2
CO (Avg)	3	2.6	2	2	2	-	-	2	2	2	2	2	2.6	2.2	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	COMBINATIONAL CIRCUITS	9

Review of Karnaugh map simplification - Adder and Subtractor - Comparator - Parity generator - Code converter - Multiplexer - De multiplexer - Encoder – Decoder.

UNIT II	SEQUENTIAL CIRCUITS	9

Flip-flops: characteristic equation, Realization - Mater-Slave circuit - Moore and Melay Model - state diagram, state table, transition table - state reduction – state assignment & its problems-lockout conditions - counters - shift registers.

UNIT III	ASYNCHRONOUS SEQUENTIAL CIRCUITS	9

Analysis of pulse mode and fundamental mode circuits – Design of pulse mode and fundamental mode circuits – primitive flow table – Races and Cycle -state assignment, asynchronous design problem.

UNIT IV	PROGRAMMABLE AND DIGITAL LOGIC FAMILIES	9

Characteristics of digital ICs – Voltage and current ratings, Noise margin, Propagation delay, Power dissipation - RTL, TTL, ECL, CMOS - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

UNIT V	VHDL	9

VHDL - Concepts and Behavioural Modelling– Sequential Processing – process statement- signal Variable assignment, sequential statements, and concurrent assignment problem – Data Types - Subprograms and Packages - Combinational circuit design using VHDL.

LIST OF EXPERIMENTS

1. Verification of logic gates
2. Design of adder circuits using logic gates.
3. Design of Subtractor circuits using logic gates.
4. Design of code converters using logic gates.
5. Design and test the multiplexer and demultiplexer circuits.
6. Design.and test the Encoder and Decoder circuits.
7. Realization of shift registers
8. Design of up/ down counters
9. Write a VHDL program to verify the logic of adder circuits.
10. Write a VHDL program to verify the logic of Subtractor circuits.
11. Write a VHDL program to verify the logic of multiplexer circuits.
12. Write a VHDL program to verify the logic of demultiplexer circuits.

Text Book (s)	
1	A.Anandkumar, "Fundamental of Digital Circuits", PHI Learning Private Ltd, 4th edition, 2014.
2	M. Morris Mano, "Digital Design with an introduction to the VHDL", Pearson Education, 2013.
Reference (s)	
1	Mandal, "Digital Electronics Principles & Application, McGraw Hill Edu, 2013.
2	William Keitz, Digital Electronics-A Practical Approach with VHDL, Pearson, 2013.
3	Thomas L.Floyd, 'Digital Fundamentals', 11th edition, Pearson Education, 2015
4	Charles.H.Roth, Jr, LizyLizyKurian John, 'Digital System Design using VHDL, Cengage, 2013.
5	D.P.Kothari, J.S.Dhillon, 'Digital circuits and Design', Pearson Education, 2016.

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC207T	Electrical Machines II	3	0	0	3

Prerequisite Course (s)

ELECTRICAL MACHINES I

Course Objective (s):

The purpose of learning this course is to:

1	Classify different types of synchronous machines and voltage regulation methods
2	Analyze the synchronous motor and hunting methods
3	Classify different types of induction machines and their characteristics
4	Study about different speed control and starting methods
5	Study about different types and starting methods of single phase motors

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Illustrate the working principle of synchronous generators and analyze the different types of voltage regulation methods
CO2	Illustrate the principle of operation and performance of synchronous motor
CO3	Illustrate the features and testing of induction motors
CO4	Analyze performance and speed control of three phase induction motors
CO5	Explain different starting methods of induction motor and performance of special motors

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO2	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO3	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO4	2	2	2	2	2	-	-	2	2	1	-	1	3.	2	1
CO5	2	2	2	2	2	-	-	2	2	1	-	1	3	2	1
CO (Avg)	2.00	2.00	2.00	2.00	2.00	-	-	2.00	2.00	1.00	-	1.00	3.00	2.00	1.00

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	SYNCHRONOUS GENERATORS	10
Types and construction features of alternators – e.m.f equation armature reaction – Synchronous reactance – determination of voltage regulation using EMF, MMF and ZPF methods – parallel operation of synchronous generators – two reaction theory – slip test.		
UNIT II	**SYNCHRONOUS MOTOR**	**8**
Constructional features and principle of operation of synchronous motor – Starting methods – torque and power relations – V curves and inverted V curves – Hunting and suppression methods–Synchronous condenser.		
UNIT III	**THREE PHASE INDUCTION MACHINES**	**12**
Construction and principle of operation of three phase induction motor – Equivalent circuit – Torque & Power equations – Slip – Torque characteristics – Maximum Torque Condition – Losses and Efficiency– Load test– No load & blocked rotor tests – Separation of no load losses – circle diagram.		
UNIT IV	**STARTING AND SPEED CONTROL OF INDUCTION MACHINES**	**7**
Starting methods of three phase induction motor – Cogging & Crawling – Speed control – Voltage control – Rotor resistance control – Pole changing – Frequency control – Slip power recovery scheme – Double cage rotor – Induction generator – Synchronous induction motor.		
UNIT V	**SINGLE PHASE MOTORS**	**8**
Single phase induction motors – Double revolving field theory – Torque – Speed characteristics – Equivalent circuit – No load and Blocked rotor test - Performance analysis – Starting methods of Single phase motors – Special motors: shaded pole motor, reluctance motor, repulsion motor, Hysteresis motor.		

Text Book (s)

1	Nagarath.I.J. and Kothari.D.P., "Electric Machines", T.M.H. Publishing Co Ltd., New Delhi, 5th edition 2010.
2	K.Murugesh Kumar, "Electrical Machines, Vol II", Vikas Publication Pvt. Ltd., 2010.

Reference (s)

1	A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, "Electric Machinery", Tata McGraw Hill publishing Company Ltd, 2014.
2	J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, 2010.
3	Battacharya S K, "Electrical Machines", Tata McGraw Hill", NewDelhi . Fourth edition 2014.
4	B.L. Theraja, "Electrical Technology Vol.II AC/DC Machines", S. Chand, Publications 2008

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC208T	Transmission and Distribution	3	0	0	3

Prerequisite Course (s)

Electro Magnetic Theory

Course Objective (s):

1	Understand the operation of the different distribution schemes.
2	Develop expressions for the computation of transmission line parameters.
3	Obtain the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system
4	Analyzes the voltage distribution in cables and Impart knowledge about insulator
5	Understand bus bar arrangements in substation.

Course Outcome (s) (COs):

CO1	Outline the distribution system connection scheme.
CO2	Analyse the line parameters of transmission lines
CO3	Analyse the features and performance of the short, medium and long transmission lines.
CO4	Label the features of different types of cables
CO5	List the need for electrical substations and its layouts

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	2	3	3	3	3	3	1	2
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	1	2
CO3	3	3	3	3	3	2	3	3	3	3	3	3	3	1	2
CO4	3	3	3	3	3	2	2	2	3	3	3	3	3	1	2
CO5	3	3	3	3	3	2	3	3	3	3	3	3	3	1	2
CO (Avg)	3	3	3	3	3	2	2.4	2.6	3	3	3	3	3	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	AC AND DC DISTRIBUTION SYSTEM	9
Classification of Distribution systems– Connection Schemes of Distribution systems– DC distributor : Concentrated Load Fed at one end & Both ends, Uniformly Loaded Distributor fed at one end & Both ends. AC distribution : Single phase Distributor , Three phase 3-wire with Balanced & Unbalanced loads.		
UNIT II	**DESIGN OF OVERHEAD TRANSMISSION LINE**	**9**
Resistance of a Transmission Line – Skin Effect – Flux Linkages – Inductance of a Single phase Two-wire Line, Inductance of a 3-Phase Overhead line(Symmetrical & Unsymmetrical spacing) – Electric Potential –Capacitance of a Single phase Two-wire Line, Capacitance of a 3-Phase Overhead line (Symmetrical & Unsymmetrical spacing)		
UNIT III	**PERFORMANCE OF TRANSMISSION LINES**	**9**
Classification of Transmission Lines – Voltage Regulation & Transmission Efficiency– Performance of Single phase Short Transmission Lines – Medium Transmission Lines (Nominal T and Nominal π Method) – Long Transmission Lines (Rigorous Method) – Corona : Factors affecting corona, Methods of reducing corona– Calculation of Sag in Overhead Lines		
UNIT IV	**CABLES AND INSULATORS**	**9**
Construction of Cables – Classification of Cables – Cables for 3-Phase service – Insulation Resistance of a Single core Cable – Capacitance of a Single core Cable – Dielectric stress in a single-core cable – Grading of Cables.Types of Insulators – Calculation of String Efficiency – Methods of Improving String Efficiency		
UNIT V	**SUBSTATIONS**	**9**
Classification of Sub-stations – Comparison between Indoor & Outdoor Sub-stations – Transformer substation-Pole-Mounted Substation – Underground Substation – Substation Equipments –Busbar Arrangement in Sub-stations – 66/11kV Substation – 11/400 V Indoor Substation.		

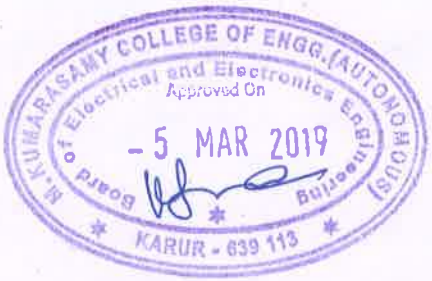
Text Book (s)

1	Gupta B.R., "Power System Analysis and Design", S. Chand, New Delhi, 2016.
2	Soni M L, Gupta P V, Bhatnagar U S and Chakrabarthi A, "A Text Book on Power System Engineering", Dhanpat Rai & Co., New Delhi, 2015.

Reference (s)

1	Uppal S L, "Electrical Power", Khanna Publishers, New Delhi, Thirteenth Edition, 1995.
2	Wadhwa C L, "Electrical Power Systems", New Age International Publishers, Delhi, 2006 Fourth Edition Reprint Aug, 2007
3	Mehta V K, Rohit Mehta , "Principles of Power Systems", S.Chand & Co. Pvt. Ltd., New Delhi, 2004.

4	Gupta J B, "A Course in Electrical Power", S. K. Kataria & Sons, 2003
5	Singh S.N., "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, 2002.



Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC209T	Control Systems	3	0	0	3

Prerequisite Course (s)

Transforms and Boundary Value Problems

Course Objective (s): The purpose of learning this course is to

1	Illustrate basic concepts of physical systems and transfer function modeling
2	Analyze the system dynamics in time domain specifications using various techniques and steady state error analysis
3	Develop the system in frequency domain specifications using various analysis techniques and obtaining the open loop and closed–loop frequency responses of systems.
4	Analyze the stability of linear control system.
5	Anayze the time domain and frequency domain performance using MATLAB tool.

Course Outcome (s) (COs): At the end of this course, learners will be able to

CO1	Develop the transfer function modeling for analysis of physical systems
CO2	Determine the time response of various models of linear system subjected to standard test signals
CO3	Infer the concept of frequency domain specifications applied to systems using various analysis techniques
CO4	Analyze the performance and stability of linear control system and design appropriate compensator for the given specifications
CO5	Develop the Matlab program to indicate time domain and frequency domain performance.

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	-	1	2	2	-	2	2	2	-	-
CO2	3	2	1	1	2	-	1	2	2	-	2	1	2	-	-
CO3	3	2	2	1	2	-	1	2	2	-	2	1	2	-	-
CO4	3	2	3	2	2	-	1	2	2	-	2	2	2	-	-
CO5	3	2	2	1	2	-	1	2	2	-	2	2	2	-	-
CO (Avg)	3	2	2.2	1.2	2	-	1	2	2	-	2	1.6	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
Open loop and feedback control systems- Mathematical modeling of Electrical systems- Mathematical modeling of Mechanical systems - Electrical analogy of mechanical systems- Transfer function- Block diagram reduction techniques- Signal flow graphs.		
UNIT II	**TIME RESPONSE ANALYSIS**	**9**
Standard test signals– first order system response – second order system response - time domain specifications - static error constants and steady state error- generalized error series.		
UNIT III	**FREQUENCY RESPONSE ANALYSIS**	**9**
Frequency response - frequency domain specifications - bode plot- polar plot-determination of closed loop response from open loop response-Constant M and N circles.		
UNIT IV	**STABILITY ANALYSIS**	**9**
Characteristics equation- Location of roots in S-plane for stability- Routh-Hurwitz Stability criterion- Root locus - Nyquist stability criterion.		
UNIT V	**CONTROL SYSTEM DESIGN USING MATLAB**	**9**
MATLAB - Introduction, display formats, Built-in functions, arrays and its operations, polynomials, script files, programming, graphs, laplace transform. Second order system response, root locus, frequency response - bode diagrams, polar plots, nyquist plot.		

Text Book (s)

1	Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
2	Ogata K., —Modern Control Engineeringll, 5th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2010
3	M. Gopal, "Control Systems, Principles & Design", 4th Edition, Tata McGraw Hill,2012, New Delhi.

Reference (s)

1	Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.
2	S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013.
3	DhaneshN.Manik, "Control Systems", Cengage Learning, Delhi, 1st Edition, 2012.
4	Gopal M, Modern Control Systems Theory, 3rd Edition, New Age International Publishers, New Delhi, 2015
5	RaoV.Dukkipati, "Analysis and design of Control Systems using MATLAB", New Age International Publishers, 2nd edition, Reprint : 2019

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC210T	Power Electronics and Converters	3	0	0	3

Prerequisite Course (s)

Basic Electrical and Electronics Engineering and Analog Electronics

Course Objective (s):

1	Understand the different types of power semi-conductor devices and their switching characteristics and various Triggering Circuits.
2	Illustrate the operation, characteristics and performance parameters of controlled rectifiers.
3	Understand the operation, switching techniques and basic topologies of DC-DC switching regulators.
4	Understand the different modulation techniques of pulse width modulated inverters and to understand the harmonic, reduction methods, Series and Parallel Inverter.
5	Illustrate the operation of AC-voltage regulator, Cycloconverter and Matrix Converter.

Course Outcome (s) (COs):

CO1	Ability to express characteristics of SCR, BJT, MOSFET, IGBT and IGCT.
CO2	Design a suitable Power Converter for given DC load specification from AC input.
CO3	Design and analyze of various DC – DC converters.
CO4	Design and analyze the Single and Three Phase Inverters.
CO5	Analyze different AC to AC converters.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	0	0	0	0	0	3	3	3	3	2	2	3
CO2	3	2	2	1	2	0	0	0	3	3	3	3	2	2	3
CO3	3	2	2	1	2	0	0	0	3	3	3	3	2	2	3
CO4	3	2	2	1	2	0	0	0	3	3	3	3	2	2	3
CO5	3	2	2	1	2	0	0	0	3	3	3	3	2	2	3
CO (Avg)	3	2	2	0.8	1.6	0	0	0	3	3	3	3	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	POWER SEMI-CONDUCTOR DEVICES	9
Introduction to Power Electronics: Construction, Principle of operation – Static and dynamic characteristics of Power Diode, Power BJT, SCR, TRIAC, Power MOSFET, IGBT and IGCT- Gate Triggering Methods: Resistance Firing Circuit – RC Firing Circuit – UJT firing circuit – Pulse Transformer		
UNIT II	**PHASE CONTROLLED CONVERTERS**	**9**
Introduction Controlled Rectifiers: Single phase and three phase half and fully controlled converters with R, RL and RLE Load – Estimation of average load voltage and average load current for continuous current operation – Dual Converter – Applications.		
UNIT III	**CHOPPER**	**9**
Introduction to Chopper: Principle of operation of Step-down and Step-up chopper - Control Strategies – Principle of operation Type A, B, C, D & E Chopper – Buck, Boost, Buck-Boost and Cuk Regulators – Applications.		
UNIT IV	**INVERTERS**	**9**
Introduction to Inverters: Voltage Source Inverter–Single Phase Bridge Inverter – Three Phase Bridge Inverter - PWM techniques: single, multiple, sinusoidal PWM – Single & Three phase current source Inverter – Series & Parallel Inverter – Applications.		
UNIT V	**AC – AC CONVERTERS**	**9**
Introduction: Single phase AC voltage controllers – Integral Control and Phase Control – Estimation of RMS load voltage and average load current –Three Phase AC Voltage Controller – step up and step down cycloconverters – Single phase and Three phase cycloconverters – Matrix Converter – Applications.		

Text Book (s)	
1	Rashid M.H., "Power Electronics: Circuits and Applications", 3rd Edition, Pearson Education, New Delhi,2014.
2	L.Ashok Kumar, A.Kalaiarasi, Y.Uma Maheswari , "Power Electronics with MATLAB", 1st Edition, Cambridge University Press,2018.
Reference (s)	
1	M.D.Singh, K.B.Khanchandani, "Power Electronics",TMH publishing Co, Ltd., 2008
2	Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics: Converters, Applications and Design", John Wiley and Sons,3rd Edition,2009.
3	Andrzej M.Trznadlowski, "Introduction to Modern Power Electronics" Wiley India Pvt. Ltd., Second Edition 2012.
4	V.Jagannathan, "Power Electronics Devices and Circuits" PHI Learning Private Ltd. Second Edition 2011.
5	Bimbra P.S.,"Power Electronics", 5th Edition, Khanna Publishers, 2013.

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC211L	Electrical Machines II Laboratory	0	0	3	1.5

Prerequisite Course (s)

Basic Electrical and Electronics Engineering Lab, Electrical Machines I Laboratory.

Course Objective (s):

The purpose of learning this course is to:

1	Understand the characteristics of Synchronous machines
2	Understand the characteristics of Single phase & Three phase Induction machines
3	Describe the speed control methods of Three phase Induction machines
4	Estimate the efficiency of Single phase & Three phase Induction Machines by indirect testing methods
5	Estimate the performance of Synchronous machines by indirect testing methods

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze the performance of Synchronous machines
CO2	Estimate the voltage regulation of alternators by indirect testing methods
CO3	Estimate the losses & efficiency of Single phase & Three phase Induction machines by direct & indirect methods
CO4	Analyze the performance of Single phase & Three phase Induction machines
CO5	Analyze the speed control methods of Three phase Induction motors

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO2	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO3	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO4	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO5	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1
CO (Avg)	2	2	2	2	1	2	-	-	3	3	1	1	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

List of Experiment(s)	
1	Regulation of three phase alternator by E.M.F. method
2	Regulation of three phase alternator by M.M.F. method
3	Regulation of three phase alternator by ZPF. method.
4	Determination of direct axis and quadrature axis reactance of salient pole alternator by slip test
5	V and inverted V-curves of three phase synchronous motors.
6	Load test on three-phase induction motor.
7	Determine the equivalent circuit parameters of three-phase induction motor.
8	Separation of no-load losses of three-phase induction motor.
9	Load test on single-phase induction motor.
10	Determine the equivalent circuit parameters of single-phase induction motor.
11	No load and blocked rotor test on single-phase induction motor.

Regulation 2018		Semester IV	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC212L	Control System Laboratory	0	0	3	1.5

Course Objective (s): The purpose of learning this course is to

1	Learn to evaluate the transfer function parameters of DC generators.
2	Learn to evaluate the transfer function parameters of DC motors.
3	Evaluate the transfer function of servo motors.
4	Analyze the performance of first order and second order systems using test inputs.
5	Analyze the stability of linear systems.

