



Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008



CURRICULUM AND SYLLABI

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Regulation 2020

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

Vision and Mission of the Department

VISION

To provide the students with high quality technical education in the field of Electrical and Electronics Engineering enabling them to become competent and responsible engineers with employability and entrepreneurial skills.

MISSION

M1: Equip the students with adequate knowledge in the field of Electrical and Electronics Engineering and professional skills necessary to face the future challenges with confidence and courage.

M2: Engineer them to engage in research activities leading to innovative applications of technology.

M3: Enable them to become responsible citizens of the country with a willingness to serve the society.

Programme Outcomes (POs)

At the time of their graduation students of Electrical and Electronics Engineering Programme should be in possession of the following Programme Outcomes

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

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

PO3. Design/development of solutions: Design solutions for complex electrical 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 electrical 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.

PO9. 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.

Program Educational Objectives (PEOs)

PEO1: Graduates will have successful career in industry that meets the needs of Indian and multinational companies.

PEO2: Graduates will synthesize data and technical concepts for application to product design and to solve research problems.

PEO3: Graduates will work as a part of teams on multidisciplinary projects with good communication and interpersonal skills.

PEO4: Graduates will exercise their knowledge in mathematical, scientific and engineering fundamentals to formulate, analyze and solve engineering problems following ethical practices.

PEO5: Graduates will exhibit life-long learning updating knowledge continuously.

Mapping of PO's to PEO's

Programme Educational Objectives	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
PEO 1	3	3	3	2	3	2	3	2	2	3	2	3
PEO 2	3	3	3	2	3	2	3	2	2	3	3	3
PEO 3	2	2	2	3	2	2	3	2	2	3	2	3
PEO 4	3	3	3	2	3	2	2	2	2	3	3	2
PEO 5	2	2	2	1	1	3	2	3	3	2	2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed
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Program Specific Outcome (PSOs)

After the successful completion of the B.E. Electrical and Electronics Engineering programme, the graduates will be able to:

PSO1: Explore the physics and mathematical concepts, methodologies and cutting-edge technologies in the field of Electrical Engineering to design, implement, operate and maintain energy efficient system.

PSO2: Engage in the design and development of integrated electronic systems applying the relevant hardware and software tools.

PSO3: Adopt ethical Practices lifelong in their profession in the field of Electrical and Electronics Engineering.

Year	S e m	Course Code / Course Title	Program Outcomes												Program Specific Outcomes		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I Year	Semester I	20SB101 - Engineering Biology	2	2	2	2	0	3	2	0	0	0	0	3	2	0	0
		20MA101 - Engineering Mathematics I	3	2	3	2	2	0	0	0	2	0	0	0	3	1	0
		20PH102 - Physics for Electrical Science	2	2	2	2	2	0	0	0	2	0	0	1	2	1	0
		20EE101 - Analog Electronics	3	2	1	1	2	0	0	0	0	0	0	2	3	3	0
		20CS111 - Problem Solving using C Programming	3	2	3	2	2	0	0	0	2	0	0	0	3	0	0
		20ME103 - Engineering Practices Laboratory	3	2	3	1	2	0	2	1	1	1	0	1	2	0	0
		20MC101- Induction Programme	0	0	0	0	0	3	3	3	2	3	0	3	0	0	3
	Semester II	20GE201- Universal Human Values	0	0	0	0	0	3	3	3	2	2	0	3	0	0	3
		20MA201 - Engineering Mathematics II	3	2	3	2	2	0	0	0	2	0	0	0	3	1	0
		20EN101 - Technical Communication Skills	0	0	0	0	2	3	0	3	2	3	0	3	0	0	3
		20CH101- Engineering Chemistry	2	1	2	1	0	0	1	0	0	0	0	0	2	0	0
		20EE201 - Basics of Electrical Circuits	3	3	3	3	0	0	0	0	1	0	0	0	3	0	0
		20ME111 - Engineering Graphics	2	2	1	0	0	0	0	2	2	0	2	0	2	0	0
		20MC102 - Environmental Sciences	0	0	0	0	0	3	3	3	2	0	0	3	0	0	3

Year	Sem	Course Code / Course Title	Program Outcomes												Program Specific Outcomes		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
II Year	Semester III	20EE301-Electrical Machines – I	3	2	2	1	0	0	0	0	0	0	0	1	0	2	0
		20EE302-Digital Circuits	3	2	2	1	0	0	0	0	0	0	0	1	0	2	0
		20EE303-Electric Power Generation	3	2	2	1	0	0	0	0	0	0	0	1	2	1	0
		20EE304-Measuring Instruments and Smart sensors	3	2	2	1	1	0	0	0	0	0	0	1	1	2	0
		20MA301-Engineering Mathematics III	3	3	0	3	0	0	0	0	0	0	0	0	1	0	0
		20CS311-Data Structures using C++	2	3	2	0	2	0	0	0	0	0	2	3	0	3	2
		20EE305-Electrical Machines – I Laboratory	3	3	2	2	1	0	1	2	2	2	0	0	3	0	3
		20EE306-Digital Circuits Laboratory	3	3	2	1	1	1	1	2	2	2	1	0	0	3	0
		20MC1XX-Mandatory Course III	2	3	2	0	2	0	0	0	0	0	2	3	0	3	2
	Semester IV	20EE401-Electrical Machines – II	2	2	1	1	0	0	0	0	2	0	0	1	3	0	3
		20EE402-Transmission and Distribution	3	3	2	2	2	0	0	0	0	0	0	0	3	2	0
		20EE403-Control Systems	3	3	2	2	1	0	0	0	0	1	0	2	3	0	0
		20EE404-Linear Integrated Circuits	3	2	1	1	3	0	2	0	0	0	2	2	3	1	0
		20MA403-Applied Mathematics	3	3	0	0	3	0	0	0	0	0	0	0	1	0	0
		20IT101-Python Programming	2	3	2	0	2	0	0	0	0	0	2	3	0	3	2
		20EE405-Electrical Machines – II Laboratory	2	2	1	1	1	0	0	0	2	0	0	1	3	0	3
		20EE406-Control Systems Laboratory	3	2	1	1	1	0	0	1	0	1	0	1	2	1	0
		20EE407-Linear Integrated Circuits Laboratory	3	2	1	1	1	0	0	1	0	1	0	1	2	1	0
		20MC1XX-Mandatory Course IV	0	0	0	0	0	3	3	3	2	2	2	3	3	3	2
		20EE408-Mini Project-I	3	3	3	3	2	2	3	2	3	3	2	3	3	3	3

III Year	Semester V	20EE501 - Power Electronics	3	2	2	2	2	0	2	0	2	0	1	2	3	3	0
		20EE502 - Microcontrollers	3	2	2	2	2	0	2	0	0	0	1	2	3	2	0
		20EE503 - Power System Analysis	3	2	2	2	2	1	0	0	1	1	0	0	3	0	0
		20EE9XX - Professional Elective-I	3	3	3	3	2	2	3	2	3	3	2	3	3	3	3
		20EE9XX - Professional Elective-II	3	3	3	3	2	2	3	2	3	3	2	3	3	3	3
		20EE0XX - Open Elective-	3	3	3	3	2	2	3	2	3	3	2	3	3	3	3
		20EE504 - Power Electronics Laboratory	3	2	1	1	1	0	0	1	0	1	0	1	2	1	0
		20EE505 - Microcontrollers Laboratory	3	2	1	1	1	0	0	1	0	1	0	1	2	1	0
		20EE506 - Power System Simulation Laboratory	3	2	1	1	1	0	0	1	0	1	0	1	2	1	0
		20MC1XX - Mandatory Course V	0	0	0	0	0	3	3	3	2	2	2	3	3	3	2