Course Outcome (s) (Cos): At the end of this course, learners will be able to

CO1	Ability to formulate transfer function of DC motor
CO2	Ability to formulate transfer function of DC generator.
CO3	Ability to formulate transfer function of servo motors.
CO4	Determine the time and frequency response.
CO5	Expose the knowledge on stability of linear systems.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	2	2	-	-	-	-	2	2	-	-	2
CO2	2	2	2	1	3	1	-	-	-	-	2	1	-	-	2
CO3	2	1	2	1	1	2	-	-	-	-	2	2	-	-	2
CO4	2	2	2	1	1	1	-	-	-	-	2	1	-	-	2
CO5	2	2	2	1	1	1	-	-	-	-	2	1	-	-	2
CO (Avg)	2.2	2	2.2	1	1.6	1.4	-	-	-	-	2	1.4	-	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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List of Experiment(s)	
1	Determination of transfer functions of self excited DC generator
2	Determination of transfer function of armature controlled DC motor
3	Determination of transfer function of field controlled DC motor
4	Determination of transfer function of AC servo motor
5	Determination of transfer function of DC servo motor
6	Digital simulation of Type-0 and Type-1 systems
7	Digital simulation of first order system
8	Digital simulation of second order system
9	Stepper motor control system
10	Stability analysis of linear systems

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Regulation 2018		Semester IV	Total Hours			30
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18MBM202L	CRITICAL AND CREATIVE THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Focus on listening, speaking, & writing skills through audio & video sessions
2	Hone soft skill and analytical ability of students
3	Overcome the fear in group communication and to provide the effective communication
4	Expertise intelligible pronunciation, stress and intonation patterns

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in an effective manner
CO2	Demonstrate an ability to design and deliver messages
CO3	Improve their communication with practical experience

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	-	2.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Time and Work - Pipes and Cisterns. **Communication:** Sentence Pattern - Debate.		
UNIT II	**Module - 2**	**6**
Aptitude: Boats and Streams. **Communication:** Tenses and voices - Tech Talk.		
UNIT III	**Module - 3**	**6**
Aptitude: Problems on Ages - Probability **Communication:** Analogies - Biography.		
UNIT IV	**Module - 4**	**6**
Aptitude: Data sufficiency - Logical Puzzles. **Communication:** Punctuation - Connection.		
UNIT V	**Module - 5**	**6**
Aptitude: Mensuration. **Communication:** Preposition - News of the Week.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

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Regulation 2018		Semester III / Semester IV	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18CYM201T	Environmental Science	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):

The purpose of learning this course is to:

- To demonstrate in-depth knowledge within environmental engineering and an awareness of social, economic, political, and environmental impacts of engineering practices.
- To have competence for working with multi-disciplinary teams to arrive at solutions to environmental engineering problems.
- To get solutions which will minimize the negative impact of human activities on the environment and to protect human health

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Improve fundamental knowledge of the inter-relationships between the built environment and natural systems
CO2	Characterize and mitigate man-made hazards like nuclear hazards. Understand the principles involved in the generation of different forms of energy
CO3	Improve the reliability, performance, disaster-management of natural calamities and solid waste and water supplies and treatment processes.
CO4	Understand the source, effects and control measure of various environmental pollution
CO5	Apply information technology in the control of human population and women and child welfare

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	3	3	-	-	-	-	-	-	-	-
CO3	-	2	-	2	-	3	3	-	-	-	-	-	-	-	-
CO4	-	2	-	-	-	3	3	2	-	-	-	-	-	-	-
CO5	-	2	-	2	-	3	3	-	-	-	-	-	-	-	-
CO (Avg)	-	2.00	-	2.00	-	3.00	3.00	2.00	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENVIRONMENT& BIODIVERSITY	3
Definition-types of environment, components of environment, scope-importance of environmental studies- Bio diversity-definition-value of biodiversity-Threats to biodiversity - India a mega diversity nation-endangered and endemic species of India-conservation of biodiversity.		
UNIT II	**ENERGY SOURCES**	**3**
Energy resources- Growing energy needs- Renewable and Nonrenewable energy sources- Use of alternate energy sources - Nuclear Energy- Alternative energy fuels-power alcohol-Bio diesel (preparation, properties &uses)		
UNIT III	**SOCIAL ISSUES AND ENVIRONMENT**	**3**
Environment ethics – Climate change – Global warming – Acid rain – Ozone layer depletion –Nuclear accidents-holocaust. Solid waste management - Rain water Harvesting-watershed management-		
UNIT IV	**ENVIRONMENTAL POLLUTION & ACTs**	**3**
Source, types, effects & control- Air pollution -Water pollution – Soil pollution – Marine pollution and Plastic Pollution -Thc Environment (Protection) Act - Air (Prevention and control of pollution) Act - Water (Prevention and control of pollution) Act- Role of individual in prevention of pollution.		
UNIT V	**HUMAN POPULATION AND ENVIRONMENT**	**3**
Sustainable development – Urban Population growth and distribution – Population explosion – Family Welfare Program –Women and child welfare- Role of information technology in environment and human health- case studies		

Text / Reference (s) books:

1	Dr.J.P.Sharma, " Environmental studies" , Laxmi Publications(p) Ltd, New Delhi.
2	Miller "Environmental Science" 11th Edition, Cengage Learning India Private Limited, New Delhi, (2006).
3	Master. G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt Ltd., (2004)
4	Dr.A.Ravikrishnan " Environmental Science and Engineering " Sri Krishna publications, Chennai(2015)
5	P.Anandan, R.Kumaravelan "Environmental Science and Engineering" Scitech Publication (India) Pvt. Ltd, Chennai, Reprint 2009.

Regulation 2018		Semester III/ Semester IV	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM103T	INDIAN TRADITION AND HERITAGE	1	0	0	-

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

CLR-1	Make students understand the role and impact of culture in human life.
CLR-2	Draw attention towards languages and literatures of ancient period.
CLR-3	Cultivate secularism in students
CLR-4	Equip students with the knowledge of Indian art and architectural evolution over years.
CLR-5	Make students identify Indian culture in abroad.

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Understand the meaning of culture, trace the influence and significance of geographical features on Indian culture.
CO2	Develop an awareness of the variety of languages and literatures in India.
CO3	Recognise the characteristics of various religious movements in ancient India.
CO4	Identify the characteristics and various styles of Indian architecture and sculpture at different times.
CO5	Examine various modes through which Indian culture spread abroad.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	2	2	1	2	2	1	2	-	-	-
CO3	-	-	-	-	-	1	1	1	1	1	1	1	-	-	-
CO4	2	2	2	2	2	2	2	2	2	2	1	2	-	-	-
CO5	-	-	-	-	-	2	2	2	2	2	-	2	-	-	-
CO (Avg)	**2**	**2**	**2**	**2**	**2**	**1.8**	**1.8**	**1.6**	**1.8**	**1.8**	**1**	**1.8**	-	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

UNIT I	HISTORY OF INDIAN CULTURE	2
Characteristics of Indian Culture - Significance of Geography on Indian Culture -Society in India through ages- Ancient Period - Varna and Jati, family and marriage in India - Position of women in ancient India- Contemporary period; Caste system and communalism.		
UNIT II	**LITERATURE AND EDUCATION**	**4**
Evolution of script and languages in India : Harappan Script and Brahmi Script, Short History of the Sanskrit Literature: The Vedas, The Brahmanas and Upanishads and Sutras, Epics: Ramayana and Mahabharata&Puranas - History of Buddhist and Jain Literature in Pali, Prakrit and Sanskrit, Sangam Literature and Odia Literature.		
UNIT III	**RELIGION AND PHILOSOPHY**	**4**
Religion and Philosophy in India: Ancient Period: Pre-Vedic and Vedic Religion, Buddhism and Jainism, Indian Philosophy - Vedanta and Mimansa school of Philosophy.		
UNIT IV	**ART AND ARCHITECTURE**	**2**
Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Budhhist Architecture, Medieval Architecture and Colonial Architecture, Indian Painting Tradition, Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Rise of modern theatre and Indian cinema.		
UNIT V	**SPREAD OF INDIAN CULTURE ABROAD**	**3**
Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World through ages.		
Text Book (s)		
	Nil	
Reference (s)		
Chakravarti, Ranabir: Merchants, Merchandise & Merchantmen, in: Prakash, Om (ed.): *The Trading World of the Indian Ocean, 1500-1800* (*History of Science, Philosophy and Culturein Indian Civilization,* ed. by D.P. Chattopadhyaya, vol. III, 7), Pearson, Delhi, 2012.		

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Regulation 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM301L	ANALYTICAL AND LOGICAL THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	To sharpen problem solving skills and to improve thinking capability of the students
2	To drive the students to use language with great commitment and cooperation
3	To expertise the creative thinking and presentation skills to meet the company needs

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Students will be able to solve both analytical and logical problems in a fruitful manner
CO2	Students will organize and convey the information in such an incomparable way
CO3	Presentation skills will be imparted to students

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	-	-	-	-	-	-	-	-	2	-	-	-	1	1	1
CO3	-	-	-	-	-	-	-	-	-	2	-	-	2	2	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-	1.66	1.66	1.66

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Alligations or Mixtures - Blood Relations. **Communication:** How to set Goals - Interpersonal Relationships - JOHARI Window - Work & Business Etiquette		
UNIT II	**Module - 2**	**6**
Aptitude: Partnership - Statement and Assumptions. **Communication:** Transition to Corporate World - Career opportunities in Various Sectors and know your industry.		
UNIT III	**Module - 3**	**6**
Aptitude: Arithmetic and Geometric Progressions - Syllogisms. **Communication:** Time Management - Anger and Stress Management - Conflict Management.		
UNIT IV	**Module - 4**	**6**
Aptitude: Permutations and Combinations - Statements & Conclusions. **Communication:** Launch a Product - Telephonic Etiquette.		
UNIT V	**Module - 5**	**6**
Aptitude: Geometric Problems. **Communication:** Presentation Skills - Oral presentation and public speaking skills, Business presentations.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester VI	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM302L	EMPLOYABILITY SKILLS AND PRACTICES	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	To learn the application of mathematical or statistical models to different real-world contexts
2	To focus on writing & speaking skills through vigorous practices.
3	To enhance soft skills and analytical ability of students
4	To defeat the fear while communicating in group and to master the effective communication

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Students can solve both analytical and logical problems in a productive manner
CO2	Students can launch their ability of comprising and delivering the information
CO3	The communication quality will be upgraded in near future

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	-	-	-	-	-	-	-	-	3	-	-	-	1	1	1
CO3	-	-	-	-	-	-	-	-	-	3	-	-	2	2	2
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO (Avg)	3.00	-	-	-	-	-	-	-	3.00	3.00	-	-	1.66	1.66	1.66

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Time and Distance (Speed, Streams) - Problems on Trains - Arrangements and BloodRelations. **Communication:** Job Application - Cover letter,Bio-data,Resume & CV building.		
UNIT II	Module - 2	**6**
Aptitude: Time and Work - Pipes & Cisterns - Situation Reaction Test & Data Interpretations. **Communication:** Writing practices on circulars, notices, memos, Agenda preparation and Minutes of meeting.		
UNIT III	Module - 3	**6**
Aptitude: Ages - Averages - Probability - Profit and Loss. **Communication:** Email Etiquette - Essay writing.		
UNIT IV	Module - 4	**6**
Aptitude: Mensuration - SI & CI - Cause and Effect Analysis - Statement, Assumptions & Conclusions. **Communication:** Group Discussion and guidelines.		
UNIT V	Module - 5	**6**
Aptitude: Permutation and Combinations - Partnership - Alligations or Mixtures. **Communication:** Interview skills - General instructions, Review of interview questions, Mock Interviews.		

Text Book (s)	
1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester V	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC301T	POWER SYSTEM ANALYSIS	3	1	0	4

Prerequisite Course (s)

Electric Power Generation, Transmission and Distribution

Course Objective (s): The purpose of learning this course is to:

1	Understand about Per Unit calculation, Single Line Diagram and Network Matrices formation for power system
2	Apply numerical techniques to solve load flow analysis
3	Solve symmetrical faults occurring in power system network
4	Solve unsymmetrical faults occurring in power system network
5	Summarize the stability issues in power system

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Relate single line diagram, per unit Computations and network matrices of power system
CO2	Carry out power flow analysis by iterative techniques
CO3	Formulate and Analyse symmetrical faults occurring in power system network
CO4	Formulate and Analyse various type of unsymmetrical faults occurring in power system network
CO5	Explain the role of stability, swing equation and equal area criterion

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2
CO (Avg)	3	2	2	2	-	-	-	-	-	-	-	1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	AN OVERVIEW AND MODELLING OF THE POWER SYSTEM	12
Introduction - Structure of Electric Power System - Modelling of Power System Components - Single line diagram - Impedance Diagram - Reactance Diagram - Per unit System - Network Modelling - Bus Frame Network - Primitive Network - Incident Matrices - Formation of bus admittance matrix (YBUS) - Direct Inspection method - Formation of bus impedance matrix (ZBUS) without mutual coupling.		
UNIT II	**POWER FLOW ANALYSIS**	**12**
Introduction – Bus Classification – Load Flow Equations – Load flow methods – Gauss-Seidel Method – Newton-Raphson Method – Computation of slack bus power and transmission line losses – Comparison of above methods.		
UNIT III	**SYMMETRICAL FAULT ANALYSIS**	**12**
Introduction – Types of Faults – Short circuit analysis of power system components: Synchronous Machine and Transmission Line – Short circuit current calculation using Thevenin's theorem and Bus Impedance Matrix – Short circuit capacity – Selection of circuit breakers.		
UNIT IV	**UNSYMMETRICAL FAULT ANALYSIS**	**12**
Introduction – Symmetrical Components – Sequence Impedances – Sequence Network of power system components: Synchronous Machines, Transmission Line, Transformer and Loads – Single Line to Ground Fault – Line to line Fault – Double Line to Ground Fault – Unsymmetrical fault analysis using bus impedance matrix.		
UNIT V	**POWER SYSTEM STABILITY**	**12**
Introduction – Classification of Power System Stability – Power Angle Equations – Swing Equation – Transient Stability – Assumptions in transient stability analysis – Equal Area Criterion – Solution of Swing Equation: Step By Step Methods – Critical clearing angle and time.		

Text Book (s)

1	John J. Grainger and Stevenson Jr. W.D., "Power System Analysis", McGraw Hill International Edition, Fourth Edition, 1994.
2	P. Venkatesh, B. V. Manikandan, S. Charles Raja and A. Srinivasan, "Electrical Power Systems: Analysis, Security and Deregulation", PHI Learning Pvt. Ltd., First Edition, 2012.

Reference (s)

1	Nagarath.I.J, Kothari.D.P, "Modern Power System Analysis", Tata McGraw Hill Pub. Co. Ltd., Third Edition, 2004
2	Hadi Saadat., "Power System Analysis" Tata McGraw Hill Publishing Company, New Delhi, 2002.
3	Stagg, G.W. and El-Abiad, A.H., "Computer Methods in Power System Analysis", Tata McGraw Hill Book Co., 1968.

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC302T	MICROCONTROLLER AND EMBEDDED SYSTEM	3	0	0	3

Prerequisite Course (s)

Analog Electronics, Digital Electronics

Course Objective (s): The purpose of learning this course is to:

1	Understand the architecture of 8085 Microprocessors and its comparable features with microcontroller
2	Understand the concept of 8051 Microcontroller and its various features with simple programs
3	Enumerate the various Advanced Microcontrollers Architectures
4	Understand the various network topologies in Embedded system.
5	Study the introduction of RTO's and its scheduling mechanisms and applications of embedded systems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the architecture of microprocessor 8085
CO2	Describe the 8051 architecture and the function of on-chip hardware units in 8051
CO3	Explain the architecture and hardware features of PIC 16F877 and ARM 7 (LPC2148).
CO4	Describe the basic concept of embedded system architecture and its communication networks.
CO5	Explain the methods of scheduling, multitasking and the application of embedded systems

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	1	-	-	-	-	1	2	2	2
CO2	3	2	1	-	-	2	1	-	-	-	-	1	2	2	2
CO3	3	1	1	1	1	2	2	-	-	-	-	2	3	2	3
CO4	3	-	-	-	-	2	2	-	-	-	-	2	3	3	3
CO5	3	2	1	-	-	2	1	-	-	-	-	2	2	2	3
CO (Avg)	3	1.6	1	1	1	2	1.4	-	-	-	-	1.6	2.4	2.2	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	8085 MICROPROCESSOR INTRODUCTION	9
Introduction to Microcontroller and Microprocessor – Von Neumann and Harvard architecture – CISC and RISC -Architecture of 8085 Microprocessor – Memory Interfacing -Timing Diagram – Interrupt System – Instruction Format – Addressing Modes - Comparison of Microcontroller and Microprocessor- Application of Microcontroller and Microprocessor		
UNIT II	**8051 MICROCONTROLLER**	**9**
8051 Architecture – Pin details – Addressing modes – Instruction sets – Timing diagrams- Memory – I/O Ports – Counters/Timers – Interrupts – Serial Ports - Simple Programs -Application of Stepper Motor Control		
UNIT III	**ADVANCED MICROCONTROLLERS AND ITS ARCHITECTURE**	**9**
PIC 16F877 Microcontroller – Architecture – On chip ADC – Capture/Compare/PWM Module – Serial peripheral buses (UART, I2C, SPI) – Watchdog Timer – ARM 7 (LPC2148) Microcontroller – Architecture and applications		
UNIT IV	**EMBEDDED SYSTEMS & NETWORKING**	**9**
The build in process for embedded systems – Structural units for an embedded microcontroller – Selection of processor and memory devices – Embedded Networking –RS485 – USART- CAN Bus – USB – CPU bus, ARM/SHARC buses		
UNIT V	**RTO'S AND EMBEDDED APPLICATIONS**	**9**
Task, Process & Threads – Interrupt routines in RTO's – Multiprocessing and Multitasking – Scheduling – Context Switching – deadlock – Watchdog timer. Applications: Automatic Washing Machine – Automotive Application-Digital Camera		

Text Book (s)

1	Muhammed Ali Mazidi,Janice Gilliespie Mazidi,Rolin D.McKinlay " The 8051 Microcontroller and Embedded Systems ",Pearson Prentice hall, 2nd edition 2007.2.
2	Ajay V.Deshmukh,"Microcontrollers – Theory and Applications",Tata McGraw Hill Publisher,sixth edition 2007.
3	Rajkamal S,"Embedded Systems", Tata McGraw Hill Publisher, Re-print 2012
4	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085". Sixth edition, Penram International Publishing 2012.

Reference (s)

1	Kenneth J Aayala, "The 8051 Microcontroller, Architecture,Programming and Application", Penram International, India 2008
2	John B.Peatman, "Design with microcontrollers", Pearson Prentice hall,4th edition 2011.
3	Shibu K V, "Introduction to embedded system",Tata McGraw Hill Publisher, 2013.
4	Tim Wilmshurst, "Designing Embedded Systems with PIC Microcontrollers-Principles and Applications", Newnes Publications, 2007

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC303L	POWER ELECTRONICS AND CONVERTERS LABORATORY	0	0	3	1.5

Prerequisite Course (s)

Power Electronics and Converters

Course Objective (s): The purpose of learning this course is to:

1	Study the characteristics of power semi conductor devices
2	Impart knowledge on different converters
3	Construct converter topology using simulation tool

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Experiment about characteristics of power semi conductor devices
CO2	Acquire knowledge on DC to DC Circuits
CO3	Construct the DC to AC Circuits
CO4	Demonstrate on AC to AC Circuits
CO5	Acquire knowledge on simulation tool to construct converter topologies

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	1	-	-	1	3	1	-
CO2	3	2	2	2	-	-	-	-	1	-	-	1	3	1	-
CO3	3	2	2	2	-	-	-	-	1	-	-	1	3	1	-
CO4	3	2	2	2	-	-	-	-	1	-	-	1	3	1	-
CO5	3	2	2	2	3	-	-	-	1	-	-	1	3	1	-
CO (Avg)	3	2	2	2	3	-	-	-	1	-	-	1	3	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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S.No	List of Experiments
1	Steady State Characteristics of SCR and TRIAC
2	Steady State Characteristics of MOSFET and IGBT
3	Analysis the Performance of Buck and Boost Choppers
4	Analysis the Performance of Voltage commutated chopper
5	Understand the operation of Single-phase PWM inverter
6	Understand the operation of Three-phase PWM inverter
7	Analysis the Performance of Series inverter
8	Analysis the Performance of Parallel inverter
9	Implementation of Single Phase AC Voltage Controllers
10	Implementation of Single phase half and fully controlled Rectifiers using Simulation Software
11	Implementation of Three phase half and fully controlled Rectifiers using Simulation Software

Regulation 2018		Semester V	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC304L	MICROCONTROLLER AND EMBEDDED SYSTEM LABORATORY	0	0	3	1.5

Prerequisite Course (s)

Digital Circuits Laboratory

Course Objective (s): The purpose of learning this course is to:

1	Study the basic processor and controller functions
2	Know the operation of various interfacing techniques.
3	Learn the control program for various applications
4	Expose the students to do programming in PIC Microcontroller
5	Study the interfacing concepts in 8051 Microcontroller

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Demonstrate the arithmetic operations that can be implemented using Microcontroller
CO2	Describe the interfacing methods that can be used in Microcontroller
CO3	Understand the functional block of 8051 Microcontroller and PIC Microcontroller
CO4	Demonstrate a program to interface application oriented control using 8051
CO5	Describe the display and voltage control module using PIC Microcontroller

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	-	3	-	1	1	3	2	3
CO2	3	2	2	1	1	1	1	-	1	-	1	1	3	3	3
CO3	3	2	2	1	1	1	1	-	2	-	1	1	2	3	2
CO4	3	2	2	1	1	1	1	-	1	-	1	1	3	3	3
CO5	3	2	2	1	1	1	1	-	1	-	1	1	3	3	3
CO (Avg)	3	2	2	1	1	1	1	-	1.6	-	1	1	2.8	2.8	2.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

S.No	List of Experiments
1	Programming utilizing Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
2	Demonstration of basic instructions with 8051 microcontroller execution, including: (i) Conditional jumps, looping. (ii) Calling subroutines.
3	Serial Communication between two Microcontroller Kits using 8251.
4	Square wave generation using microcontroller for ON time and OFF time of 0.5ms.
5	Read a key, interface display with 8279 using 8051 controller.
6	Interface Experiments: with 8051 (i) A/D Interfacing (ii) D/A Interfacing.
7	Interfacing and Programming of Stepper Motor and DC Motor Speed control using 8051 controller.
8	Measurement of room temperature using PIC and temperature sensor
9	Interfacing Real Time Clock (RTC) with PIC controller.
10	Interfacing relay to turn ON and turn OFF using PIC controller.
11	Mini project development with microcontroller.