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
REGULATION 2020
CHOICE BASED CREDIT SYSTEM
I – VIII SEMESTER CURRICULUM AND SYLLABI

SEMESTER I							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20SB101	Engineering Biology	3/0/0	3	3	50/50	BSC
Theory Cum Laboratory							
2	20MA101	Engineering Mathematics- I	2/1/2	5	4	40/60	BSC
3	20PH102	Physics for Electrical Science	3/0/3	6	4.5	40/60	BSC
4	20EE101	Analog Electronics	3/0/2	5	4	40/60	PCC
5	20CS111	Problem Solving using C Programming	3/0/2	5	4	40/60	ESC
Practical							
6	20ME103	Engineering Practices Laboratory	0/0/3	3	1.5	40/60	ESC
Mandatory Course							
7	20MC101	Mandatory Course I: Induction Programme	3 Weeks		0	0/100	MC
Total			14/1/12	27	21	700	

SEMESTER II							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20GE201	Universal Human Values	3/0/0	3	3	50/50	HSMC
Theory Cum Laboratory							
2	20MA201	Engineering Mathematics II	2/1/2	5	4	40/60	BSC
3	20EN101	Technical Communication Skills	2/0/2	4	3	40/60	HSMC
4	20CH101	Engineering Chemistry	3/0/3	6	4.5	40/60	BSC
5	20EE201	Basics of Electrical Circuits	3/1/2	6	5	40/60	ESC
Practical							
6	20ME111	Engineering Graphics	1/0/3	4	2.5	40/60	ESC
Mandatory Course							
7	20MC102	Mandatory Course II	2/0/0	2	0	0/100	MC
Total			16/2/12	30	22	600	

SEMESTER III							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20EE301	Electrical Machines – I	3/0/0	3	3	50/50	PCC
2	20EE302	Digital Circuits	2/1/0	3	3	50/50	PCC
3	20EE303	Electric Power Generation	3/0/0	3	3	50/50	PCC
4	20EE304	Measuring Instruments and Smart sensors	3/0/0	3	3	50/50	PCC
Theory Cum Laboratory							
5	20MA301	Engineering Mathematics III	2/1/2	5	4	40/60	BSC
6	20CS311	Data Structures using C++	3/0/2	5	4	40/60	ESC
Practical							
7	20EE305	Electrical Machines – I Laboratory	0/0/2	2	1	40/60	PCC
8	20EE306	Digital Circuits Laboratory	0/0/2	2	1	40/60	PCC
Mandatory Course							
9	20MC1XX	Mandatory Course III	2/0/0	2	0	0/100	MC
Total			18/2/8	28	22	900	

SEMESTER IV							
S..No	Course Code	Course	L/T/P	Contact hrs./wk.	C	Ext./Int.	Cat.
Theory							
1	20EE401	Electrical Machines – II	3/0/0	3	3	50/50	PCC
2	20EE402	Transmission and Distribution	3/0/0	3	3	50/50	PCC
3	20EE403	Control Systems	3/1/0	4	4	50/50	PCC
4	20EE404	Linear Integrated Circuits	3/0/0	3	3	50/50	PCC
Theory Cum Laboratory							
5	20MA403	Applied Mathematics	2/1/2	5	4	40/60	BSC
6	20IT101	Python Programming	3/0/2	5	4	40/60	ESC
Practical							
7	20EE405	Electrical Machines – II Laboratory	0/0/2	2	1	40/60	PCC
8	20EE406	Control Systems Laboratory	0/0/2	2	1	40/60	PCC
9	20EE407	Linear Integrated Circuits Laboratory	0/0/2	2	1	40/60	PCC
Mandatory Course							
10	20MC1XX	Mandatory Course IV	2/0/0	2	0	0/100	MC
Mini Project							
11	20EE408	Mini Project-I	0/0/2	2	1	40/60	PROJ
Total			19/2/12	33	25	1100	

SEMESTER V							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20EE501	Power Electronics	3/0/0	3	3	50/50	PCC
2	20EE502	Microcontrollers	3/0/0	3	3	50/50	PCC
3	20EE503	Power System Analysis	3/0/0	4	4	50/50	PCC
4	20EE9XX	Professional Elective-I	3/0/0	3	3	50/50	PEC
5	20EE9XX	Professional Elective-II	3/0/0	3	3	50/50	PEC
6	20EE0XX	Open Elective-I	3/0/0	3	3	50/50	OEC
Practical							
7	20EE504	Power Electronics Laboratory	0/0/2	2	1	40/60	PCC
8	20EE505	Microcontrollers Laboratory	0/0/2	3	1	40/60	PCC
9	20EE506	Power System Simulation Laboratory	0/0/2	2	1	40/60	PCC
Mandatory Course							
10	20MC1XX	Mandatory Course V	2/0/0	2	0	0/100	MC
Total			18/1/6	28	22	900	

SEMESTER VI							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20EC611	Communication Engineering	3/0/0	3	3	50/50	PCC
2	20EE9XX	Professional Elective-III	3/0/0	3	3	50/50	PEC
3	20YY9XX	Professional Elective-IV	3/0/0	3	3	50/50	PEC
4	20EE0XX	Emerging Elective-1	3/0/0	3	3	50/50	EEC
5	20EC612	Principles of Digital Signal Processing	2/1/0	3	3	50/50	PCC
Theory Cum Laboratory							
6	20EN602	Business Communication and Value Science	2/0/2	4	3	40/60	HSMC
Practical							
7	20EC613	Principles of Digital Signal Processing Laboratory	0/0/2	2	1	40/60	PCC
Mini Project							
8	20EE601	Mini Project-II	0/0/2	2	1	40/60	PROJ
Employability Enhancement Skills							
9	20EES01	Employability Enhancement Skills			-	-	2
Total			16/1/6	23	22	900	

SEMESTER VII							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Theory							
1	20EE701	Power System Protection and Switchgear	3/0/0	3	3	50/50	PCC
2	20MG701	Engineering Economics	3/0/0	3	3	50/50	HSMC
3	20EE9XX	Professional Elective-V	3/0/0	3	3	50/50	PEC
4	20EE9XX	Professional Elective-VI	3/0/0	3	3	50/50	PEC
5	20EE0XX	Emerging Elective-2	3/0/0	3	3	50/50	EEC
6	20EE0XX	Open Elective-2	3/0/0	3	3	50/50	OEC
Practical							
7	20EE702	Electrical Workshop Laboratory	0/0/2	2	1	40/60	PCC
Total			18/0/2	20	19	800	

SEMESTER VIII							
S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Ext/Int	Cat.
Project							
1	20EE801	Project	0/0/24	24	12	40/60	PROJ
Total			0/0/24	24	12	100	

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S.No	Stream	Credits/Semester								Credits	Courses		%
		I	II	III	IV	V	VI	VII	VIII		Theory	Lab	
1.	Humanities and Social Sciences Including Management (HSMC)		6				3	3		12	4		7.27
2.	Basic Science Courses (BSC)	11.5	8.5	4	4					28	7		16.97
3.	Engineering Science Courses (ESC)	5.5	7.5	4	4					21	5	1	12.72
4.	Professional Core Courses (PCC)	4		14	16	13	7	4		58	14	10	35.15
5.	Professional Elective Courses (PEC)					6	6	6		18	6		10.90
6.	Open Elective Courses (OEC) /Emerging Elective Course(EEC)					3	3	6		12	4		7.27
7.	Project Work (PROJ)/ Employability Enhancement Skills (EES)				1		3		12	16		3	9.70
8.	Mandatory Courses (MC)	-	-	-	-					-	-		-
Total		21	22	22	25	22	22	19	12	165	40	14	100

CURRICULUM STRUCTURE FOR UG DEGREE PROGRAMME

S.No	Course Work - Subject Area	AICTE Suggested Breakdown of Credits	SKCET Credits
1.	Humanities and Social Sciences (HS), including Management Courses	12*	12
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology	26*	28
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation	20*	21
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch	53*	58
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/branch;	18*	18
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas	18*	12
7.	Project Work, Seminar and/or Internship in Industry or elsewhere	11*	14
8.	Employability Enhancement Skills	-	2
9.	Mandatory Courses (MC)	Non-credit	Non-credit
Total		158*	165
<i>*Minor Variations is allowed as per need of the respective disciplines</i>			

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (12 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs/wk	C	Cat.
1.	20EN202	Universal Human Values	3/0/0	3	3	HSMC
2.	20EN201	Technical Communication Skills	2/0/2	4	3	HSMC
3.	20EN602	Business Communication and Value Science	2/0/2	4	3	HSMC
4.	20MG701	Engineering Economics	3/0/0	3	3	HSMC

BASIC SCIENCE COURSES (28 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs/wk	C	Cat.
1.	20SB101	Engineering Biology	3/0/0	3	3	BSC
2.	20MA101	Engineering Mathematics I	2/1/2	5	4	BSC
3.	20PH102	Physics for Electrical Science	3/0/3	6	4.5	BSC
4.	20MA201	Engineering Mathematics II	2/1/2	5	4	BSC
5.	20CH101	Engineering Chemistry	3/0/3	6	4.5	BSC
6.	20MA301	Engineering Mathematics III	2/1/2	4	4	BSC
7.	20MA403	Applied Mathematics	2/1/2	4	4	BSC

ENGINEERING SCIENCE COURSES (21 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs/wk	C	Cat.
1.	20CS111	Problem Solving using C Programming	3/0/2	5	4	ESC
2.	20ME102	Engineering Practices Laboratory	0/0/3	4	1.5	ESC
3.	20EE201	Basics of Electrical Circuits	3/1/2	6	5	ESC
4.	20ME111	Engineering Graphics	1/0/3	3	2.5	ESC
5.	20CS323	Data Structures using C++	3/0/2	5	4	ESC
6.	20CS422	Python Programming	3/0/2	5	4	ESC

PROFESSIONAL CORE COURSES (58 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs/wk	C	Cat.
1.	20EE102	Analog Electronics	4/0/2	6	5	PCC
2.	20EE301	Electrical Machines – I	3/0/0	3	3	PCC
3.	20EE302	Digital Circuits	3/1/0	4	4	PCC
4.	20EE303	Electric Power Generation	3/0/0	3	3	PCC
5.	20EE304	Measuring Instruments and Smart sensors	3/0/0	3	3	PCC
5.	20EE305	Electrical Machines – I Laboratory	0/0/2	2	1	PCC
6.	20EE306	Digital Circuits Laboratory	0/0/2	2	1	PCC
7.	20EE401	Electrical Machines – II	3/0/0	3	3	PCC
8.	20EE402	Transmission and Distribution	3/0/0	3	3	PCC
9.	20EE403	Control Systems	3/1/0	4	4	PCC
10.	20EE404	Linear Integrated Circuits	3/0/0	3	3	PCC
11.	20EE405	Electrical Machines - II Laboratory	0/0/2	2	1	PCC
12.	20EE406	Control Systems Laboratory	0/0/2	2	1	PCC
13.	20EE407	Linear Integrated Circuits Laboratory	0/0/2	2	1	PCC
14.	20EC511	Communication Engineering	3/0/0	3	3	PCC
15.	20EE501	Power Electronics	3/0/0	3	3	PCC
16.	20EE502	Microcontrollers	3/0/0	3	3	PCC
17.	20EE503	Power System Analysis	3/1/0	4	4	PCC
18.	20EE504	Power Electronics Laboratory	0/0/2	2	1	PCC
19.	20EE505	Microcontrollers Laboratory	0/0/3	3	1.5	PCC
20.	20EE506	Power System Simulation Laboratory	0/0/2	2	1	PCC
21.	20EC612	Principles of Digital Signal Processing	3/1/0	4	4	PCC
22.	20EC613	Principles of Digital Signal Processing Laboratory	0/0/2	2	1	PCC
23.	20EE701	Power System Protection and Switchgear	3/0/0	3	3	PCC
24.	20EE702	Electrical Workshop Laboratory	0/0/2	2	1	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)

S.No	Course Code	Course Title	L/T/P	Contact hrs/wk	C	Cat.
Elective Stream I - Power System						
1.	20EE901	Smart Grid Technology	3/0/0	3	3	PEC
2.	20EE902	Energy Management	3/0/0	3	3	PEC
3.	20EE903	Power System Restructuring	3/0/0	3	3	PEC
4.	20EE904	Power System Operation and Control	3/0/0	3	3	PEC
5.	20EE905	Power Quality	3/0/0	3	3	PEC
6.	20EE906	High Voltage Engineering	3/0/0	3	3	PEC
7.	20EE907	Renewable Energy and Storage Systems	3/0/0	3	3	PEC
8.	20EE908	Industrial Electrical Systems	3/0/0	3	3	PEC
9.	20EE909	HVDC Transmission Systems	3/0/0	3	3	PEC
Elective Stream II - Applied Electronics						
1.	20EC304	Data Communications and Networks	3/0/0	3	3	PEC
2.	20EE910	Introduction to Soft Computing	3/0/0	3	3	PEC
3.	20EC941	VLSI Design	3/0/0	3	3	PEC
4.	20EC931	Wireless Sensor Networks	3/0/0	3	3	PEC
5.	20EC942	Advanced Microprocessors	2/0/2	3	3	PEC
6.	20EE911	Automotive Electronics	3/0/0	3	3	PEC
7.	20EE912	Virtual Instrumentation	2/0/2	3	3	PEC
8.	20EC943	Embedded System Design	2/0/2	3	3	PEC
9.	20EC909	Nano Electronics	3/0/0	3	3	PEC
Elective Stream III - Power Electronics						
1.	20EE913	Design of Electrical Machines	3/0/0	3	3	PEC
2.	20EE914	Special Electrical Machines	3/0/0	3	3	PEC
3.	20EE915	PLC and Automation	3/0/0	3	3	PEC
4.	20EE916	Servo Drives in Robotics	3/0/0	3	3	PEC
5.	20EE917	Flexible AC Transmission Systems	3/0/0	3	3	PEC
6.	20EE918	Digital Simulation of Power Electronic Circuits	2/0/2	3	3	PEC
7.	20EE919	Electric Drives and control	2/0/2	3	3	PEC
8.	20EE920	Line-Commutated and Active PWM Rectifiers	3/0/0	3	3	PEC
9.	20EE921	Electric and Hybrid Vehicles	3/0/0	3	3	PEC