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Regulation 2018		Semester V	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM301L	ANALYTICAL AND LOGICAL THINKING SKILLS	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Sharpen problem solving skills and to improve thinking capability of the students
2	Drive the students to use language with great commitment and cooperation
3	Expertise the creative thinking and presentation skills to meet the company needs

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in a fruitful manner
CO2	Organize and convey the information in such an incomparable way
CO3	Improve their presentation skills

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	2	-	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	2.00	2.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Alligations or Mixtures - Blood Relations. **Communication:** How to set Goals - Interpersonal Relationships - JOHARI Window - Work & Business Etiquette		
UNIT II	**Module - 2**	**6**
Aptitude: Partnership - Statement and Assumptions. **Communication:** Transition to Corporate World - Career opportunities in Various Sectors and know your industry.		
UNIT III	**Module - 3**	**6**
Aptitude: Arithmetic and Geometric Progressions - Syllogisms. **Communication:** Time Management - Anger and Stress Management - Conflict Management.		
UNIT IV	**Module - 4**	**6**
Aptitude: Permutations and Combinations - Statements & Conclusions. **Communication:** Launch a Product - Telephonic Etiquette.		
UNIT V	**Module - 5**	**6**
Aptitude: Geometric Problems. **Communication:** Presentation Skills - Oral presentation and public speaking skills, Business presentations.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester V/ VI	Total Hours			15
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18LEM301T	INDIAN ART FORMS (Common to all UG Programmes)	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Introduce the learners to various art forms and whet their aesthetics sense.
CLR-2	Improve learners' knowledge on history of theatre and drama and draw connections between theatrical practices and social contexts in both modern and pre modern periods..
CLR-3	Enable the learners to identify and understanding various types of dance and music concepts
CLR-4	Make learners explore the diversity of Architecture, Sculpture, Painting and its intersection with community, culture and society.
CLR-5	Make students to get familiarized with the formal, historical, and theoretical aspects of literary arts.

Course Outcome (s) (COs):
At the end of this course, learners will be able to:

CO1	Identify aesthetics traits found throughout Indian art.
CO2	Demonstrate understanding of the social and artistic movements that have shaped theatre and dance.
CO3	Recognize different concepts involved in music and dance.
CO4	Identify and appreciate the salient features and various styles of Indian Architecture, Sculpture and Painting at different times.
CO5	Demonstrate a broad understanding of Indian literary arts and appreciate the role that historical context plays in the creation and interpretation of literary works

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO3	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO4	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO5	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	1	2	2	1.6	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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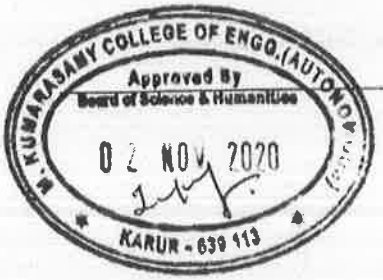
UNIT I	INDIAN ARTS	3
Introduction to art (aesthetics, taste)- fine arts - applied arts.–Terminology - Subject matter -Art as propaganda - Purposes/uses of art.		
UNIT II	THEATRE & DRAMA	3
History of Theatre and Drama- Traditional Theatre forms- Modern Theatre and its characteristics- Puppetry –different forms and elements of drama.		
UNIT III	MUSIC AND DANCES	3
Origin of Music and Dance- Classical music and Carnatic Music- Regional Music -Musical Instruments-Regional Classical Dances.		
UNIT IV	ARCHITECTURE, SCULPTURE, PAINTING	3
History of architecture, sculpture, painting -Indo-Islamic Architecture- Temple Architecture– different types of Sculptures and its characteristics-Painting and its different styles.		
UNIT V	LITERARY ARTS	3
Ancient Indian Literature- Early Dravidian Literature- Medieval Literature- Modern Indian Literature-Contemporary Literature.		

Text Book (s)	
	NIL
Reference (s)	
1	Dhar, Parul Pandya, ed., 2011, Indian Art History Changing Perspectives, New Delhi: D.K. Print world and National Museum Institute (Introduction).
2	Guha-Thakurta, Tapati, The making of a new modern Indian art: Aesthetics and nationalism in Bengal, 1850-1920, Cambridge University Press, 1992
3	Huntington, Susan, The Art of Ancient India: Hindu, Buddhist, Jain, Weatherhill, 1985
4	Mitter, Partha, Indian Art, Oxford History of Art series, Oxford University Press, 2001



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Thalavapalayam, Karur, Tamilnadu.

Regulation 2018		Semester V/VI	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM302T	SELF DEVELOPMENT AND ENTREPRENEURSHIP	1	0	0	Nil

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Develop entrepreneurship and self-employment abilities to start any venture plan, use, and monitor and control resources optimally and economically.
2	Know the Micro, small and medium industries Registration Process.
3	Study about product selection and development.
4	Learn about the Project report preparation.
5	Analysis the Enterprise risk management.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify entrepreneurial quality.
CO2	Know the entrepreneurial support agencies.
CO3	Prepare project setup planning and project report
CO4	Select appropriate agencies for technical and financial support.
CO5	Explain SWOT analysis and strategies to achieve goals.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	1	1	1	-	-
CO2	-	1	-	-	-	2	1	1	1	2	2	1	-	-
CO3	1	3	-	-	-	-	2	1	1	1	2	1	-	-
CO4	-	1	-	-	-	1	2	1	1	1	2	1	-	-
CO5	2	1	-	-	-	-	1	-	1	1	1	1	-	-
CO (Avg)	1.50	1.50	-	-	-	1.33	1.50	1.00	1.00	1.20	1.60	1.00		

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	**INTRODUCTION TO SELF-EMPLOYMENT AND ENTREPRENEURSHIP DEVELOPMENT**	**6**
Introduction of self-employment – Characteristics- Creativity. Entrepreneurship development-Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, importance of productivity, quality, cost consciousness and customers' satisfaction. Types of enterprise-Sole partnership -Partnership firm- Joint stock company- Co-operative society.		
UNIT II	**ENTREPRENEURIAL SUPPORT AGENCIES**	**6**
Definition – Micro, small and medium industries- Registration process of an enterprise with Government agencies-Name, type and role of state and national level support agencies. Current state & National Level Promotional Schemes for establishment of new.		
UNIT III	**PROJECT SET UP PLANNING**	**6**
Product Selection: importance- Product development stages. Process Selection: Factors affecting process selection - Technology lifecycle. Process Conversion-Capacity Planning: Basic method to assess / estimate capacity. Selection of location and layouts: Factors affecting selection of location - Objectives and types of plant layout.		
UNIT IV	**PROJECT PROPOSAL PLANNING**	**6**
7-M resources- Marketing- definition, need for enterprise, 4Ps channels- Market survey. Methods - Project report preparation for mechanical feature based product: Meaning of project planning and report: Feasibility study. Details required for preparing project plan. Project cost estimation.		
UNIT V	**ENTERPRISE AND RISK MANAGEMENT**	**6**
Concept of risk in the context of enterprise/ project-Uncertainty and certainty of project elements-Decision making under risk-Methods of risk management-Strength, Weakness, Opportunity and Threat (SWOT) analysis.		
Reference (s)		
1	Entrepreneurship & Venture Management, Clifford and Bombak, JosephR.Momanso.	
2	Small Industries management – Karmakar.M.B.	
3	Creativity –Pradeep Khandwala	
4	Entrepreneurship development and Management, R.K.Singal, S.K.Kataria Sons.	

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Regulation 2018		Semester VI	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH201T	MANAGEMENT PRINCIPLES FOR ENGINEERS	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Enable the students to study the evolution of management.
2	Study about planning tools and techniques in management for engineers.
3	Learn about career planning for engineers.
4	Enable the effective and barriers communication in the organization.
5	Study the system and process of effective controlling in the organization.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Acquired the knowledge on fundamental concept of management and its various functions.
CO2	Gained knowledge on planning and decision making process.
CO3	Attained the knowledge of organization structure and career planning.
CO4	Demonstrate the ability to directing, leadership and communicate effectively.
CO5	Analysis isolates issues and formulates best control methods.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	1	-	-	1	-	1	2	-	-
CO2	2	2	-	-	-	1	-	-	1	1	1	1	-	-
CO3	2	-	-	-	-	1	-	-	-	-	1	2	-	-
CO4	1	-	-	-	-	1	-	-	1	1	1	-	-	-
CO5	2	-	-	-	-	1	-	-	-	1	1	3	-	-
CO (Avg)	1.80	2.00	-	-	-	1.00	-	-	1.00	1.00	1.00	2.00	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO MANAGEMENT PRINCIPLES	6
Meaning, Definition of Management – Managerial Role - POSDCORB -Management vs. Administration- Evolution of Management Thoughts- Henry Fayol's 14 Principles- Opportunities and Challenges in Management.		
UNIT II	**PLANNING**	**6**
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting - Objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.		
UNIT III	**ORGANIZING**	**6**
Nature and purpose – Formal and informal organization – organization chart – Organization Structure– Types – Line and staff authority – Departmentalization – Delegation of Authority – Centralization and Decentralization – Job Design.		
UNIT IV	**DIRECTING**	**6**
Foundations of individual and group behavior – Motivation – Motivation Theories – Motivational - Techniques –Leadership – Types and Theories of Leadership – Communication – Process of Communication – Barrier in Communication – Effective Communication.		
UNIT V	**CONTROLLING**	**6**
System and Process of Controlling – budgetary and Non-Budgetary Control Techniques – Use of Computers and IT in Management control – Control and performance – Direct and Preventive control – Reporting.		

Reference (s)

1	P.C.Tripathi., P.N Reddy, Principles of Management, McGraw Hill, 5th Edition 2012.
2	Harold Koontz, Heinz Weihrich, A RamachandraAryasri, Tata McGraw Hill, Principles of Management, 2016
3	Charles W Hill; Stephen L Mcshane, Principles of Management, McGraw Hill, Special Indian Edition 2007.
4	1.Stephen A. Robbins & David A. Decenzo& Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education, 2011.
5	Harold Koontz & Heinz Weihrich "Essentials of management" Tata McGraw Hill, 1998.

Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC305T	POWER SYSTEM PROTECTION AND SWITCHGEAR	3	0	0	3

Prerequisite Course (s)

Transmission and Distribution, Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Understand the need of protection of electrical equipment and their protection schemes
2	Compare the operations and characteristics of various electromagnetic and static relays.
3	Elaborate the unit protection and over voltage protection of different apparatus in power system.
4	Understand the concepts of arc phenomenon and arc interruption
5	Enumerate the operations of various types of circuit breakers and their ratings.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze the causes of different types of faults and choose a suitable protection schemes.
CO2	Analyze the working principles of various types of protective relays.
CO3	Apply suitable protection schemes of various power system components like alternators, transformers, feeders, transmission lines, bus bars and motors.
CO4	Examine the concept of circuit theory interruption and its impact on power system safety.
CO5	Summarize the various types of circuit breakers operation.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	-	-	-	-	-	3	3	2
CO2	3	2	2	1	1	-	-	-	-	-	-	-	3	2	1
CO3	3	2	2	1	1	-	-	-	-	-	-	-	3	3	2
CO4	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	1	2	-	-	-	-	-	-	-	1	2	1
CO (Avg)	3	2	2	1	1.4	-	-	-	-	-	-	-	2.4	2.4	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION	10
Principles and need for protective schemes – nature and causes of faults – types of faults – Zones of protection and essential qualities of protection – Protection scheme – Protection against over voltages due to lightning and switching – Protection of electrical apparatus against travelling waves; surge absorber and diverters – Power System earthing – Neutral earthing – basic ideas of insulation coordination – Blackout case study		
UNIT II	**RELAYING SCHEMES**	**10**
CT, PT and Digital Instrument Transformers - Basic requirements of protective relaying – Types of protection - Classification of relays; over current relays, directional, distance and differential relays, under frequency, negative sequence relays – static relays: Microprocessor based relays and Numerical relays.		
UNIT III	**PROTECTION OF ELECTRICAL APPARATUS**	**7**
Apparatus protection – Differential protection of transformer - Differential protection of stator winding of generator – Loss of excitation - Differential protection of bus bars and feeders – Protection schemes of Induction motor, Protection schemes of transmission lines – Earth fault protection system.		
UNIT IV	**THEORY OF CIRCUIT INTERRUPTION**	**9**
Physics of arc phenomena and arc interruption. Restriking voltage & Recovery voltage, rate of rise of restriking voltage, current chopping, interruption of capacitive current, Inrush Currents and Swings- resistance switching – Fuses: definitions-types of fuses – Applications, Advantages and Disadvantages - DC circuit breaking		
UNIT V	**CIRCUIT BREAKERS**	**9**
Switch gear – fault clearing process – interruption of current – Factor influencing for the Selection of CB - Types of Circuit Breakers – Air blast, Oil, SF_6 and Vacuum Circuit Breakers – Comparative merits of different circuit breakers – Testing of Circuit Breakers – Circuit Breaker ratings-Recent Development in Circuit Breaker Design and its Operation.		

Text Book (s)

1	Badri Ram, D N Vishwakarma, "Power System Protection and Switchgear", Tata McGraw-Hill Education, New Delhi, Second Edition, 2011
2	Y.G.Paithankar, S.R. Bhide, "Fundamentals of Power System Protection", PHI Learning, Second Edition, 2013
3	A.Chakrabati,M.L.Soni,P.V.Gupta,U.S.Bhatnagar, "A Text Book on Power System Engineering', Dhanpat Rai & Co (Pvt) Ltd, New Delhi, Second revised Edition 2010.

Reference (s)

1	Sunil S: Rao, "Switchgear Protection and Power systems", Khanna publishers, New Delhi, 14th Edition, 2019
2	P.M.Anderson, "Power system protection", IEEE Press, Wiley & Sons Publications, 1999
3	B.Ravindranath, M Chander, "Power system protection and switchgear", New Age International Pvt Limited, 1977

Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC306T	SOLID STATE DRIVES	3	0	0	3

Prerequisite Course (s)

Electrical Machines I, Electrical Machines II, Power Electronics and Converters

Course Objective (s): The purpose of learning this course is to:

1	Understand the basic knowledge of Electrical Drives
2	Learn the operation of controlled rectifier and chopper fed DC Drives
3	Analyze the stator and rotor control of induction motor
4	Understand the synchronous motor drive and control synchronous motor drives.
5	Study the applications of electric drives in industries

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Illustrate the choice of electric drives & types ,dynamics of electrical drives
CO2	Explain the concept of phase controlled ,chopper controlled DC motor drives
CO3	Apply open and closed loop speed control to induction motor
CO4	Apply open and closed loop speed control to synchronous motor
CO5	Illustrate the applications of DC and AC drives

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	-	-	-	1	-	1	1	-	-
CO2	3	2	1	-	-	1	1	-	1	1	-	1	1	-	-
CO3	3	2	1	-	-	1	1	-	1	1	-	1	1	-	-
CO4	3	2	1	-	-	1	1	-	1	-	-	-	1	-	-
CO5	3	2	1	-	-	1	-	-	-	1	-	-	1	-	-
CO (Avg)	3	2	1	-	-	1	1	-	1	1	-	1	1	-	-

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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UNIT I	INTRODUCTION TO ELECTRICAL DRIVES	9
Introduction – electrical drive system, Choice of electrical drives, Classification of drives, selection of motor ratings- Dynamics of electrical drives: fundamental torque equation - multi-quadrant operation - components of load torques - nature & classification of load torques - steady state stability.		
UNIT II	**DC MOTOR DRIVES**	**9**
Speed control methods of DC motor- Single phase and three phase controlled converters fed DC drive - Two and Four quadrant DC drive - chopper fed drives: Quadrant fed chopper drives, Closed loop speed control of separately excited dc motor drive (PWM and hysteresis controllers).		
UNIT III	**INDUCTION MOTOR DRIVES**	**9**
Speed control of induction motor: Stator voltage control & Variable frequency control -Current Source Inverter, Voltage Source Inverter & Cycloconverter fed induction motor drive - Closed loop speed control for VSI and Cycloconverter drive – Slip Power Recovery Scheme: Static rotor resistance control - Static scherbius drive - Static Kramer drive – vector control basic concepts.		
UNIT IV	**SYNCHRONOUS MOTOR DRIVES**	**9**
Speed control of synchronous motor: True synchronous (Separate) & self controlled drive - Voltage Source Inverter, Current Source Inverter and Cycloconverter fed synchronous motor drives - Closed loop VSI fed sinusoidal PMAC motor drive - Operation from fixed frequency supply (starting, pull-in, braking, transients due to load disturbances).		
UNIT V	**APPLICATIONS OF DC AND AC DRIVES**	**9**
Drive applications: Steel rolling mill, Paper mill, Traction, Cranes and Lifts – Solar powered pump drive –Battery powered vehicles - Drive circuits for stepper motors – Unipolar drive for variable reluctance motor – Bipolar drive for permanent magnet and hybrid motors.		

Text Book (s)	
1	Dubey G.K., "Fundamentals of Electrical Drives", Narosa Publishing House, Second Edition, 2017.
2	Krishnan R., "Electric Motor & Drives: Modelling, Analysis and Control", Pearson Education, 2015.
3	Bimal K Bose, "Modern Power Electronics and AC Drives", Pearson Education., 2016.
Reference (s)	
1	Pillai S.K., "A First Course on Electrical Drives", New Age International Publishers, Third Edition, 2013.
2	N.K.De., and P.K.Sen., "Electric Drives" PHI., 2012.
3	Ned Mohan, Tore Undeland & William Robbins, "Power Electronics Converters Applications and Design", John Willey and sons, 2003
4	Vedam Subramanyam, "Electric Drives – Concepts and Applications", McGraw Hill, Second Edition, 2010

Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC307L	POWER SYSTEM SIMULATION LABORATORY	0	0	3	1.5

Prerequisite Course (s)

POWER SYSTEM ANALYSIS

Course Objective (s): The purpose of learning this course is to:

1	Identify and formulate solutions to power system problems using simulation software.
2	Acquire software development skills and experience in the usage of standard packages necessary for Analysis.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Analyze the performance of transmission lines.
CO2	Design and form network matrices for any power system network.
CO3	Design and get power flow solution for any power system network.
CO4	Analyze fault analysis for given simple power system network.
CO5	Analyze stability of power system network using given software.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1
CO2	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1
CO3	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1
CO4	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1
CO5	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1
CO (Avg)	3	2	2	2	2	-	-	1	1	-	1	2	2	1	1

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

S.No	List of Experiments
1	Computation of Line Parameters.
2	Modelling of Transmission Lines.
3	Performance of Transmission Lines.
4	Per unit computation.
5	Formation of Bus Admittance and Impedance Matrices.
6	Solution of Load Flow and related Problems using Gauss-Seidel Method.
7	Solution of Load Flow and related Problems using Newton Rapson Method.
8	Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
9	Symmetrical Fault Analysis.
10	Unsymmetrical Fault Analysis.

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Regulation 2018		Semester VI	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
C	18EEC308L	SOLID STATE DRIVES LABORATORY	0	0	3	1.5

Prerequisite Course (s)

Electrical Machines Laboratory, Power Electronics and Converters Laboratory

Course Objective (s): The purpose of learning this course is to:

1	To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics
2	To impart industry oriented learning
3	To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Construct and simulate power converters for DC motor drives.
CO2	Construct and simulate power converters for AC motor drives.
CO3	Employ various control strategies for motor drives.
CO4	Perform speed control of various motor drives.
CO5	Analyse drive circuit for switched reluctance motor drive.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	1	-	2	2	1	1	2	2	1	-
CO2	3	1	1	1	-	1	-	2	2	1	1	2	2	1	-
CO3	3	1	1	1	-	1	-	2	2	1	1	1	2	1	-
CO4	3	1	1	1	-	1	-	2	2	1	1	1	2	1	-
CO5	3	1	1	1	-	1	-	2	2	1	1	2	2	1	-
CO (Avg)	3	1	1	1	-	1	-	2	2	1	1	1.6	2	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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S.No.	List of Experiments
1	Simulation of closed loop control of converter fed DC motor.
2	Simulation of closed loop control of chopper fed DC motor.
3	Simulation of VSI fed three phase induction motor.
4	Simulation of three phase synchronous motor drive.
5	Speed control of DC motor using three phase Rectifier.
6	Speed control of three phase induction motor using PWM inverter.
7	DSP based closed loop drive for induction motor.
8	Induction motor speed control using FPGA.
9	DSP based chopper fed DC motor drive.
10	PLC based drive system.
11	Study of Brushless DC motor.
12	Study of Switched Reluctance Motor Drive using DSP.