OPEN ELECTIVE COURSES (6 Credits)

S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Cat.
Stream – I						
1.	20EE001	Power Generation Systems	3/0/0	3	3	OEC
2.	20EE002	Energy Auditing, Conservation and Management	3/0/0	3	3	OEC
3.	20EE003	Smart Grid	3/0/0	3	3	OEC
Stream – II						
4.	20EE004	Renewable Energy Sources	3/0/0	3	3	OEC
5.	20EE005	Servo and Robot Drives	3/0/0	3	3	OEC
6.	20EE006	Special Purpose Machines	3/0/0	3	3	OEC

EMERGING ELECTIVE COURSES (6 Credits)

S.No	Course Code	Course	L/T/P	Contact hrs/wk	C	Cat.
Stream – I						
1.	20EE007	Machine Learning Applications in Energy Systems	3/0/0	3	3	EEC
2.	20EE008	Big data Analytics for Smart Grid	3/0/0	3	3	EEC
3.	20EE009	Digital Simulation for Electrical Systems	3/0/0	3	3	EEC
Stream – II						
4.	20EE010	Advanced Sensor Technology	3/0/0	3	3	EEC
5.	20EE011	Real Time Operating Systems	3/0/0	3	3	EEC
6.	20EE012	Modern Rectifiers and Resonant Converters	3/0/0	3	3	EEC

MANDATORY COURSES (0 credits)

S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Cat.
1.	20MC101	Induction Program	3 weeks		0	MC
2.	20MC102	Environmental Sciences	2/0/0	2	0	MC
3.	20MC103	Soft Skills	2/0/0	2	0	MC
4.	20MC104	Management Organizational Behavior	2/0/0	2	0	MC
5.	20MC105	General Aptitude	2/0/0	2	0	MC
6.	20MC106	Life Skills and Ethics	2/0/0	2	0	MC
7.	20MC107	Stress Management	2/0/0	2	0	MC
8.	20MC108	Constitution of India	2/0/0	2	0	MC
9.	20MC109	Essence of Indian Traditional Knowledge	2/0/0	2	0	MC

ONE CREDIT COURSES

S.No	Course Code	Course Title	Credits
1.	20EEA01	MOOC Courses	1
2.	20EEA02	Electrical Testing and Safety Procedures	1
2.	20EEA03	PLC and SCADA	1
3.	20EEA04	Embedded Structure Design	1
4.	20EEA05	Robotics	1
5.	20EEA06	PCB design and Fabrication	1
6.	20EEA07	MATLAB Programming for Electrical Engineering	1
7.	20EEA08	Solar Panel Installation	1
8.	20EEA09	Embedded Raspberry Pi	1
9.	20EEA10	Wind Turbine Design	1
10.	20EEA11	Industrial Electronics Design	1
11.	20EEA12	Foreign language / spoken Hindi	1
12.	20EEA13	Certification Courses	1
13.	20EEA14	NSS	1
14.	20EEA15	Sports	1
15.	20EEA16	Swachh Bharat Summer Internship	1
16.	20EEA17	Yoga	1

EMPLOYABILITY ENHANCEMENT SKILLS (2 Credits)

S.No	Name of the Course	L/T/P	Duration	C
1.	Employability Enhancement Skills (Internship / Journal Publication)	-	4 Weeks	2

SEMESTER WISE CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	21	22	22	25	22	22	19	12	165

Total Credits: 165

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **Cat.:** Category

HSMC : Humanities and Social Sciences
(including Management Courses)

OEC : Open Elective Courses

BSC : Basic Science Courses

PROJ : Project Work

ESC : Engineering Science Courses

EEC : Emerging Elective Courses

PCC : Professional Core Courses

MC : Mandatory Course

PEC : Professional Elective Courses

EES : Employability Enhancement Skills

20SB101	Engineering Biology	3/0/0/3
Nature of Course	C (Theory Concept)	
Course Objectives:		
1	To grasp and apply biological engineering principles, procedures needed to solve real-world problems.	
2	To give a basic knowledge of the applications of biological systems in relevant Industries	
3	To understand the mutual dependence of modern biology and engineering	
4	To give a basic knowledge of artificial organs and physiological assist devices.	
5	To understand about the use of various nanomaterials towards biological applications	
Course Outcomes:		
Upon completion of the course, students shall have ability to		
C101.1	Explain the structure of human physiology.	[U]
C101.2	Compare biological and artificial neural networks.	[A]
C101.3	Realize the basic concepts of brain computer interface	[U]
C101.4	Apply the concept of Brain computer interface in different applications	[AP]
C101.5	Recognize the compatibility and functioning of artificial organs inside the human being.	[U]
C101.6	Integrate the knowledge core of modern physiological assist device and its functionalities.	[AP]
C101.7	Comprehend the concepts of Nanomaterials for biotechnology	[U]
Course Contents:		
Module 1: Human Physiology and Artificial Organs		15 Hrs
Cell and their structure-Transport of ions through cell, Different systems of human body. Biological neural networks- Artificial neural networks, applications of neural networks- Artificial Kidney, Artificial Pancreas, Artificial liver, Artificial heart valves.		
Module 2: Biological Concepts Instrument (BCI)		15 Hrs
Fundamentals of BCI –Working of BCI , Classification of BCI, measuring of surgical and non-surgical BCI,Neuro feedback Training for BCI Control,signal processing and application.		
Module 3: Nanobiology		15 Hrs
Introduction to Nanobiology, Bioremediation- removal of bacteria and microbes. Nanomaterials for antimicrobial coatings- medical implants–medical and defence textiles. Biosensors- biodevices and implantable devices. Nanomaterials for diagnosis and therapy- Implications of Drug delivery- various forms of nanocarriers -Polymeric Nanoparticles as drug carriers - Drug release mechanism- Targeted drug delivery. Point-of-care and Personalized medicine.		
Total Hours:		45
Text Books:		
1	Leslie Cromwell. Bomedical Instrumentation and measurements-Prentice Hall,2011	
2	Bernhard Graimann,Brenden Allison,GertPfurtscheller, Computer	

	Interfaces: Revolutionizing Human-Computer Interaction, Springer 2010
3.	M Arumugam, Bio medical instrumentation, Anuradha Publications, 2002
4.	B. Bhushan, Springer Handbook of Nanotechnology, Springer-Verlag, 2004

Reference Books:

1	Malcom Carpenter, —Textbook of Neuroanatomy, Mc. Graw hill Edition, 1996.
2	Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
3	Matews G.G., Neurobiology, Second Edition, Blackwell Science, UK, 2000