Regulation 2018		Semester VI	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18MBM302L	EMPLOYABILITY SKILLS AND PRACTICES	0	0	2	1

Course Objective (s):

The purpose of learning this course is to:

1	Learn the application of mathematical or statistical models to different real-world contexts
2	Focus on writing & speaking skills through vigorous practices.
3	Enhance soft skills and analytical ability of students
4	Defeat the fear while communicating in group and to master the effective communication

Course Outcome (s) (Cos):

At the end of this course, learners will be able to:

CO1	Solve both analytical and logical problems in a productive manner
CO2	Launch their ability of comprising and delivering the information
CO3	Upgrade their communication quality in near future

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	-	-	-	-	-	-	3	-	-	-			
CO3	-	-	-	-	-	-	-	-	-	3	-	-			
CO4	-	-	-	-	-	-	-	-	-	-	-	-			
CO5	-	-	-	-	-	-	-	-	-	-	-	-			
CO (Avg)	3.00	-	-	-	-	-	-	-	3.00	3.00	-	-			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	Module - 1	6
Aptitude: Time and Distance (Speed, Streams) - Problems on Trains - Arrangements and BloodRelations. **Communication:** Job Application - Cover letter,Bio-data,Resume& CV building.		
UNIT II	Module - 2	6
Aptitude: Time and Work - Pipes & Cisterns - Situation Reaction Test & Data Interpretations. **Communication:** Writing practices on circulars, notices, memos, Agenda preparation and Minutes of meeting.		
UNIT III	Module - 3	6
Aptitude: Ages - Averages - Probability - Profit and Loss. **Communication:** Email Etiquette - Essay writing.		
UNIT IV	Module - 4	6
Aptitude: Mensuration - SI & CI - Cause and Effect Analysis - Statement, Assumptions & Conclusions. **Communication:** Group Discussion and guidelines.		
UNIT V	Module - 5	6
Aptitude: Permutation and Combinations - Partnership - Alligations or Mixtures. **Communication:** Interview skills - General instructions, Review of interview questions, Mock Interviews.		

Text Book (s)

1	Dr.R.S.Aggarwal, "Quantitative Aptitude", S. Chand & Company Limited, 2015
2	Dr.R.S.Aggarwal, "A Modern Approach to Verbal & Non - Verbal Reasoning", S. Chand & Company Limited, 2015

Regulation 2018		Semester V/ VI	Total Hours			15
			Hours / Week			C
Category	Course Code	Course Name	L	T	P	
M	18LEM301T	INDIAN ART FORMS (Common to all UG Programmes)	1	0	0	-

Prerequisite Course (s)

NIL

Course Objective (s):
The purpose of learning this course is to:

CLR-1	Introduce the learners to various art forms and whet their aesthetics sense.
CLR-2	Improve learners' knowledge on history of theatre and drama and draw connections between theatrical practices and social contexts in both modern and pre modern periods..
CLR-3	Enable the learners to identify and understanding various types of dance and music concepts
CLR-4	Make learners explore the diversity of Architecture, Sculpture, Painting and its intersection with community, culture and society.
CLR-5	Make students to get familiarized with the formal, historical, and theoretical aspects of literary arts.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Identify aesthetics traits found throughout Indian art.
CO2	Demonstrate understanding of the social and artistic movements that have shaped theatre and dance.
CO3	Recognize different concepts involved in music and dance.
CO4	Identify and appreciate the salient features and various styles of Indian Architecture, Sculpture and Painting at different times.
CO5	Demonstrate a broad understanding of Indian literary arts and appreciate the role that historical context plays in the creation and interpretation of literary works

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO2	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO3	-	-	-	-	-	1	1	2	2	1	-	2	-	-	-
CO4	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO5	-	-	-	-	-	1	1	2	2	2	-	2	-	-	-
CO (Avg)	-	-	-	-	-	1	1	2	2	1.6	-	2	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	**INDIAN ARTS**	3
Introduction to art (aesthetics, taste)- fine arts - applied arts –Terminology - Subject matter -Art as propaganda - Purposes/uses of art.		
UNIT II	**THEATRE & DRAMA**	3
History of Theatre and Drama- Traditional Theatre forms- Modern Theatre and its characteristics-Puppetry –different forms and elements of drama.		
UNIT III	**MUSIC AND DANCES**	3
Origin of Music and Dance- Classical music and Carnatic Music- Regional Music -Musical Instruments-Regional Classical Dances.		
UNIT IV	**ARCHITECTURE, SCULPTURE, PAINTING**	3
History of architecture, sculpture, painting -Indo-Islamic Architecture- Temple Architecture-different types of Sculptures and its characteristics-Painting and its different styles.		
UNIT V	**LITERARY ARTS**	3
Ancient Indian Literature- Early Dravidian Literature- Medieval Literature- Modern Indian Literature-Contemporary Literature.		

Text Book'(s)

	NIL

Reference (s)

1	Dhar, Parul Pandya, ed., 2011, Indian Art History Changing Perspectives, New Delhi: D.K. Print world and National Museum Institute (Introduction).
2	Guha-Thakurta, Tapati, The making of a new modern Indian art: Aesthetics and nationalism in Bengal, 1850-1920, Cambridge University Press, 1992
3	Huntington, Susan, The Art of Ancient India: Hindu, Buddhist, Jain, Weatherhill, 1985
4	Mitter, Partha, Indian Art, Oxford History of Art series, Oxford University Press, 2001

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Regulation 2018		Semester V/VI	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	18LEM302T	SELF DEVELOPMENT AND ENTREPRENEURSHIP	1	0	0	Nil

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Develop entrepreneurship and self-employment abilities to start any venture plan, use, and monitor and control resources optimally and economically.
2	Know the Micro, small and medium industries Registration Process.
3	Study about product selection and development.
4	Learn about the Project report preparation.
5	Analysis the Enterprise risk management.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Identify entrepreneurial quality.
CO2	Know the entrepreneurial support agencies.
CO3	Prepare project setup planning and project report
CO4	Select appropriate agencies for technical and financial support.
CO5	Explain SWOT analysis and strategies to achieve goals.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	-	-	1	1	1	1	-	-
CO2	-	1	-	-	-	2	1	1	1	2	2	1	-	-
CO3	1	3	-	-	-	-	2	1	1	1	2	1	-	-
CO4	-	1	-	-	-	1	2	1	1	1	2	1	-	-
CO5	2	1	-	-	-	-	1	-	1	1	1	1	-	-
CO (Avg)	1.50	1.50	-	-	-	1.33	1.50	1.00	1.00	1.20	1.60	1.00	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO SELF-EMPLOYMENT AND ENTREPRENEURSHIP DEVELOPMENT	6
Introduction of self-employment – Characteristics- Creativity. Entrepreneurship development-Qualities of entrepreneur and Characteristics of Diploma holder as a self-employer like developing networking and personal contacts, importance of productivity, quality, cost consciousness and customers' satisfaction. Types of enterprise-Sole partnership -Partnership firm- Joint stock company- Co-operative society.		
UNIT II	**ENTREPRENEURIAL SUPPORT AGENCIES**	6
Definition – Micro, small and medium industries- Registration process of an enterprise with Government agencies-Name, type and role of state and national level support agencies. Current state & National Level Promotional Schemes for establishment of new.		
UNIT III	**PROJECT SET UP PLANNING**	6
Product Selection: importance- Product development stages. Process Selection: Factors affecting process selection - Technology lifecycle. Process Conversion-Capacity Planning: Basic method to assess / estimate capacity. Selection of location and layouts: Factors affecting selection of location - Objectives and types of plant layout.		
UNIT IV	**PROJECT PROPOSAL PLANNING**	6
7-M resources- Marketing- definition, need for enterprise, 4Ps channels- Market survey. Methods - Project report preparation for mechanical feature based product: Meaning of project planning and report: Feasibility study. Details required for preparing project plan. Project cost estimation.		
UNIT V	**ENTERPRISE AND RISK MANAGEMENT**	6
Concept of risk in the context of enterprise/ project-Uncertainty and certainty of project elements-Decision making under risk-Methods of risk management-Strength, Weakness, Opportunity and Threat (SWOT) analysis.		

Reference (s)

1	Entrepreneurship & Venture Management, Clifford and Bombak, JosephR.Momanso.
2	Small Industries management – Karmakar.M.B.
3	Creativity –Pradeep Khandwala
4	Entrepreneurship development and Management, R.K.Singal, S.K.Kataria Sons.

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Regulation 2018		Semester VII	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
H	18MBH202T	SOCIAL ENGINEERING	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Learn about fundamental concept of social engineering
2	Know the different elements of ethical hacking and social engineering.
3	Understand the concepts of threats and attack vectors
4	Understand the ethical hacking
5	Learn about the attacks against individuals and organizations

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concept of social engineering and types of attacks.
CO2	Identify the key security concepts, CIA and IT governance and best practices
CO3	Understand principles of social engineering.
CO4	Exhibit the ethical hacking concepts and scopes, threats and attack vectors and common areas of vulnerability.
CO5	Gain knowledge of attacks against individuals and organizations.

CO-PO Mapping

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	1	1	1	1	1	-	1	-	-
CO2	1	1	-	-	-	2	-	2	1	-	-	1	-	-
CO3	-	1	-	-	-	-	1	2	1	-	-	1	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	1	-	-
CO5	1	1	-	-	-	-	-	-	1	1	-	1	-	-
CO (Avg)	1.33	1.25	-	-	-	1.50	1.00	2.00	1.00	1.00		1.00		-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	**INTRODUCTION TO SOCIAL ENGINEERING**	**6**
Social Engineering Defined - Why Does Social Engineering Work - Identify Communication Style - key aspects of social engineering - Categories of Social Engineering Attacks – human – based attacks and technology - based attacks		
UNIT II	**KEY SECURITY**	**6**
Key security - concepts - Types of key security concepts – Cyber security position. The CIA Triad - the significance of incident response and frameworks around cyber security. IT Governance - Best practices - compliance.		
UNIT III	**PSYCHOLOGY OF SOCIAL ENGINEERING**	**6**
Mind Tricks: Psychological Principle - Four fundamental aspects of human nature that social engineers - the desire to be helpful - the tendency to be trusting - the fear of offending others - the tendency to cut corners		
UNIT IV	**ETHICAL HACKING AND SOCIAL ENGINEERING**	**6**
Ethical Hacking Concepts and Scopes - Threats and Attack Vectors - Information Assurance - Threat Modelling - Enterprise Information Security Architecture - Vulnerability Assessment and Penetration Testing - Types of Social Engineering - Insider Attack - Preventing Insider Threats - Social Engineering Targets and Defence Strategies. Common Areas of Vulnerability - Appropriate access - Assessed resistance - Information availability		
UNIT V	**CASES OF SOCIAL ENGINEERING**	**6**
Notable Cases of Social Engineering - Attacks against Individuals - Attacks against Organizations - Preventing Social Engineering Attacks - Mitigating the Damage of Social Engineering Attacks - Segregation of Access - Maintain Access Logs - Ensure That Backups Occur Regularly - Automatically Revoke User Privileges If Suspicious Activity Is Detected		

Reference (s)

1	Kevin D. Mitnick, William L. Simon, Steve Wozniak, The Art of Deception: Controlling the Human Element of Security, Wiley, October 17th 2003
2	Christopher Hadnagy, Social Engineering: The Science of Human Hacking Paperback- Wiley Publishing Inc.,Edition 2018
3	Lester Evans, Cybersecurity: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyberwarfare Paperback –2018
4	Dr. Erdal Ozkaya, Learn Social Engineering: Learn the art of human hacking with an internationally renowned expert-2018

Regulation 2018		Professional Elective Group-I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE001T	POWER SYSTEM OPERATION AND CONTROL	3	1	0	4

Prerequisite Course (s)

Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Study the introduction of power system operation and control.
2	Understand Real power frequency interaction and design of power frequency controller
3	Understand Reactive power voltage interaction and control action to be implemented for maintaining the voltage
4	Interpret Economic operation of power system
5	Understand SCADA and its application for real time operation and control of power system

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the day-to-day operation of electric power system.
CO2	Derive the real power frequency control technique
CO3	Derive the reactive power voltage control technique
CO4	Calculate the economic load dispatch for a system comprising of 'n' thermal plants
CO5	Describe the system involved in computer control of power systems

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	1	-	1	-	1	-	3	1	1
CO2	3	2	1	1	1	-	1	-	1	-	1	-	3	1	1
CO3	3	2	1	1	1	-	1	-	1	-	1	-	3	1	1
CO4	3	2	1	1	1	-	1	-	1	-	1	-	3	1	1
CO5	3	2	1	-	-	-	1	-	1	-	1	-	3	1	1
CO (Avg)	3	2	1	1	1	-	1	-	1	-	1	-	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
System load – variation – load characteristics – load curves and load-duration curve (daily, weekly and annual) - load factor – diversity factor – Importance of load forecasting and simple techniques of forecasting – An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).		
UNIT II	**REAL POWER – FREQUENCY CONTROL**	**9**
Basics of speed governing mechanism and modelling – speed-load characteristics – load sharing between two synchronous machines in parallel – 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 – modelling – static analysis of uncontrolled case – tie line with frequency bias control of two-area system – state variable model.		
UNIT III	**REACTIVE POWER – VOLTAGE CONTROL**	**9**
Basics of reactive power control – Excitation systems – modelling – Static and dynamic analysis – stability compensation – 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 and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.		
UNIT IV	**UNIT COMMITMENT AND ECONOMIC DISPATCH**	**9**
Statement of Unit Commitment problem – constraints – spinning Reserve – thermal unit constraints – hydro constraints, fuel constraints and other constraints – Solution methods – Priority-list methods – forward dynamic programming approach – Numerical problems only in priority-list method using full-load average production cost. 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 V	**COMPUTER CONTROL OF POWER SYSTEMS**	**9**
Need of computer control of power systems – 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 – Network topology – state estimation – security analysis and control – Various operating states (Normal, alert, emergency, in-extremis and restorative) - State transition diagram showing various state transitions and control strategies.		

Text Book (s)

1	Allen. J. Wood and Bruce F. Wollenberg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., 2003.
2	V. Ramanathan, P.S.Manoharan, "Power System Operation and Control", Charulatha Publications, Third Edition, 2015.
3	Chakrabarti & Halder, "Power System Analysis: Operation and Control", Prentice Hall of India, 2004.

Reference (s)

1	P.Kundur, "Power System Stability and Control" Tata MC Craw Hill Publisher, USA, 1994.
2	Olle.I.Elgerd, "Electric Energy Systems theory an introduction", data, Mc Graw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.
3	Leon K. Kirchmayer, "Economic operation of power systems" Wiley, 2008.

Regulation 2018		Professional Elective Group-I	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE002T	DESIGN OF ELECTRICAL MACHINES	3	1	0	4

Prerequisite Course (s)

Electrical Machines I, Electrical Machines II

Course Objective (s): The purpose of learning this course is to:

1	Understand the basic concepts of magnetic circuits and their MMF calculations
2	Comprehend the armature and field systems for D.C. machines
3	Obtain the knowledge to design core, yoke, windings and cooling systems of transformers.
4	Understand the design procedures of stator and rotor of induction machines
5	Obtain the knowledge to design stator and damper winding of synchronous machines

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Calculate the mmf for dc and ac machines.
CO2	Estimate the suitable armature and field system parameters for DC machines.
CO3	Determine the design parameters involved in transformer.
CO4	Calculate the design parameters of induction machines.
CO5	Evaluate the design parameters of synchronous machines.

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1
CO2	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1
CO3	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1
CO4	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1
CO5	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1
CO (Avg)	3	2	2	1	-	1	1	-	-	-	2	2	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	MMF CALCULATION FOR ROTATING MACHINES	12
Considerations and limitations in design – Fundamentals of magnetic circuits – Magnetization curves – Magnetic leakage – Calculation of mmf in a airgap and teeth – MMF calculation of induction and salient pole machines – Real and apparent flux densities.		
UNIT II	**DESIGN OF DC MACHINES**	**12**
Output equation – Main dimensions – Separation of D and L of a d.c machine – Factors affecting size of rotating machines – Choice of specific magnetic loadings – Choice of specific electric loadings - Selection of number of poles – armature design – Design of series and shunt field system.		
UNIT III	**DESIGN OF TRANSFORMERS**	**12**
Output rating of single phase and three phase transformers – Design of core, yoke and windings for core and shell type transformers – Overall dimensions – Design of tanks and cooling tubes of transformers – transformer cooling methods.		
UNIT IV	**DESIGN OF INDUCTION MACHINES**	**14**
Output equation – main dimensions – Separation of D and L for induction motors – Choice of specific magnetic loadings – Choice of specific electric loadings – Design of stator – Number of rotor slots – Design of rotor bars and slots - Design of end rings – Design of wound rotor.		
UNIT V	**DESIGN OF SYNCHRONOUS MACHINES**	**10**
Output equation – Main dimensions – Separation of D and L for synchronous machines – Choice of specific magnetic loadings – Choice of specific electric loadings Short circuit ratio – Armature design – Estimation of air-gap length – Design of damper winding.		

Text Book (s)

1.	Sawhney A.K., "A Course in Electrical Machine Design", Dhanpat Rai & Co., New Delhi 5th Edition, 2014
2.	Sen, S.K., "Principles of Electrical Machine Designs with Computer Programmes", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2004
3.	Brian J. Mcpartland and Mcpartland J.F., "Handbook of Practical Electrical Design", Tata Mc Graw Hill Education, 2nd Edition, 1995

Reference (s)

1.	Shanmugasundaram A., Gangadharan.G, Palani R., "Electrical Machine Design Data Book", New Age International Pvt. Ltd., 2007
2.	Agarwal R.K., "Principles of Electrical Machine Design", S.K.Kataria & Sons, New Delhi, 4th Edition, 2013
3.	Mittle V.N. and Mittle A., "Design of Electrical Machines", 4th Edition, Standard Publications and Distributors, New Delhi, 2005

Regulation 2018		Professional Elective - Group 1	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE003T	ELECTRIC POWER UTILIZATION AND ENERGY AUDITING	3	1	0	4

Prerequisite Course (s)

Electrical Machines I, Electrical Machines II, Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Provide a basic understanding of illumination, type of lighting schemes and lamps.
2	Enable the students to acquire knowledge about different types of heating and welding
3	Study about the electrolytic process and energy storage systems.
4	Understand the electric traction systems and their performance.
5	Elaborate the conservation of electrical power and steps involved in energy audit

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the principle and design of illumination systems.
CO2	Identify an appropriate method of heating for any particular industrial application.
CO3	Realise types of batteries and fuel cells.
CO4	Describe the drive systems for DC and AC traction systems and magnetic levitation.
CO5	Know about the proper utilization of electrical energy and the procedure involved in energy auditing

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	-	2	-	-	2	3	2	2	1
CO2	3	2	1	-	-	1	-	-	2	2	-	3	2	2	-
CO3	3	2	1	-	-	1	2	2	-	2	2	3	2	2	1
CO4	3	2	1	-	-	1	-	-	2	-	-	3	2	2	-
CO5	3	2	1	1	-	2	2	2	-	-	2	3	2	2	1
CO (Avg)	3	2	1	1	-	1.2	2	2	2	2	2	3	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ILLUMINATION ENGINEERING	12
Production of light – Definitions - Polar curves -Determination of MHCP and MSCP - Rousseau's construction - Classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps - design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting – LED- Standards of illumination.		
UNIT II	**ELECTRIC HEATING & WELDING**	**12**
Electric Heating-need of electric heating. Modes of heat transfer- Resistance heating – Infrared heating – Arc furnaces- Induction Heating- Dielectric heating –Resistance welding – arc welding- Radiation Welding- Ultrasonic welding-Electrodes- Power supply for arc welding.		
UNIT III	**ELECTROLYTIC PROCESSES AND STORAGE OF ELECTRICITY**	**12**
Electrolysis - polarization factor - preparation work for Electro plating - Calculation of energy requirements - Methods of charging and maintenance -Ni-iron , Ni- cadmium batteries, Lead acid batteries and Li-ion battery - Components and materials - Capacity rating of batteries - Fuel cells and its types.		
UNIT IV	**TRACTION SYSTEM**	**12**
Different types of traction- Systems of Electric Traction- Track Electrification comparison between DC and AC systems of Railway electrification. Typical Speed - Time curves- Factors affecting Schedule Speed- Simplified Speed-time Curve - Mechanics of Train movement- tractive effort – Regenerative Braking- Power and Energy output from the driving axles-Determination of specific energy output—Magnetic levitation.		
UNIT V	**ENERGY CONSERVATION AND AUDIT**	**12**
Economics of generation – number and size of units – cost of electrical energy – tariff – need for electrical energy conservation-methods – Energy efficient equipment – Energy management – Energy auditing methodologies and equipment-Economics of power factor improvement – design for improvement of power factor using power capacitors – Case studies based on power quality assessment using analyzer		

Text Book (s)

1	N. V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 2014.
2	J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons,10th edition 2013.
3	R.K.Rajput, "Utilisation of Electric Power", Laxmi publications Private Limited., 2nd edition 2013

Reference (s)

1	Partab H , "Art and science of Utilisation of Electrical Energy", Dhanpat Ra& Sons,1995
2	C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd.,3rd edition 2010
3	Uppal.S. L,"Electric Power", 15th Edition , Khanna Publications.,2009

M.KUMARASAMY COLLEGE OF ENGG.(AUTONOMOUS) Board of Electrical and Electronics Engineering Approved in 15 OCT 2020

Regulation 2018		Professional Elective Group-1	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE004T	RESTRUCTURED POWER SYSTEM	3	1	0	4

Prerequisite Course (s)

Electric Power Generation, Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Understand the operation of restructured power system and the world electricity market scenario in restructured environment
2	Acquire knowledge on transmission challenges
3	Understand the concept of congestion management methods
4	Understand the concept of transmission pricing issues and classification of transmission pricing methods
5	Analyse the reforms in Indian power sector

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the basic concepts of restructured power system and review the operating experiences of restructured Electricity power Markets.
CO2	Address the technical challenges in Restructuring.
CO3	Explain the concept of congestion management methods and Ancillary Services.
CO4	Understand the transmission open access pricing issues transmission pricing methods and generator ramping.
CO5	Review the reforms in Indian power sector.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2
CO2	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2
CO3	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2
CO4	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2
CO5	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2
CO(avg)	3	2	1	1	-	-	1	1	-	-	-	-	-	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO RESTRUCTURING OF POWER MARKET	12
Introduction – Structure of restructured electric utility – Market Power - Power exchange and pool markets – Independent System Operator (ISO) – components - role of ISO - Operating Experiences of Restructured Electricity Markets in various Countries (UK, Australia, Europe, US, Asia)		
UNIT II	**TRANSMISSION CHALLENGES**	**12**
Introduction - Role of transmission planning – Transmission Capacity - Role of transmission planning – Transmission Capacity - Total Transfer Capability(TTC) – Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC		
UNIT III	**CONGESTION MANAGEMENT**	**12**
Introduction - classification of congestion management - inter-zonal & intra-zonal congestion management - price area congestion management - Location Marginal Pricing - Financial Transmission Right - Ancillary Services		
UNIT IV	**TRANSMISSION PRICING**	**12**
Introduction - Transmission pricing methods - Location Marginal Pricing – Congestion Pricing - Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Generator Ramping and Opportunity Costs.		
UNIT V	**REFORMS IN INDIAN POWER SECTOR**	**12**
Introduction - framework of Indian power sector - Framework of Indian Power sector- reform initiatives during 1990-1995 - the availability based tariff (ABT) - The Electricity Act 2003 open access issues – Indian power exchange - reforms in near future.		

Text Book (s)

1	N. V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited,2014.
2	J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons,10th edition 2013.
3	R.K.Rajput, "Utilisation of Electric Power", Laxmi publications Private Limited., 2nd edition 2013

Reference (s)

1	Partab H , "Art and science of Utilisation of Electrical Energy", Dhanpat Ra& Sons, 1995
2	C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 3rd edition, 2010
3	Uppal.S. L,"Electric Power", Khanna Publications., 15th Edition, 2009.

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Regulation 2018		Professional Elective Group-1	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE005T	DIGITAL SIGNAL PROCESSING	3	1	0	4

Prerequisite Course (s)

ENGINEERING MATHEMATICS - III

Course Objective (s): The purpose of learning this course is to:

1	Understand the signals and systems & their mathematical representation.
2	Acquire the knowledge of discrete transform applications to discrete time signal
3	Comprehend the transformation techniques & their computation.
4	Realize the filters and their design for digital implementation.
5	Understand the basics of digital signal processor

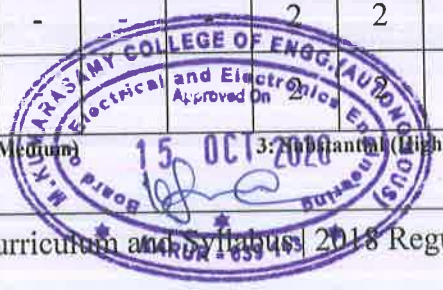
Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Classify the given discrete time System the characteristics of signals/systems and determine the operations on the signals.
CO2	Apply Z transform and DTFT for the given discrete time signal.
CO3	Apply the concepts of DFT and FFT for the given discrete time signal.
CO4	Describe the types of filters and their design for digital implementation.
CO5	Explain the DSP processor architecture and its addressing modes.

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1
CO2	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1
CO3	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1
CO4	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1
CO5	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1
CO (Avg)	3	2	2	1	1	1	1	-	-	-	2	2	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)



UNIT I	DISCRETE TIME SIGNALS AND SYSTEM	12
Classification of systems: Continuous, discrete, linear, causal, stability, dynamic, recursive, time variance - classification of signals: continuous and discrete, energy and power, periodic signal - mathematical representation of signals - Linear convolution - correlation - sampling process - aliasing effect - Nyquist rate and quantization.		
UNIT II	**DISCRETE TIME TRANSFORMS**	**12**
Z-transform and its properties, inverse z-transforms; difference equation - Solution by Z transform, application to discrete systems Stability analysis - Discrete Time Fourier transform , frequency response - magnitude and phase representation.		
UNIT III	**DISCRETE FOURIER TRANSFORM**	**12**
Discrete Fourier Transform - properties, magnitude and phase representation - Computation of DFT using FFT algorithm - DIT &DIF using radix 2 FFT - Butterfly structure - Computation of IDFT using FFT - circular convolution.		
UNIT IV	**DIGITAL FILTERS DESIGN**	**14**
IIR filter : Analog and digital butterworth and chebyshev filter design using impulse invariant and bilinear transformation – realization of IIR filters(Direct Form I, Direct Form II, Cascade and Parallel Form).FIR design: Windowing Techniques – Need and choice of windows.		
UNIT V	**DIGITAL SIGNAL PROCESSORS**	**10**
Introduction – selection and applications of PDSPs – Von Neumann and Harward Architecture – architecture of TMS320C54x and its Addressing Format.		

Text Book (s)

1	J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, PHI., New Delhi, 4th edition 2007.
2	Lonnie C.Ludeman, "Fundamentals of Digital Signal Processing", Wiley, 2013

Reference (s)

1	Poorna Chandra S, Sasikala. B, "Digital Signal Processing", Vijay Nicole/TMH, 2013
2	B.P.Lathi, "Principles of Signal Processing and Linear Systems", Oxford University Press, 2010
3	SenM.kuo, Woonsengs.gan, "Digital Signal Processors, Architecture, Implementations & Applications", Pearson, 2013
4	DimitrisG.Manolakis, Vinay K. Ingle, "Applied Digital Signal Processing", Cambridge, 2012

Regulation 2018		Professional Elective - Group 1	Total Hours			60
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE006T	ADVANCED CONTROL SYSTEMS	3	1	0	4

Prerequisite Course (s)

Control Systems

Course Objective (s): The purpose of learning this course is to:

1	Understand the state space concept for electromechanical systems
2	Explain the concept of state model analysis
3	Predict the stability of the sampled data system
4	Explain the non-linear system using phase plane and describing function methods
5	Realize the concept of state model design and its stability

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Interpret the concept of state space models
CO2	Understand the solution for LTI system and its performance indices
CO3	Acquire the knowledge of sampled data system
CO4	Provide Knowledge in Non-linear system analysis
CO5	Understand the concept of state model design and its stability

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	2	2	1	-	1	1	-	1
CO2	3	1	1	-	-	-	-	2	2	1	-	1	1	-	1
CO3	3	2	1	-	-	-	-	2	2	1	-	1	1	-	1
CO4	3	2	2	-	-	-	-	2	2	1	-	1	1	-	1
CO5	3	2	2	-	-	-	-	2	2	1	-	1	1	-	1
CO (Avg)	3	1.8	1.6	-	-	-	-	2	2	1	-	1	1	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	STATE SPACE MODEL	12
Introduction to generalized state model- state diagram – state variable analysis for physical variable – mechanical systems and electrical systems - state model for armature and field controlled dc motor – phase variable and canonical variables model for continuous time systems		
UNIT II	**STATE VARIABLE ANALYSIS**	**12**
Solution of homogeneous state equations – state transition matrix – Laplace transformation and Cayley Hamilton methods - Eigen values and Eigen vectors - Controllability and Observability – Gilbert and Kalman methods.		
UNIT III	**SAMPLED DATA SYSTEM**	**12**
Sampled data theory- Sampling Process- Sample and hold Circuits-Signal reconstruction- Pulse transfer function- Response of Sampled Data system to step input – Stability analysis of sampled data systems- Jury's test and bilinear transformation.		
UNIT IV	**NON LINEAR SYSTEM ANALYSIS**	**12**
Types of non linearity – Phase plane analysis – Singular points – Limit cycle - construction of phase trajectories – analytical method and isocline method – Describing function analysis – Saturation, Dead zone, saturation-dead zone, Relay and Backlash.		
UNIT V	**STABILITY ANALYSIS AND STATE MODEL DESIGN**	**12**
Definiteness of scalar functions –quadratic forms – Basics of stability theorems – Liapunov functions – Direct method Liapunov – constructing of Liapunov functions using krasovskii's method – state feedback controller design - Design of reduced and full order observers.		

Text Book (s)

1	Ogata K., "Modern Control Engineering", Prentice Hall of India Pvt. Ltd, New Delhi, 5th Edition, 2010.
2	B.C. Kuo, and F.Golnaraghi, "Automatic Control Systems", Wiley India Pvt limited, 9th Edition, 2014.
3	Gopal M., "Modern Control Systems Theory", New Age International Publishers, 3rd Edition, New Delhi, 2015.
4	Bay.J.S., "Linear State Space Systems",Tata McGraw-Hill, 1999.

Reference (s)

1	Nagarth I.J. and Gopal M., "Control Systems Engineering", New Age International Publishers, 5th Edition, 2011
2	Robert H Bishop and Richard C Dorf, "Modern Control Systems", Pearson Education, 12th Edition, 2010
3	K.K.Agarwal, "Control system analysis and Designs", Khanna Publishers, 2003.

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE007T	WIND ENERGY CONVERSION SYSTEMS	3	0	0	3

Prerequisite Course (s)

Electric Power Generation, Power Electronics and Converters

Course Objective (s): The purpose of learning this course is to:

1	Understand the fundamentals of wind energy and its conversion system
2	Understand the control of Wind turbine rotor for maximum power extraction
3	Understand the concepts of fixed speed systems and Variable speed systems
4	Learn the modern wind turbine control & monitoring.
5	Understand the grid integration issues.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Acquire knowledge on the basic concepts of Wind energy conversion system.
CO2	Realize the concepts of mathematical modeling and control of Wind turbine for maximum power extraction
CO3	Explain the concept of Fixed speed system, Variable speed system and its modeling.
CO4	Describe the modern wind turbine control and monitoring.
CO5	Interpret the Grid integration issues..

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	2	1	-	1	1	1	1	2	1
CO2	2	1	1	1	-	-	2	1	-	1	1	1	1	2	1
CO3	2	1	1	1	1	-	2	1	-	1	1	1	1	2	1
CO4	2	1	1	1	-	-	2	1	-	1	1	1	1	2	1
CO5	2	1	1	1	-	-	2	1	-	1	1	1	1	2	1
CO (Avg)	2	1	1	1	1	-	2	1	-	1	1	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
Components of WECS - WECS schemes - Power obtained from wind - simple momentum theory - Power coefficient - Sabinin's theory - Aerodynamics of Wind turbine.		
UNIT II	**WIND TURBINES**	**9**
HAWT - VAWT- Power developed - Thrust-Efficiency - Rotor selection - Rotor design considerations - Tip speed ratio - No. of Blades - Blade profile - Power Regulation - yaw control - Pitch angle control stall control - Schemes for maximum power extraction.		
UNIT III	**WIND TURBINE CONTROL & MONITORING SYSTEM**	**9**
Details of Pitch System - Control Algorithms, Protections used - Safety Consideration in Wind turbines - Wind Turbine Monitoring with Error codes - SCADA and Databases: Remote Monitoring and Generation Reports - Operation and Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), Standards and Grid Codes.		
UNIT IV	**FIXED SPEED AND VARIABLE SPEED SYSTEMS**	**9**
Generating Systems - Constant speed constant frequency systems - Choice of Generators - Deciding factors - Squirrel Cage Induction Generator - Model of Wind Speed - Model wind turbine rotor - Drive Train model - Need of variable speed systems - Power-wind speed characteristics - Variable speed constant Frequency systems synchronous generator – DFIG - Variable speed generators modeling - Variable speed variable frequency schemes.		
UNIT V	**GRID CONNECTED SYSTEMS**	**9**
Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady - state and dynamic performance of the power system including modeling issue.		

Text Book (s)	
1	L.L.Freris, "Wind Energy conversion Systems", Prentice Hall, 1990
2	S.N.Bhadra, D.Kastha,S.Banerjee, "Wind Electrical Sytems",Oxford University Press, 2010.
3	John D Sorensen and Jens N Sorensen, "Wind Energy Systems", Woodhead Publishing Ltd, 2011.
4	Mario Garcia-Sanz, Constantine H. Houpis, "Wind Energy Systems", CRC Press 2012.
Reference (s)	
1	N. Jenkins, " Wind Energy Technology" John Wiley & Sons,1997
2	Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3	E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd.,Trowbridge, 1976.
4	S.Heir "Grid Integration of WECS", Wiley 1998.
5	Spera D.A., "Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering", ASME Press, 1994.
6	Twidell J.W. and Weir A., "Renewable Energy Sources", EFN Spon Ltd., 1983.

Regulation 2018		Professional Elective Group-II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE008T	HIGH VOLTAGE DC TRANSMISSION	3	0	0	3

Prerequisite Course (s)

Transmission and Distribution, Power Electronics and Converters and Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Understand about modern trends in HVDC Transmission and its application.
2	Impart knowledge on various HVDC converter circuits.
3	Know about different control strategies in HVDC system.
4	Understand the basis of fault analysis in HVDC System
5	Understand about the harmonics in HVDC system.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Address the modern trends and planning of HVDC system.
CO2	Classify the various converters used in the HVDC system.
CO3	Summarize various control strategies associated with the HVDC system.
CO4	Illustrate and select the fault analysis and protection methods for HVDC system
CO5	Categorize the harmonics and explain the concepts of filters.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	2	2	-	-	2	2	1	2	1	2
CO2	3	2	1	1	-	2	1	-	-	1	2	1	2	2	2
CO3	3	2	1	1	-	1	1	-	-	2	2	2	3	2	1
CO4	3	2	1	1	1	2	1	-	-	2	2	1	1	2	2
CO5	3	2	1	1	-	2	2	-	-	2	2	1	2	2	2
CO (Avg)	3	2	1.2	1	1	2.4	1.4	-	-	2.4	2	1.2	2	1.8	1.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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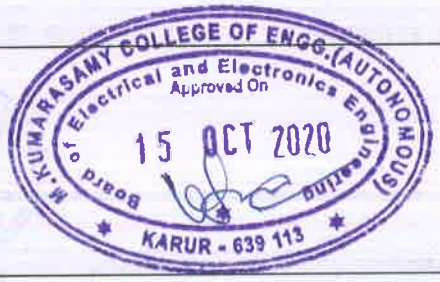
UNIT I	DC POWER TRANSMISSION TECHNOLOGY	9
Introduction – comparison of AC and DC transmission –Application of DC transmission – Description of.DC transmission system - Planning for HVDC transmission – Modern trends in DC transmission – Limitations - Protection Systems in HVDC Substation		
UNIT II	**ANALYSIS OF HVDC CONVERTERS**	**9**
Thyristor converter circuits – choice of converter configurations – Analysis of Graetz bridge neglecting overlap – Basic two level converter -Characteristics of a twelve pulse converters - Converter bridge characteristics		
UNIT III	**HVDC SYSTEM CONTROL**	**9**
Principles of DC link control - Converter control Characteristics - System control Hierarchy – Firing angle control – Current and extinction angle control – Starting and Stopping of DC link – Power Control – Higher level Controllers.		
UNIT IV	**ANALYSIS OF FAULT IN DC SYSTEM**	**9**
Introduction-DC reactor-voltage oscillations and valve dampers-current oscillations and anode dampers-DC line oscillations and line dampers-clear line faults and reenergizing the line.		
UNIT V	**HARMONICS AND FILTERS**	**9**
Generation of Harmonics – Design of AC filters – Passive AC filters – DC filters – Active filters – Types of MTDC system		

Text Book (s)

1	Padiyar. K.R, "HVDC Power Transmission Systems", New Age International (P) Limited, Publishers., 3rd edition, 2014.
2	Kundur P, "Power System Stability and Control", Tata McGraw-Hill, 1993.
3	Kimbark E.W., "Direct Current Transmission" John Wiley & Sons., 1971.

Reference (s)

1	J.Arrillaga, "High Voltage Direct Current Transmission", Peter Pregrinus, London 1983.
2	Erich Uhlmann, "Power Transmission by Direct Current", BS Publications, 2004.
3	Sood V.K, "HVDC and FACTS controllers Applications of Static Converters in Power System", Kluwer Academic Publisher, 2004.
4	Kakshaish S., Kamaraju V., "HVDC Transmission", TataMcGraw-Hill Publishers, 2012.
5	Rao S., "EHV AC and HVDC Transmission Engineering and Practice", Khanna Publishers, New Delhi, 1990.



Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE009T	HIGH VOLTAGE ENGINEERING	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation, Power System Analysis

Course Objective (s): The purpose of learning this course is to:

1	Understand the causes of over voltages and protection against them.
2	Know about various breakdown phenomenon in Gas, Liquid and Solid Dielectrics.
3	Impart knowledge on generation of high AC& DC voltages and Impulse voltage & current.
4	Impart knowledge on measurement of high AC& DC voltages and Impulse voltage & current.
5	Provide knowledge on Testing of Electrical Apparatus.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the causes and effects of over voltages and protection of power system against over voltages.
CO2	Classify the different breakdown mechanisms in Gases, liquids and solids.
CO3	Describe the principle of generation of high DC, AC and impulse voltages.
CO4	Explain the various measurement techniques of high voltages and high currents.
CO5	Summarize the testing of high voltage electrical power apparatus.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	2	-	-	-	1	3	3	1	-
CO2	3	2	2	-	-	-	1	-	-	-	1	3	3	1	-
CO3	3	2	2	-	-	-	2	-	2	2	1	3	3	1	1
CO4	3	2	2	1	1	-	2	-	2	2	1	3	3	1	1
CO5	3	2	2	1	1	-	2	-	-	-	1	3	3	2	1
CO (Avg)	3	1.8	1.8	1	1	-	1.8	-	2	2	1	3	3	1.2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	OVERVOLTAGES IN ELECTRICAL POWER SYSTEMS	9
Causes of over voltages: Lightning - Charge formation in the clouds - Lightning phenomenon – Mechanism of lightning stroke, Mathematical model for lightning - Switching surges and temporary over voltages - causes - its effect on power system. Protection against over voltages- Control of over voltages due to switching-Introduction about Insulation Co-ordination.		
UNIT II	**ELECTRIC BREAKDOWN IN GASES, LIQUIDS AND SOLIDS**	**9**
Ionization process - Uniform field - Townsend & Streamer theory - Pachen's law - Non-uniform fields – Corona discharges – Vacuum breakdown - Conduction and breakdown in pure and commercial liquids – Breakdown mechanism in solid and composite dielectrics.		
UNIT III	**GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS**	**9**
Generation of High DC voltages: Voltage doubler, Cockcroft Walton voltage multiplier circuit and Van de Graaff generator - Generation of high AC voltages: Cascaded transformers, Resonant transformers and Tesla Coil - Generation of Impulse voltages: Marx Circuit and Multistage impulse generator - Generation of Impulse currents - Tripping and control of Impulse generators.		
UNIT IV	**MEASUREMENT OF HIGH VOLTAGES AND CURRENTS**	**9**
Measurement of high DC voltages - Measurement of High AC and Impulse voltages - Measurement of High DC, AC and Impulse currents – Partial discharge Measurements.		
UNIT V	**HIGH VOLTAGE TESTING**	**9**
Testing of Insulators and Bushings- Testing of isolators and circuit breakers - Testing of surge arrestors - Testing of cables - Testing of transformers - Radio interference measurements.		