Web References:

1	https://ocw.mit.edu/courses/biological-engineering/20-010j-introduction-to-bioengineering-be-010j-spring-2006/videos/Lecture-1-bioengineering/
2	https://www.technicalsymposium.com/alllecturenotes_biomed.html
3	https://ocw.mit.edu/courses/biology/7-28-molecular-biology-spring-2005/

Online Resources:

1	https://onlinecourses.nptel.ac.in/noc16_ge03
2	https://onlinecourses.nptel.ac.in/noc17_ge04
3	https://onlinecourses.nptel.ac.in/nanobiotechnology

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C101.1	Understand	Quiz Assignment Class Presentation Group Assignment	20
C101.2	Analyze		
C101.3	Understand		
C101.4	Apply		
C101.5	Understand		
C101.6	Apply		
C101.7	Understand		

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 Marks]
	CIA1 [10 Marks]	CIA2 [10 Marks]	CIA3 [10 Marks]	
Remember	20	10	10	10
Understand	80	30	40	40
Apply	-	30	30	30
Analyse	-	30	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

[illegible]

20MA101	Engineering Mathematics I (Common to MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concept of Differentiation and Matrices	
Course Objectives:			
1	To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.		
2	To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system		
3	To familiarize with functions of several variables applicable in many branches of engineering.		
4	To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Recall the concepts of matrices, ordinary and partial derivatives.		[R]
C101.2	Express square matrix in the diagonal form.		[U]
C101.3	Solve systems of linear equations numerically and to find inverse matrices.		[AP]
C101.4	Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems.		[AP]
C101.5	Find the extreme values of the given functions to solve the engineering problems.		[AP]
C101.6	Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion.		[AP]
Course Contents:			
Module 1: Matrices		14 Hrs	
Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.			
Module 2: Solution of Equations and Eigenvalue Problems		16 Hrs	
Newton-Raphson method – Fixed point iteration method – Gauss-Elimination method – Gauss-Jordan method – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method.			
Module 2: Calculus		18 Hrs	
Concepts of limits and continuity – Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations – Higher order linear differential equations with constant coefficients –Euler Cauchy's equations – Applications of ODE: Solving electrical circuits and simple harmonic motion.			
Lab Component			
1.	Entering row vector, column vector, accessing blocks of elements in MATLAB.		

2.	Entering matrices, to locate matrix elements and Correcting any entry through indexing in MATLAB		
3.	Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.		
4	Eigenvalues and eigenvectors of a matrix using MATLAB.		
5.	System of linear equations in MATLAB using Gaussian elimination.		
6.	System of linear equations in MATLAB using matrix inverse method.		
7.	System of linear equations in MATLAB using linsolve		
8.	First and second derivative of single variable functions using MATLAB.		
9.	Maxima and Minima of a function using MATLAB		
10.	Higher Order Equations of constant coefficients using MATLAB		
Total Hours:(48+12)		60	
Text Books:			
1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition,Pearson, Reprint,2018		
2	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.		
3	Grewal. B.S, "Higher Engineering Mathematics", 43 rd edition, Khanna Publications, Delhi, 2018.		
Reference Books:			
1	Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.		
2	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4 th edition, 2012.		
3	N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9 th edition, Laxmi publications ltd, 2014.		
Web References:			
1	http://www.nptel.ac.in/courses/111105035		
2	http://www.nptel.ac.in/courses/122104017		
3	http://nptel.ac.in/courses/122102009		
4	http://nptel.ac.in/courses/111107063		
Online Resources:			
1	https://www.coursera.org/learn/linearalgebra2		
2	https://www.coursera.org/learn/differentiation-calculus		
3	https://www.coursera.org/learn/single-variable-calculus		
4	https://alison.com/courses/Algebra-Functions-Expressions-and-Equations		
Assessment Methods & Levels (based on Blooms' Taxonomy)			
Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Continuous Assessment		End Semester Examination
	Theory	Practical& Project	

20PH102	Physics for Electrical Science (EEE)		3/0/3/4.5
Nature of Course		: E (Theory skill based)	
Prerequisites		: Nil	
Course Objectives:			
1	To gain knowledge of the basics of conducting materials, semiconducting materials, magnetic materials, superconducting materials and nanomaterials		
2	To familiarize the principles of electrostatics and electrodynamics		
Course Outcomes:			
Upon completion of the course, students shall have the ability to			
C102.1	Describe the knowledge of conducting materials.		[U]
C102.2	Outline the semiconductor physics and functioning of semiconductor devices.		[U]
C102.3	Interrelate electric and magnetic fields behaviour of electrostatics and electrodynamics.		[Ap]
C102.4	Infer changes in the properties of superconducting materials and their applications.		[AP]
C102.5	Recall the basic concepts of magnetic materials, smart materials and nano materials in different Engineering applications.		[R]
C102.6	Apply the gained knowledge to solve the problems related to their field of study.		[Ap]
Course Contents:			
Conducting Materials and Semiconducting Materials			15 Hrs
Conducting Materials: Classical free electron theory: Drude – Lorentz theory, electrical conductivity and thermal conductivity, Wiedemann-Franz law – Origin of band theory – Classification of solid materials based on band theory – Fermi distribution function. Semiconducting materials: direct and indirect band gap semiconductors – Intrinsic semiconductors: density of electrons, density of holes, Fermi Energy – Doping – Extrinsic semiconductor: n-type and p-type carrier semiconductor, carrier concentration derivation, Fermi energy – Conductivity of semiconductors – Law of mass action – Hall effect: Hall coefficient measurement, applications – Application of semiconductors: solar cell.			
Electrostatics and Magnetism			15 Hrs
Electrostatics: Coulomb's law – Gauss's law and applications of Gauss's law: Electric field around a plane, sheet of conductor and charged sphere – Electric field in matter: dielectric, polarization, susceptibility, types of polarization – Internal field – Clausius-Mosotti equation – Capacitors. Magnetism: Definitions of fundamental terms – Magnetic field around a current carrying conductor – Direction of magnetic field and current – Biot-Savart law and its applications: magnetic field due to circular current loop – Ampere's law and its applications: magnetic field due to a solenoid and a toroid – Magnetic Lorentz force: force experienced by a current carrying conductor in a magnetic field – Force between two long parallel current carrying conductors – Electromagnetic induction Faraday's law of induction – Lenz law – Expression for induced emf in a conductor – Time varying magnetic fields. Maxwell's equations (equations only) – Propagation of electromagnetic waves in dielectric medium.			
Materials			15 Hrs
Magnetic materials: definition of terms permeability(absolute and relative), magnetic permeability, magnetic field intensity, magnetic moment of a bar magnet, intensity of magnetization, magnetic lines of force, magnetic flux – classification of magnetic materials: dia, para, ferro and anti-ferro magnetic materials and its properties – Domain theory of ferromagnetism, hysteresis, hard and soft magnetic materials – Applications. Superconductors: properties of superconductor: resistivity, Meissner effect, persistent current, heat capacity, entropy, isotope effect, effect of heavy current, effect of temperature and effect of magnetic field – Type I and II superconductors – BCS theory (qualitative) – High temperature superconductors			

Josephson effect – Quantum interference (qualitative), SQUID – Applications of superconductors. **Metallic Glasses:** Properties, Preparation and applications – Shape memory alloys, Characteristics and properties of Ni-Ti alloy and applications. **Nanomaterials:** Introduction and properties, Moore's law Quantum confinement, Quantum well, wire and dot. (Definitions) – Synthesis: chemical vapor deposition and ball milling – Applications. Carbon nanotubes: structure, properties and applications.

Lab Component		30 Hours
1	Determination of thermal conductivity of a bad conductor – Lee’s disc.	[U]
2	Determination of a bandgap of semiconductor.	[U]
3	Determination of Hall co-efficient – Hall Effect.	[U]
4	Characteristics curves of solar cell.	[U]
5	Time constant of RC circuits.	[U]
6	Magnetic field along the axis of current carrying coil- Stewart and Gee method.	[U]
7	LCR circuits.	[U]
8	Faraday’s electromagnetic induction law – simulation lab.	[U]
9	Hysteresis loss.	[U]
10	Determine the mass susceptibility of a diamagnetic material – Quincke’s method.	[U]
Life Skills Experiments		
1	How does a fuel (gas/liquid) pump nozzle shut off?	[U]
2	How does a circuit breaker work?	[U]
3	How to Check Earthing at Home?	[U]
	Total Hours:	75
Text Books:		
1	Rajendran, V “Engineering Physics” Mc Graw Hill Publications Ltd, New Delhi, 2016.	
2	David Halliday, Robert Resnick, Jearl Walker “Fundamentals of Physics” Wileyplus.2018.	
Reference Books:		
1	Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS “A Text Book of Engineering Physics”S.Chand& Co Ltd, 2018.	
2	Richard P. Feynman. Robert B. Leighton, Matthew Sands “The Feynman Lectures on Physics Vol. II”: The New Millennium Edition.2015	
3	David Griffiths ‘Introduction to Electrodynamics’ 4th Edition, Cambridge University Press 2017.	
4	David Jiles “Introduction to Magnetism and Magnetic Materials”, 3 rd Edition, Taylor & Francis Group, 2015	
Web References/Online Resources:		
1	https://www.electronics-tutorials.ws/diode/diode_1.html	
2	https://nptel.ac.in/courses/115/104/115104109/	
3	https://nptel.ac.in/courses/115/102/115102025/	
4	http://www.phys.ufl.edu/~korytov/phy2049/old_notes/all_chapters.pdf	
5	http://www.eas.uccs.edu/~mwickert/ece3110/lecture_notes/N3110_4.pdf	
6	https://www.tcd.ie/Physics/research/groups/magnetism/files/lectures/5006/5006-2.pdf	
7	https://www.askiitians.com/iit-jee-magnetism/magnetic-properties-of-materials/	
8	https://nptel.ac.in/courses/115/101/115101012/	
9	https://nptel.ac.in/courses/118/104/118104008/	

20EE101	Analog Electronics		3/0/2/4
Nature of Course :		D (Theory application)	
Course Objectives:			
1	To remember the basic PN junction diode and its applications.		
2	To understand the basic structure, operation and characteristics of Electronic Devices.		
3	To apply BJT to act as amplifier.		
4	To gain knowledge about differential amplifiers.		
5	To analyse the small signal characteristics of transistor amplifiers and oscillators.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Describe the basic PN junction diode and its applications		[U]
C101.2	Analyse the basic structure, operation and characteristics of Electronic Devices.		[A]
C101.3	Apply the characteristics of transistors for amplifier operations		[AP]
C101.4	Analyse the characteristics of feedback amplifiers		[A]
C101.5	Infer the operation of phase shift and Wien bridge oscillator/		[U]
Course Contents:			
Module 1: Diodes			20 Hrs
Theory of PN junction - PN Junction Diode –Structure, Operation and V-I Characteristics - Rectifiers - Half Wave and Full Wave Rectifiers, Diode clippers and clippers - Operation and V-I Characteristics of Zener diode - Structure, Operation of LED and LCD - Structure, Operation of Charge Coupled Display (CCD)			
Module 2: Electronic Devices and their Characteristics			20 Hrs
Bipolar Junction Transistors (BJT) - Types - Structure and Operation - Input and Output Characteristics - Transistor as a switch - Biasing of BJT. Junction Field Effect Transistors (JFET) - Types - Structure and Operation - Drain and Transfer Characteristics - FET as Variable Resistor - Metal Oxide Semiconductor Field Effect Transistor(MOSFET) - Types - Structure, Operation and V-I Characteristics of n-channel MOSFET-Biasing of MOSFET. Uni Junction Transistor (UJT) - Structure, Operation and V-I Characteristics.			
Module 3: Amplifier Circuits and Oscillators			20 Hrs
BJT small signal model - Analysis of CE amplifier, Gain and Frequency response - Differential Amplifier - Multi-stage amplifier - Common mode and Differential mode analysis - Current mirror circuits. Basic concepts of Feedback amplifier- types - positive feedback - Stability of Feedback Amplifier. Condition for oscillations - Phase shift Oscillator - Wien bridge Oscillator.			
Lab Component			
1	Characteristics of PN diode		[U]
2	Line and load regulation of Zener regulator		[AP]
3	Design of half wave, full wave and bridge rectifier circuits		[AP]
4	Diode as clipper and clamper		[AP]
5	Characteristics of BJT in CE configuration		[AP]
6	Characteristics of JFET		[U]
7	UJT triggering circuit for Power Switch.		[AP]
8	Frequency Response of Common Emitter BJT Amplifier for a public addressing system.		[AP]
9	Wien bridge oscillator		[U]
10	Transistorized Differential amplifier		[AP]
11	Analyze the basic electronic circuits by simulation		[A]
Total Hours:			75

Text Books:	
1	David A. Bell, 'Electronic Devices and Circuits', Oxford University Press, 5 th Edition, reprint 2015.
2	Floyd, Thomas.L 'Electronic Devices', Prentice Hall, 9 th Edition, 2012
3	S. Salivahanan, N.Suresh Kumar, 'Electronic Devices and Circuits' Tata McGraw Hill , 6 th edition, 2015
Reference Books:	
1	Robert Diffenderfer, 'Electronic Devices: Systems and Applications', Cengage Learning, 2010.
2	Robert L.Boylestad, 'Electronic Devices and Circuit theory', Pearson Education, 2013,
3	Jacob Millman, Christos.C.Halkias and SatyabrataJit, 'Electronic Devices and Circuits', Tata McGraw Hill, 2010.
4	Theodore F. Bogart, Jeffery S. Beasley and Guillermo Rico, 'Electronic Devices and Circuits', Pearson Education , 6 th edition, 2019.
Web References:	
1	https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf
2	https://nptel.ac.in/video.php?subjectId=117103063

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Rubrics Based Practical Assessment [30 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Remember	10	10	10	10	10
Understand	30	30	30	30	40
Apply	20	20	20	20	20
Analyse	40	40	40	40	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C101.1	2	1			2							2	3	3	
C101.2	3	3	2	2	2							2	3	3	
C101.3	3	2	1	1	2							2	3	3	
C101.4	3	3	2	2	2							2	3	3	
C101.5	2	1			2							2	3	3	
	3 Strongly agreed			2 Moderately agreed			1 Reasonably agreed								