Text Book (s)

1	Naidu M. S., Kamaraju V., "High Voltage Engineering", Tata McGraw- Hill Publishing Company Ltd., New Delhi, 5th Edition, 2009.
2	Wadhwa C.L., "High Voltage Engineering", New Age International Private Ltd., New Delhi, 3rd Edition, 2010.
3	E. Kuffel and M. Abdullah, "High Voltage Engineering", Pergamon Press, 2nd Edition, 2000.

Reference (s)

1	Ravindra Arora and Wolfgang Mosch, "High Voltage - Insulation Engineering", New Age International Publishers Limited, New Delhi, 1st Edition, 2008.
2	Kuffel, E., Zaengl W.S., Kuffel J., "High Voltage Engineering: Fundamentals", Newnes Publishers, New Delhi, 2nd Edition, 2000.
3	Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International Private Ltd., New Delhi, 4th Edition 2010.

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE010T	COMMUNICATION ENGINEERING	3	0	0	3

Prerequisite Course (s)

Analog Electronics

Course Objective (s): The purpose of learning this course is to:

1	Study the concepts of amplitude modulation and its modulator circuits.
2	Illustrate the concepts of angle and frequency modulation and its transmitter and receiver circuits.
3	Learn the concepts of Pulse Modulations and digital communications techniques.
4	Study about various types of network protocol.
5	Interpret the concepts of satellite orbits and optical fibre communications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the basic concepts of amplitude modulations
CO2	Describe the concepts of frequency and phase modulation
CO3	Infer an idea about various Pulse modulations and the OOK systems.
CO4	Identify the data communication codes and various network protocol
CO5	Understand the concept of satellite orbits and optical fibre communication system.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	3	2	-	-	-	-	1	3	2	2
CO2	3	1	1	-	-	2	2	-	-	-	-	1	3	2	2
CO3	3	1	1	-	-	2	1	-	-	-	-	1	3	2	2
CO4	3	2	1	-	-	2	2	-	-	-	-	2	3	2	3
CO5	3	2	1	-	-	3	2	-	-	-	-	2	3	2	3
CO (Avg)	3	1.4	1	-	-	2.4	1.8	-	-	-	-	1.4	3	2	2.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	AMPLITUDE MODULATION	9
Modulation introduction – Amplitude modulation fundamentals - AM envelope, frequency spectrum and bandwidth, modulation index and percent modulation, AM voltage distribution, AM power distribution. AM modulator circuits - Low level AM modulator circuit. AM transmitters – Low level transmitter. AM receivers – Super heterodyne receivers		
UNIT II	**ANGLE MODULATION**	**9**
Angle modulation - Definition, relation between FM & PM, waveforms, modulation index, average power. FM and PM modulators - Direct FM (FET reactance modulator) - Indirect FM. PLL Direct FM Transmitter. FM receiver. PLL FM demodulator. Angle modulation vs amplitude modulation		
UNIT III	**DIGITAL COMMUNICATION**	**9**
Pulse modulations: Generation, transmission and demodulation of PAM, PDM, PPM, and PCM. Transmitter and receiver of DM- slope overload error & Granular noise, ADM Digital communication: Generator and detector of ASK, Transmitter and receiver of FSK, Generation and reception of PSK, Transmitter and receiver of DPSK and QPSK.		
UNIT IV	**DATA COMMUNICATION AND NETWORK PROTOCOL**	**9**
Data Communication codes- ASCII – EBCDIC Code- Error control. Public Switched Telephone Network, ISDN, LAN, ISO-OSI seven layer architecture for WAN. SS & MA techniques: FDMA, TDMA, CDMA. Application in wireless communication- WiFi & WiMax		
UNIT V	**SATELLITE AND OPTICAL FIBRE COMMUNICATION**	**9**
Orbits of satellite – look angles – Satellite frequency plans and allocations – satellite uplink, downlink, and transponder – optical fibre communication: advantages – Light Propagation through fibre, losses in fibres, Light sources, detectors.		
Text Book (s)		
1	Herbert Taub, L Schilling "Principles of communication system" Tata MCGraw ,4th Edition 2013	
2	Anokh Singh, A.K.Chhabra "Principles of Communication Engineering" S.Chand Publications, 17th edition 2013.	
Reference (s)		
1	Wayne Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition, 2012	
2	Kennedy and Davis, "Electronic Communication Systems", Tata MCGraw hill , 5th Edition 2011	

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Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE011T	ELECTRIC VEHICLES	3	0	0	3

Prerequisite Course (s)

Electrical Machines I, Electrical Machines II, Power Electronics and Converters

Course Objective (s): The purpose of learning this course is to:

1	Understand Configuration of Electric Vehicles
2	Comprehend the energy storage for Electric and Hybrid Vehicles
3	Comprehend the electric propulsion for Electric and Hybrid Vehicles
4	Acquire the knowledge in design procedure of Series and Parallel Hybrid Electric Drive Train
5	Obtain the knowledge in power converter topologies involved in Electric Vehicles

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the configuration and its concepts of Electric Vehicles and Hybrid Vehicles
CO2	Classify and apply the types of batteries and fuel cells.
CO3	Discuss the electric propulsion unit and its drive for application of electric vehicles.
CO4	Discuss the design procedures of the Electric and Hybrid Electric Vehicles
CO5	Describe the different power converter topology used for electric vehicle application.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2
CO2	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2
CO3	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2
CO4	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2
CO5	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2
CO (Avg)	3	1	1	1	2	2	2	2	2	1	2	2	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ELECTRIC AND HYBRID ELECTRIC VEHICLES	9
Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.		
UNIT II	**ENERGY STORAGE FOR EV AND HEV**	**9**
Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Fuel Cells technologies-Proton Exchange Membrane Fuel Cells (PEMFCs).		
UNIT III	**ELECTRIC PROPULSION**	**9**
Typical Electric Vehicle Propulsion system, DC motor drive: Operation and its performance, Chopper control of DC drives. Induction motor drives: Basic principles, Steady state response, Constant volt/hertz control and power electronic control. Switched Reluctance Motor Drive: Basic magnetic structure, Torque production, SRM drive converter and Sensorless control.		
UNIT IV	**DESIGN OF SERIES AND PARALLEL HYBRID ELECTRIC DRIVE TRAIN**	**9**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, and design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design and energy storage design.		
UNIT V	**POWER ELECTRONIC CONVERTER FOR BATTERY CHARGING**	**9**
Grid and Photo Voltaic System for EV / PHEV charging, The Z-converter, Isolated bidirectional DC-DC converter, High frequency transformer based Isolated charger topology, Transformer less topology		

Text Book (s)	
1	M.Ehsani, Y. Gao, S. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2005.
2	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003
Reference (s)	
1	C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", OXFORD University Press, 2001.
2	Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications With Practical Perspectives", Wiley Publication, 2011.

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Regulation 2018		Professional Elective Group - II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE012T	SMART GRID	3	0	0	3

Prerequisite Course (s)

Basic Electrical and Electronics Engineering, Communication Engineering

Course Objective (s): The purpose of learning this course is to:

1	Study the basic concepts of smart grid and its characteristics, working principle.
2	Outline the role of Automation in transmission and distribution.
3	Study about the metering system for smart grid.
4	Understand the concepts of information systems and control method using in smart grid.
5	Illustrate the security issues in smart grid and solution approaches.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Extent the basic concepts of smart grid, working, new technologies and features of smart grid in the context of Indian grid.
CO2	Explain the design of smart grid, role of automation in transmission and distribution.
CO3	Interpret the concept of sensing and measuring methods, types of advanced meters and power electronics using in smart grid.
CO4	Describe the concept of information technologies, types of communication systems and control methods
CO5	Distinguish the security problem in smart grid and various methods to solve the security problems in smart grid.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	1	1	-	2	2	1	1
CO2	3	2	2	-	-	-	-	-	1	1	-	2	2	1	2
CO3	3	2	2	-	1	-	1	-	1	1	-	2	2	2	1
CO4	3	2	2	-	1	-	1	-	1	1	-	2	1	1	1
CO5	3	2	2	-	1	-	1	-	1	1	-	2	2	2	1
CO (Avg)	3	2	2	-	1	-	1	-	1	1	-	2	1.8	1.4	1.2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION	9
Evolution of Electric Grid – Need for smart grid – Working definitions of Smart Grid and Associated Concepts Characteristics of Smart grid-Smart grid function-Traditional Power Grid and Smart Grid-New Technologies for Smart Grid-Advantages-Indian Smart Grid-Key challenges for Smart Grid.		
UNIT II	**SMART GRID ARCHITECTURAL DESIGN**	**9**
Components and Architecture of Smart Grid Design-Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs-Transmission Automation-Distribution Automation-Renewable integration.		
UNIT III	**METERING SYSTEM FOR SMART GRID**	**9**
Sensor Network-Smart Meter-Advanced Meter Reading-Advanced meter Management-Smart electric vehicle Chargers Vehicle to grid Systems-SCADA-RTU-IED-Phasor measurement Unit-Fault Detection and Self- Healing Systems-Applications and Challenges.		
UNIT IV	**COMMUNICATION AND CONTROL INFRASTRUCTURE**	**9**
Communication Technology – Two way Digital Communication Paradigm-Network Architectures-IP based system-Power line Communication-Broadband over Power lines- GSM -Wide area Measurement protection and Control System-Energy management System-Distribution System management-Home area Network(HAN)/Home Energy Network (HEN)		
UNIT V	**SMART GRID COMMERCIALISATION**	**9**
Metering Protocol-Substation Automation Protocol-Security and Privacy: Cyber Security Challenges in Smart Grid-Load Altering Attacks-False Date Injection Attacks- Defense Mechanisms-Privacy Challenges-Pricing and Energy Consumption Scheduling-Wheeling Price - Storage technologies for smart grid		

Text Book (s)

1	Janaka Ekanayake, Nick Jenkins,Kithsiri Liyanage, "Smart Grid Technologies and Applications", John Wiley Publishers Ltd., 2012
2	James Momoh, "Smart Grid Fundamentals of Design and Analysis", IEEE Press, 2012

Reference (s)

1	Stuart Borlase, "Smart Grids, Infrastructure, Technology and Solution", CRC Press, 2013
2	Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grid", John & Sons, Jersey, 2012
3	Caitlin G.Elsworth, "The Smart Grid and Electric Power Transmission", Nova Science Publishers, 2010.
4	Lars T.Berger, Krzysztof Iniewski, "Smart Grid application, Communication and Security", John Wiley Publishers Ltd., 2012.

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE013T	ARTIFICIAL INTELLIGENCE SYSTEMS	3	0	0	3

Prerequisite Course (s)

Prior knowledge of MATLAB software is required.

Course Objective (s): The purpose of learning this course is to:

1	Introduce the basics and essentials of Artificial Neural Networks
2	Be exposed to Fuzzy Logic
3	Learn genetic algorithm
4	Introduce the fundamentals of ANFIS
5	Provide exposure to theory as well as practical systems

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand about different learning process in ANN
CO2	Implement the Fuzzy logic algorithm to real time problem.
CO3	Examine the concepts of Genetic Algorithm.
CO4	Apply the different engineering applications of Artificial intelligence techniques.
CO5	Understand different soft computing techniques.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	1	1	2	-	1	-	2	2
CO2	3	2	1	1	1	1	-	1	1	2	-	1	-	2	2
CO3	3	2	1	1	1	1	-	1	-	2	-	1	-	2	2
CO4	3	2	1	1	1	1	-	1	-	2	-	1	-	2	2
CO5	3	2	1	1	1	1	-	1	-	2	-	1	-	2	2
CO (Avg)	3	2	1	1	1	1	-	1	1	2	-	1	-	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ARTIFICIAL NEURAL NETWORK	9
Fundamental Concepts - Important Terminologies - Perceptron Network - Adaptive Linear Neuron - Back Propagation Network - Radial Basic Function - Auto Associative Memory Network - Hetero Associative Memory Network - Bidirectional Associative Memory - Fixed Weight Competitive Nets - Learning Vector Organization.		
UNIT II	**FUZZY LOGIC SYSTEMS**	**9**
Introduction - Classical Set - Fuzzy Set - Classical Relation - Fuzzy Relation - Tolerance And Equivalence Relation - Fuzzification - Methods Of Membership Value Assignments - Defuzzification Methods - Fuzzy Arithmetic - Fuzzy Measures - Fuzzy Reasoning - Fuzzy Interference System - Architecture And Operation Of Fuzzy Control System.		
UNIT III	**GENETIC ALGORITHM**	**9**
Introduction - Biological Background - Traditional Optimization And Search Techniques - Basic Terminologies - General GA - Operators In GA - Encoding – Selection - Crossover And Mutation - Classification Of GA - Problem Solving Using GA - Genetic Programming.		
UNIT IV	**HYBRID SOFT COMPUTING TECHNIQUES**	**9**
Introduction - Neuro- Fuzzy Hybrid Systems – Comparison - Characteristics – Classification - ANFIS – Genetic - Neuro - Hybrid Systems – Properties - Genetic Algorithm Back Propagation Network - Genetic Fuzzy Hybrid And Fuzzy Genetic Hybrid Systems - Genetic Fuzzy Rule Based System And Advantages.		
UNIT V	**SOFT COMPUTING TECHNIQUE USING MATLAB**	**9**
Introduction - Matrices And Vectors - Neural Network MATLAB Toolbox - Creating- Commands - Graphical User Interface - Fuzzy Logic MATLAB Toolbox - Commands - Simulink Blocks – GUI - Genetic Algorithm MATLAB Toolbox – Commands - GUI - Source Codes For Fuzzy Logic - Neural Network And Genetic Algorithm.		

Text Book (s)	
1	S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing", Wiley India, 2nd Edition, 2012.
2	Simon Haykin, "Neural Networks, A Comprehensive Foundation", Addison Wesley Longman, 2nd Edition, 2001.
3	Timothy J.Ross, "Fuzzy Logic with Engineering Application ", Wiley, 2nd Edition, 2010.
Reference (s)	
1	Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, 1st Edition, 2007.
2	S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, 1st Edition, 2003.
3	J. S. R. Lang, C. T. Sun and E. Mizutaju "Neuro-Fuzzy and soft computing", Pearson Education, 2003

Regulation 2018		Professional Electives- Group-II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE014T	BIO MEDICAL ENGINEERING	3	0	0	3

Prerequisite Course (s)

Measurements and Instrumentation

Course Objective (s): The purpose of learning this course is to:

1	Gain the knowledge about the organs of human body and measure the parameters
2	Learn the bio potential electrodes, transducers and their types
3	Gain the knowledge about the various measurements of blood pressure.
4	Study about the modern imaging systems.
5	Know the latest technologies in biomedical engineering

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the physiology of human system
CO2	Describe the various electrodes and transducers
CO3	Demonstrate the cardiac and respiratory diagnostic instruments
CO4	Demonstrate the imaging techniques in medical field
CO5	Understand the applications of telemetry and Surgical devices.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	2	2	-	-	-	-	1	1	1	1
CO2	3	2	2	1	1	2	2	-	-	-	-	1	2	2	2
CO3	3	2	2	1	1	2	2	-	-	-	-	1	2	2	2
CO4	3	2	2	1	1	2	2	-	-	-	-	1	2	2	2
CO5	3	2	1	1	1	2	2	-	-	-	-	1	2	2	2
CO (Avg)	3	1.8	1.7	1	1	2	2	-	-	-	-	1	1.8	1.8	1.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ELECTRO PHYSIOLOGY	9
Cell and Its Structure - Electrical, Mechanical and Chemical Activities - Action and Resting Potential- Organization of Nervous System - CNS - PNS - Neurons - Axons - Synapse - Propagation of Electrical Impulses along the Nerve - Sodium Pump - Cardio Pulmonary System- Physiology of Heart, Lung, Kidney.		
UNIT II	**BIO POTENTIAL ELECTRODES AND TRANSDUCERS**	**9**
Introduction to Medical Instruments - Components of Biomedical Instrument System - Electrodes: Micro Electrodes, Needle Electrodes, Surface Electrodes - Transducers -Piezo Electric, Ultrasonic, Passive Transducers - Biomedical Measurements Like pH, pCO_2, pO_2 of Blood, Isolation Amplifier, Preamplifier, Current Amplifier, Chopper Amplifier.		
UNIT III	**DIAGNOSIS INSTRUMENTS**	**9**
ECG, Einthoven Triangle, Leads, Electrodes, Vector Cardiograph, Measurement of Cardiac Output, EEG, EMG, Plethysmography, Blood Flow Measurements - Respiratory Rate Measurement – Oximeter -Patient Monitoring System- ICCU - Sources of Electric Hazards and Safety Techniques		
UNIT IV	**ADVANCED IMAGING SYSTEM**	**9**
Ultrasonic Diagnosis, Ultrasonic Scanning, Isotopes in Medical Diagnosis - Pace Makers, Defibrillators, Medical imaging-X-ray generation-Computer Aided Tomography, PET, SPECT-Laser Applications – Echocardiography-CT Scan-MRI-Endoscopy.		
UNIT V	**THERAPEUTIC AND ROBOTIC DEVICES**	**9**
Dialysers - Surgical Diathermy - Anaesthetic and Surgical Techniques-Single Channel Telemetry, Multi-channel Telemetry, Implantable Telemetry, Wireless Telemetry, Telemedicine – Applications-Nano Robots - Robotic surgery.		

Text Book (s)

1	Khandpur, "Handbook of Biomedical Instrumentation" Tata McGraw Hill, 2nd Edition, 2003.
2	John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 3rd Edition, 2013.

Reference (s)

1	Leslie Cromwell, Fred J. Werbell and Eruch A. Pfeigger, "Biomedical Instrumentation and Measurements" 2nd Edition 2011
2	WQ. J.Tompskins and J.G. Webster, "Design of Microcomputer Based Medical Instrumentation", Prentice-Hall, 2000.
3	John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, 3rd Edition, 2013.
4	Geddes L.A. and Baker L.E., "Principles of Applied Bio-Medical Instrumentation", John Wiley & Sons, 3rd Edition, 2013

Regulation 2018		Professional Elective Group-II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE015T	VLSI DESIGN	3	0	0	3

Prerequisite Course (s)

Digital Logic Circuits

Course Objective (s): The purpose of learning this course is to:

1	Study the fundamentals of Integrated circuits and its characteristics
2	Study the CMOS processing technology and DC characteristics
3	Learn the combinational and sequential circuits using various CMOS logic styles
4	Study the various arithmetic building blocks
5	Learn the full custom and semi-custom implementation strategies in IC design

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand about fundamentals of IC design and MOS transistor theory
CO2	Demonstrate CMOS fabrication process and DC characteristics
CO3	Describe the circuits using various CMOS logic styles
CO4	Describe various arithmetic building blocks
CO5	Understand about implementation strategies in IC design

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	1	-	-	-	1	1	3	2	2
CO2	3	2	-	-	-	1	1	-	-	-	1	1	2	2	2
CO3	3	2	1	-	-	1	1	-	-	-	1	1	2	2	2
CO4	3	2	1	-	-	1	1	-	-	-	1	1	2	2	2
CO5	3	2	1	-	-	1	1	-	-	-	1	1	2	2	1
CO (Avg)	3	2	1	-	-	1	1	-	-	-	1	1	2.2	2	1.8

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	AN OVERVIEW OF VLSI AND MOS TRANSISTOR THEORY	9
Introduction to VLSI design, Complexity of IC design, Basic Concept, Design Flow in IC design, Objectives of IC design, Importance of CAD tools in IC design, nMOS, pMOS Enhancement and depletion Transistor operation, Threshold Voltage and Body Effect, MOS Device Design Equation , Second Order Effects, C-V characteristics.		
UNIT II	**CMOS LOGIC AND PROCESSING TECHNOLOGY**	**9**
The Complementary CMOS Inverter-Beta Ratio- Noise Margin-Basic CMOS Technology (N-well, P-well, Twin Tub, SOI), Inter connect, Circuit Elements, Power Dissipation and sources of power dissipation, DC characteristics, RC delay model, elmore delay model, logical effort, scaling.		
UNIT III	**STATIC CMOS AND DYNAMIC CMOS LOGIC**	**9**
Static CMOS-Realization of logic using static CMOS logic, Ratioed Circuits, Cascade Voltage Switch Logic, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Dynamic logic Circuits, Domino, CPL, DCVSPG,DPL.		
UNIT IV	**ARITHMETIC BUILDING BLOCKS**	**9**
Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers.		
UNIT V	**VARIOUS STRATEGIES IN VLSI DESIGN**	**9**
Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.		

Text Book (s)	
1	Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2017.
2	Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Prentice Hall of India, 2nd Edition, 2003.
Reference (s)	
1	M.J.Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997.
2	Sung-Mo kang, Yusuf leblebici, Chulwoo Kim"CMOS Digital Integrated Circuits:Analysis& Design", McGraw Hill Education, 4th edition, 2013
3	John P. Uyemura "Introduction to VLSI Circuits and systems", John Wiley & Sons, Inc., 2008
4	Wayne Wolf, "Modern VLSI Design," Prentice Hall PTR, 2nd edition, 2000

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Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE016T	FLEXIBLE AC TRANSMISSION SYSTEMS	3	0	0	3

Prerequisite Course (s)

Power Electronics, Power Systems.

Course Objective (s): The purpose of learning this course is to:

1	Introduce the concept of FACTS controllers.
2	Study of Static Shunt Compensators.
3	Study of Static Series Compensators.
4	Introduce the operation of UPFC
5	Realize the different special purpose FACTS controllers.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concept of various FACTS controllers.
CO2	Understand the static shunt compensation.
CO3	Understand the static series compensation.
CO4	Describe the operation of unified power flow controller.
CO5	Identify the different special purpose FACTS controller and its applications.

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	2	-	2	-	2	2	-	-
CO2	3	2	1	1	1	1	-	2	-	1	-	2	2	1	1
CO3	3	1	1	1	1	1	-	2	-	1	-	2	2	1	1
CO4	3	1	1	1	1	1	-	2	-	1	-	2	2	1	1
CO5	3	2	1	1	1	1	-	2	-	2	-	1	2	1	1
CO (Avg)	3	1.6	1	1	1	1	-	2	-	1.4	-	1.8	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
FACTS concept and general system considerations: Flow of power in an AC System - Power flow and dynamic stability considerations of a transmission interconnection - Basic types of FACTS controllers - Brief description and definitions of FACTS controllers.		
UNIT II	**STATIC SHUNT COMPENSATORS**	**9**
SVC and STATCOM - Operation and control of Thyristor Switched Capacitor(TSC),Thyristor – Controlled Reactor (TCR), Static Synchronous Compensator(STATCOM) - Compensator Control – Comparison between SVC and STATCOM.		
UNIT III	**STATIC SERIES COMPENSATORS**	**9**
TSSC, TCSC and SSSC - operation and control - Control schemes for series compensators - static voltage and phase angle regulators - Thyristor-Controlled Voltage Regulator(TCVR) and Thyristor-Controlled Phase Angle Regulator(TCPAR) - operation and control.		
UNIT IV	**UNIFIED POWER FLOW CONTROLLER**	**9**
Basic operating principles of UPFC - Independent real and reactive power flow control- Comparison of UPFC to series compensators - Control Structure – Dynamic Performance - Basic control system for P and Q control.		
UNIT V	**SPECIAL PURPOSE FACTS CONTROLLER AND APPLICATION**	**9**
Subsynchronous Resonance - NGH-SSR Damping Scheme: Basic concept, design and operation aspects - Thyristor Controlled Braking Resistor(TCBR): Basic concept, design and operation aspects- Applications: WAPA's Kayenta Advanced Series Capacitor (ASC) - BPA's Slatt Thyristor Controlled Series Capacitor(TCSC).		

Text Book (s)

1	Narain G.Hingorani, Laszlo Gyugri,, "Understanding Facts" Wiley Publication, 2015.
2	R.Mohan Mattur, Rajan K. Varma, "Thyristor- Based FACTS controller fed Electrical Transmission Systems" Wiley student edition, 2013
3	K.R.Padiyar, "FACTS controller in Power Transmission and Distribution", New age International (P) Limited, 2007.

Reference (s)

1	S.Sivanagaraju, S.Satyanarayana, "Electric Power Transmission and Distribution", Pearson Edition, 2012.
2	J.B.Gupta, " A Course in Electrical Power", S.K.Kataria and Sons, 10th Edition, 2002
3	M.S.Berde," Thristor engineering", Khanna Publishers, 9th edition, 2005.

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE017T	SPECIAL ELECTRICAL MACHINES	3	0	0	3

Prerequisite Course (s)

Electrical Machines I, Electrical Machines II

Course Objective (s): The purpose of learning this course is to:

1	Understand the performance and control of Stepper Motors and their applications
2	Know the theory of operation and control of Switched Reluctance Motor
3	Understand the working principles of Brushless DC Motor
4	Learn working and characteristics of Permanent Magnet Synchronous Motor
5	Explain the theory of linear force and its application in Linear Motors

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the performance and control of Stepper Motors and their applications
CO2	Examine the operation theory and control of Switched Reluctance Motor
CO3	Explain the working principles of Brushless DC Motor
CO4	Describe the operation and characteristics of Permanent Magnet DC Motor
CO5	Apply the theory of linear force in linear motor application

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	2	-	-	-	-	-	1	2	-	1
CO2	3	2	1	1	-	-	-	-	-	1	1	1	1	-	1
CO3	3	2	1	1	-	2	-	-	1	1	1	1	2	-	1
CO4	3	2	1	1	-	2	-	-	-	-	-	2	2	-	1
CO5	3	2	1	-	-	2	-	-	1	-	1	1	2	-	1
CO (Avg)	3	2	1	1	-	2	-	-	1	1	1	1.2	1.8	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	STEPPER MOTORS	10
Constructional features - principle of operation - Types of motors – variable reluctance, permanent magnet, hybrid type - comparison – Single and multi-stack configurations–Characteristics – Drive system and circuit control of Stepper motor –Applications: Stepper Motor for Computer printer's - microprocessor-based stepper motor control.		
UNIT II	**SWITCHED RELUCTANCE MOTORS**	**8**
Constructional features – Principle of operation – Torque equation – Torque-Speed Characteristics – Power controllers- Microprocessor based control of SRM Drive – Rotor position sensors: photo transistor, hall sensor – Sensor less control of SRM – Applications of SRM.		
UNIT III	**PERMANENT MAGNET BRUSHLESS DC MOTORS**	**12**
Permanent Magnet materials- Principle of operation – Types– Electronic commutation –Magnetic circuit analysis- EMF and torque equations – Sensors for Rotor position – Power controllers– Motor characteristics and control - Applications: PMBLDC for Motion control systems.		
UNIT IV	**PERMANENT MAGNET SYNCHRONOUS MOTORS**	**7**
Principle of operation and Classifications - EMF and Torque equations- self-control - vector control - Torque speed Characteristics - Microprocessor based control – Applications		
UNIT V	**LINEAR MOTORS**	**8**
Construction – Principle of operation – Types – expression for linear force – equivalent circuit — concept of current sheet – goodness factor – DC Linear Motor (DCLM) types – Circuit equation – DCLM control applications.		

Text Book (s)

1	T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
2	T. Kenjo, "Stepping Motors and Their Microprocessor Controls", Clarendon Press London, 2nd Edition 1994.

Reference (s)

1	R.Krishnan, "Switched Reluctance Motor Drives-Modelling, Simulation, Analysis, Design and Application", CRC Press, New York, 2001.
2	G. Janardanan, "Special electrical machines", PHI learning Private Limited, Delhi, 2014.
3	Nasar A and Boldea I, "Linear Electric Motors: Theory, Design and Practical Application", Prentice Hall Inc., New Jersey,1st edition1987.
4	I.Boldea ,S.A.Nasar "Vector Control of AC drives" CRC press, New York , 1992
5	K.Venkataratnam, 'Special Electric Machines' Universities Press (India) Private Limited, 1st Edition 2009.

Regulation 2018		Professional Elective Group-II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE018T	POWER QUALITY	3	0	0	3

Prerequisite Course (s)

Power Electronics and converters, Transmission and Distribution

Course Objective (s): The purpose of learning this course is to:

1	Understand the concepts of power quality sources and issues
2	Discuss on power quality protection and impact of harmonics in commercial / industrial loads
3	Discriminate the power quality measurement and grounding

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Explain the various Power quality sources and impacts
CO2	Explain the impact of PQ issues in various electrical components
CO3	Discuss the need for power quality and protection systems
CO4	Compute the harmonics in the commercial / industrial facilities
CO5	Analyze various power quality measurement and grounding

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	-	-	-	-	-	-	1	-	1	-
CO2	2	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO3	2	1	1	1	1	-	-	-	-	-	-	1	1	1	-
CO4	2	1	1	1	1	-	-	-	-	-	-	1	2	2	1
CO5	2	1	1	1	2	-	-	-	-	-	-	1	2	2	1
CO (Avg)	2	1	1	1	1.2	-	-	-	-	-	-	1	1.5	1.4	1

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UNIT I	INTRODUCTION TO POWER QUALITY	9
Introduction -Long duration variation such as sustained interruption, over voltages, under voltages- Short duration variations such as interruption ,Voltage sags and swells-Concepts of transients, Impulsive transients-Voltage imbalance, Voltage fluctuation, source of power quality issues - Power frequency variations-Computer Business Equipment Manufacturers Associations (CBEMA) curve and ITIC curve		
UNIT II	**VOLTAGE SAGS AND INTERRUPTIONS**	**9**
Sources of sags and interruptions - Estimating voltage sag performance-active series compensators- Static transfer switches and fast transfer switches-Motor starting sags - Estimation of the sag severity.		
UNIT III	**OVER VOLTAGES**	**9**
Sources of over voltages - Capacitor switching – Lightning-ferro resonance-Devices for Overvoltage Protection-Lightning Protection: Shielding - Line arresters - Protection of transformers and cables-Computer Tools for Transients Analysis.		
UNIT IV	**HARMONICS**	**9**
Harmonic sources from commercial and industrial loads-Locating harmonic sources- Power system response characteristics - Harmonic Distortion and its effects - Voltage and Current Harmonics - Harmonic Indexes- passive and active filters - IEEE and IEC Standards of Harmonics		
UNIT V	**SOLUTIONS FOR POWER QUALITY PROBLEMS AND GROUNDINGS**	**9**
Harmonic analyzers-Transient Disturbance analyzers – Oscilloscopes – grounding: Shock and fire hazards, essential of a grounded system, earth resistance tests, Earth - Ground Grid Systems- Power Ground System		

Text Book (s)

1	Roger .C. Dugan, Mark F.Mcgranaghan & H.Wayne Beaty, "Electrical power system Quality", McGraw-Hill Newyork, 3rd edition 2012.
2	Sankaran C,"Power Quality", CRC Press special Indian edition 2009.

Reference (s)

1	Angelo Baggini, "Handbook of Power Quality" John Wiley & Sons Ltd, 2008.
2	Arrillaga.J, Watson.N.R and Chen.S, "Power System Quality Assessment", John Wiley & Sons Ltd., England, 2000
3	Arindam Ghosh and Gerald Ledwich, "Power Quality Enhancement Using Custom Power Devices", Kluwer Academic Publishers, 2002.
4	Barry W.Kennedy, "Power Quality Primer", Tata McGraw-Hill, New York, 2000.

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE019T	VIRTUAL INSTRUMENTATION	3	0	0	3

Prerequisite Course (s)

Basic Science and Mathematics, Measurements and Instrumentation

Course Objective (s): The purpose of learning this course is to:

1	Understand the virtual instruments concepts.
2	Realize the programming techniques involved in LabVIEW
3	Enumerate the basic programming and its structure involved in VIs
4	Acquire the knowledge to interface the hardware with VIs
5	Comprehend the few application of LabVIEW in Industries

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the Virtual Instruments and its use
CO2	Describe the programming techniques involved in LabVIEW
CO3	Demonstrate the basic programming In VIs
CO4	Discuss the hardware interfacing modules in VIs
CO5	Discuss the application of LabVIEW in Industrial Applications like Biomedical, Process Control, Mechanical Measurements And Automobile

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2
CO2	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2
CO3	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2
CO4	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2
CO5	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2
CO (Avg)	3	1	1	1	3	2	2	2	2	1	2	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION	9
Evolutions of VI, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, Graphical programming, and comparison with conventional programming. Advantages of Virtual Instruments over conventional instruments – Hardware and software		
UNIT II	**PROGRAMMING**	**9**
Graphical user interfaces – Controls and indicators – 'G' programming – Labels and Text –Shape, size and colour – Owned and free labels – Data type, Format, Precision and representation – Data types – Data flow programming – Editing – Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Functions and libraries		
UNIT III	**PROGRAMMING STRUCTURE**	**9**
Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures – Arrays and Clusters– Array Operations – Bundle – Bundle/Unbundle by name, graphs and charts – String and file I/O– High-level and Low level file I/O's - Attribute modes Local and Global variables.		
UNIT IV	**HARDWARE INTERFACING**	**9**
DAQ – Block diagram – Description – Analog and Digital I/O - buffered I/O - ADC – DAC TECHNIQUES - basic system components of a signal conditioning system – RS232/485 -GPIB – VISA - PXI – VXI.		
UNIT V	**LabVIEW TOOL AND GRAPHICAL SYSTEM DESIGN - APPLICATIONS**	**9**
Industrial Applications: Digital Filter design – Toolkit, Sound and vibration Toolkit, Modulation Toolkit, Control design and Simulation – Module and toolkit, System identification toolkit, Biomedical Start-up kit, GSD Applications: Material handling system, plastic injection moulding system and Semiconductor Production control system.		

Text Book (s)

1	Jovitha Jerome, "Virtual Instrumentation using LabVIEW" PHI Publishers, New Delhi, 2nd edition 2010.
2	Gary Johnson, Richard Jennings, "Lab VIEW Graphical ProgrEdition", Tata Mc Graw Hill, New York, 2006.
3	Sanjay Gupta and Joseph John, "Virtual Instrumentation using Lab VIEW", Tata McGraw-Hill, First Edition, 2005.

Reference (s)

1	Lab VIEW: Basics I & II Manual, National Instruments, Bangalore, 2005

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Regulation 2018		Professional Elective – Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE020T	SOLAR ENERGY UTILIZATION	3	0	0	3

Prerequisite Course (s)

Electric Power Generation

Course Objective (s): The purpose of learning this course is to:

1	Enable the students to acquire knowledge of solar radiation data and its measurement.
2	Comprehend the concept of various forms of solar thermal systems.
3	Understand basic knowledge on direct steam generation systems.
4	Learn the maintenance and implementation of solar photovoltaic.
5	Recognize the latest heat energy storages in buildings

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Infer the concepts of solar radiation data and its measurement.
CO2	Explain the working process of various solar thermal systems
CO3	Describe the principles of solar parabolic concentrators and direct steam generation systems.
CO4	Enumerate the importance of solar photovoltaic maintenance and their implementation.
CO5	Understand the orientation and design of buildings by using latest heat energy storages.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	2	2	-	-	-	2	1	2	2	2
CO2	3	1	-	-	-	2	2	-	-	-	2	1	2	-	-
CO3	3	1	-	-	-	2	1	-	-	-	2	1	2	-	-
CO4	3	1	-	-	-	2	2	-	-	-	2	1	2	-	-
CO5	3	1	-	-	-	2	1	-	-	-	2	1	2	2	1
CO (Avg)	3	1	-	-	-	2	1.6	-	-	-	2	1	2	2	1.5

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UNIT I	SOLAR RADIATION AND MEASUREMENTS	9
Sun and earth geometry- Solar radiation- Beam and diffuse radiations- Measurement of solar radiation – Pyranometer -Pyrheliometer- Sunshine recorder-Solar collectors and applications.		
UNIT II	**SOLAR THERMAL SYSTEMS**	**9**
Flat plate and evacuated tube collectors- Domestic hot water and process heat systems- Solar cooker- Solar dryer-Solar desalination and solar pond.		
UNIT III	**SOLAR POWER PLANT**	**9**
Principles of solar parabolic concentrators- Trough and dish types- Compound parabolic concentrators- Fresnel lens collectors- Central receiver plant- Direct steam generation systems- Solar furnaces.		
UNIT IV	**SOLAR PHOTOVOLTAICS**	**9**
Solar photovoltaic theory- Mono and polycrystalline silicon technologies- PV modules and integrated systems implementation and maintenance.		
UNIT V	**SOLAR-CONSCIOUS BUILDINGS**	**9**
Orientation and design of buildings- Passive solar heat- Thermal capacity -Insulation- Solar cooling-refrigeration and air-conditioning- Space heating- Sensible and latest heat energy storages in buildings.		

Text Book (s)	
1	Sukhatme.K, Suhas P. Sukhatme, "Solar energy: Principles of thermal collection and storage", Tata McGraw Hill publishing Co. Ltd, 8th edition, 2008.
2	Soteris A. Kalogiru, "Solar Energy Engineering: Processes and systems", Academic press, 1st edition, 2009.
Reference (s)	
1	Duffie.J.A, & Beckman.W.A, "Solar Engineering of Thermal Processes", John Wiley & Sons, Inc., 3rd edition, 2006.
2	Martin A. Green, "Third generation Photovoltaics: Advanced energy conversion", 1st edition, 2005
3	Garg.H.P, Prakash.J, "Solar energy fundamentals and applications", Tata McGraw Hill publishing Co. Ltd, 2006

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Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE021T	ENERGY STORING DEVICES AND FUEL CELLS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand the fundamental concepts of energy storage systems
2	Analyze and design of batteries
3	Gain the knowledge about principle and operation of various batteries, ultra capacitors and flywheels and fuel cell.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Conceptualize the principles of energy storage systems.
CO2	Understand the performance of primary batteries and their design aspects.
CO3	Interpret the concepts of secondary batteries
CO4	Comprehend the fundamental concepts of ultra-capacitors and flywheels.
CO5	Perceive the importance of fuel cell system in replacing fossil fuel based energy generation.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	1	1	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	1	1	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	1	1	1	-	-
CO4	2	1	1	-	-	-	-	-	-	-	1	1	1	-	-
CO5	2	1	1	-	-	-	-	-	-	-	1	1	-	-	-
CO (Avg)	2	1	1	-	-	-	-	-	-	-	1	1	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	ENERGY STORAGE SYSTEMS	9
Introduction - Need of energy storage - Battery - Components of Cells and Batteries – Classification - Operation of a Cell - Theoretical Cell Voltage, Capacity, and Energy – Specific energy and Energy Density.		
UNIT II	**BATTERY SELECTION AND DESIGN**	**9**
Battery parameters and specification - Designing to Eliminate Potential Safety Problems- Battery Safeguards when Using Discrete Batteries - Battery Construction- Factors Affecting Battery Performance- Major Considerations in Selecting a Battery.		
UNIT III	**SECONDARY BATTERIES**	**9**
Introduction - Performance, charging and discharging- storage density, energy density, classical batteries -Lead Acid, Nickel-Cadmium, Zinc Manganese dioxide and modern batteries - Zinc-Air, Nickel Hydride, Lithium Battery.		
UNIT IV	**ULTRACAPACITORS AND FLYWHEELS**	**9**
Ultra capacitors: Features- Basic Principles of Ultra capacitors - Performance of Ultra capacitors- Ultrahigh-Speed Flywheels - Operation Principles of Flywheels - Power Capacity of Flywheel Systems - Flywheel Technologies.		
UNIT V	**FUEL CELLS**	**9**
Introduction – Principle of operation of fuel cell-conversion efficiency of fuel cell- types of fuel cells -hydrogen oxygen cells, hydrogen air cell, alkaline fuel cell, and phosphoric fuel cell-application of fuel cell.		

Text Book (s)

1	David Linden, Thomas B. Reddy, "Handbook of Batteries", McGraw-Hill, 3rd Edition, 2010.
2	MehrdadEhsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle", CRC Publisher, 2nd Edition, 2010.
3	S. Srinivasan, "Fuel Cells: From Fundamentals to Applications", Springer US, CBS Publishers: New Delhi, 2006.

Reference (s)

1	Tetsuya Osaka, MadhavDatta, "Energy Storage Systems in Electronics", Gordon and Breach Science Publishers, 4th Edition, 2000.
2	R. M. Dell, D.A.J. Rand, "Understanding Batteries", RSC Publications, 1st Edition, 2007.
3	James Larminie, Andrew Dick, "Fuel Cell System Explained", J. Wiley, 2nd Edition, 2003

Regulation 2018		Professional Elective - Group II	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
E	18EEE022T	FUNDAMENTALS OF IoT	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Recognize the IoT Architectures
2	Learn about various IOT-related protocols and technologies
3	Study the M2M and IoT architectures
4	Build simple IoT Systems using Arduino and Raspberry Pi
5	Study the IoT infrastructure for popular applications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concept of IoT
CO2	Describe various protocols and technologies for IoT.
CO3	Demonstrate various M2M and IoT architectures.
CO4	Describe the IoT solutions using Arduino/Raspberry Pi
CO5	Understand the applications of IoT in real time scenario.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	2	-	-	-	-	3	2	2	2
CO2	3	1	1	-	-	2	2	-	-	-	-	3	2	2	2
CO3	3	2	2	-	-	2	2	-	-	-	-	3	2	2	2
CO4	3	1	1	-	-	2	2	-	-	-	-	3	2	3	2
CO5	3	2	1	-	-	3	3	-	-	-	-	3	2	2	3
CO (Avg)	3	1.5	1.2	-	-	2.2	2.2	-	-	-	-	3	2	2.2	2.2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

UNIT I	INTRODUCTION TO INTERNET OF THINGS	9
Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, Logical Design of IoT, IoT Communication Models, IoT Communication APIs		
UNIT II	**IoT ENABLING TECHNOLOGIES**	**9**
Wireless Sensor Networks, Cloud Computing, Fog Computing Big Data Analytics, Communication Protocols, Embedded Systems, IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5.		
UNIT III	**M2M & IoT SYSTEM MANAGEMENT**	**9**
Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization, IoT System Management with NETCONF-YANG, Need for IoT Systems Management, Network Operator Requirements, NETCONF, YANG.		
UNIT IV	**VARIOUS IoT SOLUTIONS**	**9**
Introduction to Python, Introduction to different IoT tools, - IoT system building blocks, Introduction to Arduino and Raspberry Pi, Implementation of IoT with Arduino, Implementation of IoT with Raspberry		
UNIT V	**DOMAIN SPECIFIC APPLICATIONS**	**9**
Home automation applications, Smart cities applications, Environmental applications, Energy applications, Retail applications, Industrial applications, Agricultural applications.		

Text Book (s)

1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017

Reference (s)

1	Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2015
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st Edition, 2013
3	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things - Key applications and Protocols", Wiley, 2012
4	Cuno Pfister, "Getting Started with the Internet of Things", O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
5	Michael Margolis, "Arduino Cookbook, Recipes to Begin, Expand and Enhance Your Projects", O'Reilly Media, 2nd Edition, 2011.
6	https://www.arduino.cc/ https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

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OPEN ELECTIVES OFFERED TO OTHER DEPARTMENT

Regulation 2018		Open Elective	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18EEO001T	BASICS OF INTERNET OF THINGS	3	0	0	3

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Recognize the IoT Architectures
2	Learn about various IOT-related protocols and technologies
3	Study the M2M and IoT architectures
4	Build simple IoT Systems using Arduino and Raspberry Pi
5	Study the IoT infrastructure for popular applications

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the concept of IoT
CO2	Describe various protocols and technologies for IoT.
CO3	Demonstrate various M2M and IoT architectures
CO4	Describe the IoT solutions using Arduino/Raspberry Pi
CO5	Understand the applications of IoT in real time scenario

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	2	2	-	-	-	-	3			
CO2	3	1	1	-	-	2	2	-	-	-	-	3			
CO3	3	2	2	-	-	2	2	-	-	-	-	3			
CO4	3	1	1	-	-	2	2	-	-	-	-	3			
CO5	3	2	1	-	-	3	3	-	-			3			
CO (Avg)	3	1.5	1.2	-	-	2.2	2.2	-	-			3			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	INTRODUCTION TO INTERNET OF THINGS	9
Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, Logical Design of IoT, IoT Communication Models.		
UNIT II	**IoT ENABLING TECHNOLOGIES**	**9**
Wireless Sensor Networks, Cloud Computing, Fog Computing Big Data Analytics, Communication Protocols, Embedded Systems.		
UNIT III	**M2M & IoT SYSTEM MANAGEMENT**	**9**
Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization, IoT System Management with NETCONF-YANG		
UNIT IV	**DESIGNING IoT SOLUTIONS**	**9**
Introduction to Python, Introduction to different IoT tools, - IoT system building blocks, Introduction to Arduino and Raspberry Pi		
UNIT V	**DOMAIN SPECIFIC APPLICATIONS**	**9**
Home automation applications, Smart cities applications, Environmental applications, Energy applications, Industrial application.		

Text Book (s)	
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017
Reference (s)	
1	Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2015
2	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st Edition, 2013
3	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things - Key applications and Protocols", Wiley, 2012
4	Cuno Pfister, "Getting Started with the Internet of Things", O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
5	Michael Margolis, "Arduino Cookbook, Recipes to Begin, Expand and Enhance Your Projects", O'Reilly Media, 2nd Edition, 2011.
6	https://www.arduino.cc/ https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

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Regulation 2018		Open Elective	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18EEO002T	FUNDAMENTALS OF SMART GRID	3	0	0	3

Prerequisite Course (s)

Basics of Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Introduce the Basic Concepts of Smart grid and its Characteristics, Working Principle.
2	Outline the technologies involved in transmission Automation.
3	Study about the role of Distribution Automation in Smart Grid Technologies.
4	Acquire the knowledge in Smart Grid technologies, different smart meters and advanced metering infrastructure
5	Study the high performance computing for Smart Grid applications.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the basic concepts of Smart grid and its Characteristics, Working Principle.
CO2	Explain the Design of Smart grid and technologies using transmission automation.
CO3	Describe the different Smart Grid technologies for Distribution automation.
CO4	Discuss about different smart meters and advanced metering infrastructure.
CO5	Explain the high performance computing for Smart Grid applications.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	1	-			
CO2	3	2	1	1	-	1	-	-	-	-	1	-			
CO3	3	2	1	1	-	1	-	-	-	-	1	-			
CO4	3	2	1	1	1	2	1	-	-	1	1	-			
CO5	3	2	1	1	1	2	1	1	1	1	1	1			
CO (Avg)	3	2	1	1	1	1.5	1	1	1	1	1	1			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	**INTRODUCTION**	**10**
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.		
UNIT II	**SMART GRID TECHNOLOGIES FOR TRANSMISSION AUTOMATION**	**8**
Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: Basics about EMS, FACTS and HVDC, Wide area monitoring, Protection and control.		
UNIT III	**SMART GRID TECHNOLOGIES FOR DISTRIBUTION AUTOMATION**	**12**
DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug-in Hybrid Electric Vehicles (PHEV).		
UNIT IV	**SMART METERS AND ADVANCED METERING INFRASTRUCTURE**	**7**
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.		
UNIT V	**HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS**	**8**
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband 81 over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.		
Text Book (s)		
1	Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions", CRC Press 2012.	
2	Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grid", John & Sons, Jersey, 2012	
3	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, "Smart Grid Technologies and Applications", John Wiley Publishers Ltd., 2012.	
Reference (s)		
1	James Momoh, "Smart Grid Fundamentals of Design and Analysis", IEEE Press, 2012.	
2	Calitlin G.Elsworth, "The Smart Grid and Electron Power Transmission", Nova Science Publishers, 2010.	
3	Xi Fang, Satyajayant Misra, Guoliang Xue and Dejun Yang "Smart Grid-The New Improved Power Grid: A Survey", IEEE Transaction on Smart Grids.	

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Regulation 2018		Open Elective	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18EEO003T	ROBOTICS	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Introduce basic robotic terminologies.
2	Illustrate various parts of robots.
3	Introduce manipulator dynamics and gripper types.
4	Illustrate kinematics and path planning.
5	Illustrate various applications of robots.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the basic robotic terminologies
CO2	Understand various parts of robots.
CO3	Understand manipulator dynamics and gripper operation
CO4	Develop kinematics and path planning equations for standard configurations
CO5	Familiarize the various applications of robots.

CO-PO Mapping

Cos	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	1	2	-	2	2			
CO2	3	2	1	1	1	-	-	1	2	-	2	2			
CO3	3	1	1	1	1	1	-	1	2	-	2	1			
CO4	3	2	2	1	1	1	-	1	2	-	1	1			
CO5	3	1	1	1	1	1	-	1	2	-	2	2			
CO (Avg)	3	1.6	1.4	1	1	1	-	1	2	-	1.8	1.6			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	BASIC CONCEPTS	9
Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots.		
UNIT II	**ROBOT COMPONENTS: POWER SOURCES AND SENSORS**	**9**
Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy Hydraulic, pneumatic and electric drives: Design and control issues – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fibre optic and tactile sensors.		
UNIT III	**MANIPULATORS AND GRIPPERS**	**9**
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.		
UNIT IV	**KINEMATICS AND PATH PLANNING**	**9**
Solution of inverse kinematics problem – Multiple solution Jacobean work envelop – Hill climbing techniques – robot programming languages.		
UNIT V	**APPLICATION**	**9**
Multiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.		

Text Book (s)	
1	Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 2015.
2	Deb.S.R., "Robotics technology and flexible Automation", John Wiley, USA 1992.
Reference (s)	
1	Asfahl C.R., "Robots and manufacturing Automation", John Wiley, 2nd edition, 2014.
2	Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley & Sons, 1989.
3	Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering - An integrated approach", Prentice Hall of India, New Delhi, 1994.
4	Mc Kerrow P.J., "Introduction to Robotics", Addison Wesley, USA, 1991.
5	JohnJ.Craig, "Introduction to Robotics Mechanics and Control", Pearson Education, 3rd edition, 2009.

Regulation 2018		Open Elective	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18EEO004T	ENERGY STORING DEVICES	3	0	0	3

Prerequisite Course (s)

Nil

Course Objective (s): The purpose of learning this course is to:

1	Understand the fundamental concepts of energy storage systems
2	Analyze and design of batteries
3	Gain the knowledge about principle and operation of various batteries, ultra capacitors and flywheels and fuel cell.

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Conceptualize the principles of energy storage systems.
CO2	Understand the performance of primary batteries and their design aspects.
CO3	Interpret the concepts of secondary batteries
CO4	Comprehend the fundamental concepts of ultra-capacitors and flywheels.
CO5	Perceive the importance of fuel cell system in replacing fossil fuel based energy generation.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	1	1			
CO2	2	1	1	-	-	-	-	-	-	-	1	1			
CO3	2	1	1	-	-	-	-	-	-	-	1	1			
CO4	2	1	1	-	-	-	-	-	-	-	1	1			
CO5	2	1	1	-	-	-	-	-	-	-	1	1			
CO (Avg)	2	1	1	-	-	-	-	-	-	-	1	1			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ENERGY STORAGE SYSTEMS	9
Introduction - Need of energy storage - Battery - Components of Cells and Batteries –Classification - Operation of a Cell - Theoretical Cell Voltage, Capacity, and Energy – Specific energy and Energy Density.		
UNIT II	**BATTERY SELECTION AND DESIGN**	**9**
Battery parameters and specification - Designing to Eliminate Potential Safety Problems- Battery Safeguards when Using Discrete Batteries - Battery Construction- Factors Affecting Battery Performance- Major Considerations in Selecting a Battery.		
UNIT III	**SECONDARY BATTERIES**	**9**
Introduction - Construction, charging and discharging- storage density, energy density for Lead Acid battery, Nickel-Cadmium battery, Zinc Manganese dioxide battery and modern batteries - Zinc-Air, Nickel Hydride, Lithium Battery.		
UNIT IV	**ULTRACAPACITORS AND FLYWHEELS**	**9**
Ultra capacitors: Features- Basic Principles of Ultra capacitors - Performance of Ultra capacitors- Ultrahigh-Speed Flywheels - Operation Principles of Flywheels - Flywheel Technologies.		
UNIT V	**FUEL CELLS**	**9**
Introduction – principle of operation of fuel cell-conversion efficiency of fuel cell- types of fuel cells -hydrogen oxygen cells, hydrogen air cell, alkaline fuel cell, and phosphoric fuel cell-application of fuel cell.		

Text Book (s)

1	David Linden, Thomas B. Reddy, "Handbook of Batteries', McGraw-Hill, 3rd Edition, 2010.
2	MehrdadEhsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicle", CRC Publisher, 2nd Edition, 2010.
3	S. Srinivasan, "Fuel Cells: From Fundamentals to Applications", Springer US, CBS Publishers: New Delhi, 2006.

Reference (s)

1	Tetsuya Osaka, MadhavDatta, "Energy Storage Systems in Electronics", Gordon and Breach Science Publishers, 4th Edition, 2000.
2	R. M. Dell, D.A.J. Rand, "Understanding Batteries", RSC Publications, 1st Edition, 2007.
3	James Larminie, Andrew Dick, "Fuel Cell System Explained", J. Wiley, 2nd Edition, 2003

Regulation 2018		Open Elective	Total Hours			45
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
O	18EEO005T	FUNDAMENTALS OF ELECTRIC VEHICLES	3	0	0	3

Prerequisite Course (s)

Basics of Electrical and Electronics Engineering

Course Objective (s): The purpose of learning this course is to:

1	Understand Configuration of Electric Vehicles
2	Comprehend the energy storage for Electric and Hybrid Vehicles
3	Comprehend the electric propulsion for Electric and Hybrid Vehicles
4	Acquire the knowledge in design procedure of Series Hybrid Electric Drive Train
5	Acquire the knowledge in design procedure of Parallel Hybrid Electric Drive Train

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Describe the configuration and its concepts of Electric Vehicles and Hybrid Vehicles
CO2	Classify and apply the types of batteries and fuel cells.
CO3	Discuss the electric propulsion unit and its drive for application of electric vehicles.
CO4	Describe the steps involved in design of Series Hybrid Electric Drive Train
CO5	Describe the steps involved in design of Parallel Hybrid Electric Drive Train

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	2	2	2	2	1	2	2			
CO2	3	1	1	1	2	2	2	2	2	1	2	2			
CO3	3	1	1	1	2	2	2	2	2	1	2	2			
CO4	3	1	1	1	2	2	2	2	2	1	2	2			
CO5	3	1	1	1	2	2	2	2	2	1	2	2			
CO (Avg)	3	1	1	1	2	2	2	2	2	1	2	2			

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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UNIT I	ELECTRIC AND HYBRID ELECTRIC VEHICLES	9
Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.		
UNIT II	**ENERGY STORAGE FOR EV AND HEV**	**9**
Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Fuel Cells technologies-Proton Exchange Membrane Fuel Cells (PEMFCs).		
UNIT III	**ELECTRIC PROPULSION**	**9**
Typical Electric Vehicle Propulsion system, DC motor drive: Operation and its performance, Chopper control of DC drives. Induction motor drives: Basic principles, Steady state response, Constant volt/hertz control and power electronic control. Switched Reluctance Motor Drive: Basic magnetic structure, Torque production, SRM drive converter and Sensorless control.		
UNIT IV	**DESIGN OF SERIES HYBRID ELECTRIC DRIVE TRAIN**	**9**
Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, and design of PPS		
UNIT V	**DESIGN OF PARALLEL HYBRID ELECTRIC DRIVE TRAIN**	**9**
Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design and energy storage design.		
Text Book (s)		
1	M.Ehsani, Y. Gao, S. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2005.	
2	Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003	
Reference (s)		
1	C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", OXFORD University Press, 2001.	
2	Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles And Applications With Practical Perspectives", Wiley Publication, 2011.	

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Regulation 2018		One Credit course	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
X	18EEX001J	EMBEEDED SYSTEM USING ARM CONTROLLERS	2	0	1	1

Prerequisite Course (s)

NIL

Course Objective (s): The purpose of learning this course is to:

1	Explain the ARM architecture and the pipeline structure
2	Study about the features of the LPC 2148 and communications
3	Learn about the embedded system components and their functionality

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Understand the ARM7 Architecture
CO2	Describe about the Features and data communications of LPC2148
CO3	Understand the various embedded system components functionality with differences between the general computing system and the embedded system

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	-	-	-	-	-	1	1	1	1	1
CO2	3	2	1	1	3	-	-	-	-	-	1	1	1	1	1
CO3	3	2	1	1	3	-	-	-	-	-	1	1	1	1	1
CO (Avg)	3	2	1	1	3	-	-	-	-	-	1	1	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MODULE I	5
Introduction to ARM – ARM7 Architecture: ARM7TDMI – ARM7TDMI features – ARM7 functional block diagram – ARM7 internal structure – ARM7 operating states – ARM Registers: GPR, PC, CPSR, SPSR	
MODULE II	**5**
ARM based Embedded Microcontroller – LPC 2148 Block Diagram and features – Pin Connect Block – Memory Mapping – General Purpose Input / Output Unit: LPC 2148 Timer: Features, Registers - UART: Features, Registers - I2C Features and Operating Modes- simple programs	
MODULE III	**5**
Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, relay, Piezo buzzer, Push button switch, Communication Interface	

Text Book (s)	
1	Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides-Designing & Optimizing System Software", Elsevier, 2008
2	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009.
Reference (s)	
1	LPC 2148 USER MANUAL
2	http://www.ocfreaks.com/lpc2148-timer-tutorial/.

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Regulation 2018		One Credit course	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
X	18EEX002J	LABVIEW PROGRAMMING	1	0	2	1

Prerequisite Course (s)

Basic Mathematics and Science, Measurement and Instrumentation

Course Objective (s): The purpose of learning this course is to:

1	Acquire a programming skill in LabVIEW

Course Outcome (s) (COs): At the end of this course, learners will be able to:

CO1	Demonstrate the programming in LabVIEW tool.

CO-PO Mapping

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	3	1	1	1	2	1	3	3	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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MODULE I INTRODUCTION	5
Introduction of LabVIEW: LabVIEW Environment : Definition - Necessity of LabVIEW- Definitions of VI- LabVIEW benefits- Programming and Execution methods - How to start up the Vis- Front panel designing and working environment - Definitions of Control and Indicators- -ypes of Control and Indicators- Explanations of Controls Palette- Explanations Block Diagram and its working - Terminals - Functional Platte- Status Bar or Window tool bar.	
MODULE II BASIC PROGRAMMING AND SUBVIs	**5**
How to use Numerical functions- Designing of Boolean operations- Comparator applications- Exercises in basic programming - Need of SubVI - What is SubVI - How to use the Connector Pane with terminals- Various types in SubVI plots..	
MODULE III PROGRAMMING IN LOOPS AND STRUCTURES	**5**
About For loops - How to use Shift registers- While loop designing- Flat Sequences- Applications based on Loops- Case Structure : Definition and designing method- Event Structure : Definition and designing method - Project work of Temperature Control	

Reference (s)

1	Jovitha Jerome, "Virtual Instrumentation using LabVIEW", PHI Publishers, 3 th edition 2013.New Delhi.
2	Gary Johnson, Richard Jennings, "Lab VIEW Graphical ProgrEdition", Mc Graw Hill, New York, 2006.
3	Sanjay Gupta and Joseph John, "Virtual Instrumentation using Lab VIEW", Tata McGraw-Hill, First Edition, 2005.
4	LabVIEW: Basics I & II Manual, National Instruments, Bangalore

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Department	COMPUTER SCIENCE AND ENGINEERING					R 2016	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
16CSY10	DATA CENTER AND CLOUD BASICS	0	0	2	1	30	100	

Course Objective (s):

1. Learn the basics of CBO and Cloud Services.
2. Learn and Practice the features available in Office 365.
3. Know the basic operations of Data Center.
4. Learn the working of SCCM.

Course Outcomes:

1. Understand the basics of CBO and Cloud Services.
2. Make use of the features available in Office 365.
3. Discuss the basic operations of Data Center.
4. Understand the working of SCCM.

Unit I	CLOUD BASICS AND DATA CENTER	15

CBO Overview

- Services/Functions, Offerings, Technology stack, Japan centric Delivery

Cloud Computing

- Cloud Overview, Private/Public/Hybrid IaS/PaS/SaS Service Providers Cloud computing Services

DevOps Overview

- Dev ops model, Continuous Integration, Continuous Delivery, Process and Tools, Micro services

Office 365 Overview

- Office 365 Basics, Different Services in Office 365, Office 365 tools, Office 365 Setup/Configuration, Active Directory Federation Services (ADFS)

Datacenter Operations Overview

- Datacenter Components, Datacenter Operations support, Hybrid cloud Management, IT Service Management.

Networking Paradigm

- Network Devices, Data/voice network services, LAN/WAN Basics, Firewall Overview

Windows 10 - End User Computing Basics

- Windows 10 Operating System, Antivirus Management, Patches Management,

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Approved By Board of Computer Science On
27 OCT 2020
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