20CS111	Problem Solving Using C Programming		3/0/2/4
Nature of Course	F (Theory Programming)		
Pre requisites	Nil		
Course Objectives:			
1.	To understand problem solving using structured programming language		
2.	To gain knowledge about the control structures in C.		
3.	To develop logics and write C programs using arrays		
4.	To gain familiarity in inbuilt functions, structures and unions in C.		
5.	Apply concept and techniques for implementation in respective domain		
Course Outcomes			
Upon completion of the course, students shall have ability to			
C111.1	Apply problem solving techniques to solve real world problems		[AP]
C111.2	Understand C fundamental constructs and control structures		[U]
C111.3	Use the concept of pointers and arrays in designing programs		[AP]
C111.4	Design C programs using the concepts of strings and functions		[C]
C111.5	Develop programs using structures and Unions in C		[AP]
C111.6	Apply the suitable programming concept for the given computational problem		[AP]
Course Contents:			
Module 1: Problem Solving Techniques and C Fundamentals 15 Hrs Problem Solving Techniques: Algorithm, Pseudo-code and Flowchart. Creative Thinking and Problem solving skills in everyday life. Understanding Compiler and interpreter. Program Development LifeCycle. C Fundamentals: Structure of C program, Character Set – Identifiers and Keywords – Data Types – Constants - Variables and Arrays – Declarations - Operators and Expressions –Precedence of operators and associativity. Data input and output - Preparing and running a Complete C Program			
Module 2:Control Structures, Arrays, Strings 15 Hrs Control Structures: Branching: if-else- Looping – while - do while – for - Nested control structures –switch – break – continue – comma - goto. Arrays - Defining an array - Processing an array - Multi dimensional arrays - Strings: Defining a string - Null character - initialization of strings – reading and writing a string - processing the string			
Module 3:Pointers, Functions, Structures and Unions: 15 Hrs Pointers: fundamentals – Pointer Declaration & Usage – Dynamic Memory Allocation. Functions: Defining a Function – Accessing a function – Function Prototype Functions - Pointer to Function - Functions Returning Pointers. - Pointers and Strings - Passing arguments to a function – Recursion. Structures and Unions: The Type Definition (type def) – Enumerated types – Structure - Type Definition – Initialization – Accessing Structures - Unions.			
Total Hours			45 Hrs
Laboratory Component:			
S. No	List of Experiments		
1.	Formulate simple algorithm and flowchart using Raptor Tool for simple and complex problem		
2.	Program to process data types, format input and output and to evaluate an expression		
3.	Program using decision making statements		

4.	Program using looping statements				
5.	Program using single and two dimensional arrays				
6.	Program with Strings				
7.	Program using Pointers.				
8.	Program using Recursion				
9.	Program using structures				
10.	Branch specific application program				
Total Hours					30 Hrs
Text Books:					
1.	Sprankle M,“Problem Solving and Programming Concepts”, 9 th Edition, Pearson Education, New Delhi, 2013				
2.	Yashavant Kanetkar, “Let Us C”, 16 th Edition, BPB Publication, 2017.				
3.	Byron, S. Gottfreid, “Programming with C”, McGraw Hill, Schaum’s outlines, 4 th Edition, 2018.				
4.	Reema Thareja Computer Fundamentals and Programming in C, 2nd edition, OXFORD publications, 2016				
5.	Brian W. Kernighan, Dennis Ritchie, “ The C Programming Language”, 2 nd Edition Pearson Publicaitons, 2015				
Reference Books:					
1.	Yashavant Kanetkar, “101 Challenges in C Programming” Edition, BPB Publication, 2017				
2.	Herbert Schildt, “The Complete Reference C”, 4 th Edition , McGraw Hill , 2015				
3.	Venugopal K R and Sudeep R.Prasad , “Mastering C”, 2 nd Edition, McGraw Hill, 2017				
4.	Jeri.R Hanly, and Elliot B Koffman, “Problem solving and programming Design in C”, 8 th Edition, Pearson 2016				
Web References:					
1.	http://raptor.martincarlisle.com/				
Online Resources:					
1.	https://nptel.ac.in/courses/106/104/106104128/				
2.	https://nptel.ac.in/courses/106/105/106105171/				
3.	https://www.coursera.org/specializations/c-programming				
Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Revised Bloom’s Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical Rubric based CIA [30 Marks]	
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	30	30	20	20	20
Understand	70	50	30	20	40
Apply	-	20	50	60	40
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C111.1	3	2	3	2	2				2				3		
C111.2	2	1	2	1	2				2				2		
C111.3	3	2	3	2	2				2				3		
C111.4	3	2	3	2	2				2				3		
C111.5	3	2	3	2	2				2				3		
C111.6	3	2	3	2	2				2				3		
	3 Strongly agreed			2 Moderately agreed			1 Reasonably agreed								

20ME103		Engineering Practices Laboratory		0/0/3/1.5	
Nature of Course		Practical application			
Pre Requisites		Nil			
Course Objectives:					
1		To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry.			
2		To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting.			
Course Outcomes:					
Upon completion of the course, students shall have ability to					
C103.1	Identify and solve the basic engineering problems at home and in workplace.				[AP]
C103.2	Develop the surfaces and make simple components like tray and funnel.				[C]
C103.3	Make simple metal joints using welding equipment and wooden joints using carpentry tools.				[AP]
C103.4	Prepare pipe connections and sand moulds.				[AP]
C103.5	Understand the fundamentals of hot forging and injection moulding				[U]
C103.6	Examine and troubleshoot electrical and electronic circuits				[A]
Course Contents:					
GROUP A (CIVIL & MECHANICAL)					
Manufacturing Methods –Sheet metal operations - Welding - arc welding, gas welding, Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines					
List of Experiments:					
S.No	List of Experiments				CO Mapping RBT
1	Preparation of butt joints and lap joints using arc welding				C103.3 [AP]
2	Sheet metal Forming and Bending, Model making – Trays and funnels.				C103.2 [AP]
3	Preparation of wooden joints by sawing, planning and cutting.				C103.3 [AP]
4	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.				C103.4 [AP]
5	Demonstration of foundry operations like mould preparation for solid and split piece pattern.				C103.4 [U]
6	Demonstration of Smithy operations				C103.5 [AP]
7	Demonstration of assembly of pump / Demonstration of Injection moulding				C103.5 [AP]
GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)					
List of Experiments:					
Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.					
S.No	List of Experiments				CO Mapping RBT
1	Study and identification of electronic components with specification.				C103.6 [A]
2	Testing of CRO and Electronic components using Multimeter.				C103.6 [A]
3	Generation and measurement of signals using CRO.				C103.6 [A]

20GE201	UNIVERSAL HUMAN VALUES (All Branches)		3 /0 /0 /3
Nature of Course		C (Theory Concept)	
Pre requisites		Interpersonal Communication and Value Sciences	
Course Objectives:			
1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.		
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.		
3	Strengthening of self-reflection.		
4	Development of commitment and courage to act.		
5	Helping the students to appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings		
6	Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C201.1	Understand about themselves and their surroundings (family, society, nature).		[U]
C201.2	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.		[U]
C201.3	Apply responsibilities towards their commitments (human values, human relationship and human society).		[AP]
C201.4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.		[AP]
C201.5	Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.		[AN]
C201.6	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature.		[U]
Course Contents:			
Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself! 15 Hrs Purpose and motivation for the course. Self-Exploration–Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the 'Material Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical Facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of 'I' with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail-Programs to ensure Sanyam and Health.			

Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence - Whole existence as Coexistence **15 Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence.

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics **15 Hrs**

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

Total Hours:		45	
Text Books:			
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010		
2	Rajni Setia, Priyanka Sharma, “ Human Values”, Genius Publication”, Jaipur, 2019.		
Reference Books:			
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.		
2	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi		
3	India Wins Freedom - Maulana Abdul Kalam Azad.		
Web References:			
1	https://examupdates.in/professional-ethics-and-human-values/		
2	http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html		
3	https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf		
Online Resources:			
1	https://nptel.ac.in/courses/109/104/109104068/		
2	https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b		
3	https://www.thebalancecareers.com/life-skills-list-and-examples-4147222		
Assessment Methods & Levels (based on Bloom’sTaxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom’s Level	Assessment Component	Marks

20MA201	ENGINEERING MATHEMATICS II (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concepts of Differentiation and Integration.	
Course Objectives:			
1	To gain knowledge in integrals, which are needed in engineering applications.		
2	To develop logical thinking and analytical skills in evaluating multiple integrals.		
3	To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines.		
4	To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C201.1	Determine the area and volume by applying the techniques of double and triple integrals.		[R]
C201.2	Finding the values of integrals through different numerical methods.		[U]
C201.3	Differentiate and integrate a vector-valued function to solve real world applications.		[AP]
C201.4	Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals.		[AP]
C201.5	Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems.		[AP]
C201.6	Apply Laplace transform methods for solving linear differential equations.		[AP]
Course Contents:			
Module 1: Integral calculus 18 Hrs Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates – Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral – Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration: Trapezoidal rule and Simpson's rule for single and double integrals.			
Module 2: Vector Calculus 14 Hrs Vector differential operator – Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields – Simple problems – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems statements only) – Simple applications involving cubes and rectangular parallelepipeds.			
Module 3: Laplace Transform 16 Hrs Convergence of Laplace transform – Transform of some standard functions – Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second order ordinary differential equation.			

Lab Components:

1. Double integrals evaluation in cartesian coordinates using MATLAB.
2. Triple integral calculations using MATLAB in cartesian and cylindrical coordinates.
3. Double integral evaluation in MATLAB by Trapezoidal rule.
4. Evaluation of gradient, curl and divergence in MATLAB.
5. Line integral over a vector field using MATLAB
6. Applying Green's theorem to solve integrals in MATLAB.
7. Relation between Laplace transform of function and its derivative using MATLAB.
8. Laplace transform of Dirac delta and Heaviside functions in MATLAB.
9. Solving Differential Equations in MATLAB using Laplace Transform.
10. Inverse Laplace Transform of symbolic expressions using MATLAB.

Total Hours: 75

Text Books:

1	G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14 th Edition, Pearson, Reprint, 2018.
2	Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018.
3	Grewal. B.S, "Higher Engineering Mathematics", 43 rd edition, Khanna Publications, Delhi, 2014.

Reference Books:

1	Veerarajan. T, "Engineering Mathematics II", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.
2	Glyn James, —Advanced Modern Engineering Mathematics, Education, 4 th edition, 2012.
3	N.P.Bali and Dr.Manish Goyal, "A Text book of Engineering Mathematics" 9 th edition, Laxmi publications Ltd, 2014.

Web References:

1	http://nptel.ac.in/video.php?subjectId=122107037
2	http://nptel.ac.in/courses/122107036/
3	http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:

1	https://www.coursera.org/learn/pre-calculus
2	https://www.coursera.org/learn/linearalgebra1
3	https://alison.com/courses/Advanced-Mathematics-1
4	https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x

Assessment Methods & Levels (based on Blooms' Taxonomy)**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical & Project	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]	
Remember	20	20	20	20	20
Understand	30	30	30	30	30

20EN101	TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE)		2/0/2/3
Nature of Course		:E(Theory Skill Based)	
Pre requisites		Basics of English Language	
Course Objectives:			
1	To enhance learners' LSRW skills.		
2	To develop effective communication skills.		
3	To facilitate learners to acquire effective technical writing skills.		
4	To prepare learners for placement and competitive exams.		
5	To facilitate effective language skills for academic purposes and real-life situations.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Remember language skills for technical communication.		[R]
C101.2	Apply communication skills in corporate environment.		[AP]
C101.3	Understand and communicate effectively in personal and professional situation.		[AP]
C101.4	Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text.		[U]
C101.5	Apply technical writing skills to write letters, emails and prepare technical documents.		[AP]
C101.6	Apply language skills with ease in academic and real-life situations.		[AP]
Course Contents:			
Module 1: Listening and Speaking			17 Hrs
Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - Listening to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions Speaking - Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration- Leadership Conflict and Persuasion.			
Module 2: Reading			13 Hrs
Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading - Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations.			
Module 3: Grammar and Writing			15 Hrs
Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors.			
Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume			

Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

Lab Components

1	Listening Comprehension	[E]
2	Pronunciation, Intonation, Stress and Rhythm	[E]
3	Situational Dialogues	[E]
4	Formal Presentation	[E]
5	Group Discussion	[E]
6	Interview Skills- Online and Offline	[E]
Total Hours:		60

Text Books:

1	Practical English Usage. Michael Swan. OUP. 1995.
2	Remedial English Grammar. F.T. Wood. Macmillan.2007
3	On Writing Well. William Zinsser. Harper Resource Book. 2001
4	Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015.

Reference Books:

1	Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
2	Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Web References:

1	http://www.academiccourses.com/Courses/English/Business-English
2	https://steptest.in

Online Resources:

1	https://www.coursera.org/specializations/business-english
2	http://www.academiccourses.com/Courses/English/Business-English
3	https://scoop.eduncle.com/one-word-substitution-list

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-I [10 marks]	CIA-II [10 marks]	Term End Examination [10 marks]	Rubric based CIA [30 Marks]	
Remember	20	20	20	20	20
Understand	40	40	40	40	40
Apply	40	40	40	40	40
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C101.1					2	3		3	2	3		3			3
C101.2					2	3		3	2	3		3			3
C101.3					2	3		3	2	3		3			3
C101.4					2	3		3	2	3		3			3
C101.5					2	3		3	2	3		3			3
C101.6					2	3		3	2	3		3			3
	3		Strongly agreed				2	Moderately agreed			1	Reasonably agreed			

20CH101	ENGINEERING CHEMISTRY (Common to all I Year B.E. / B.Tech)		3 /0 /3 /4.5
Nature of Course		: E (Theory skill based)	
Pre requisites		: NIL	
Course Objectives:			
1	To make the students conversant with water treatment, boiler feed water techniques.		
2	To learn the effect of corrosion in materials and the methods for prevention of corrosion.		
3	To understand the principles and applications of electrochemistry and to learn electroanalytical methods.		
4	To understand the basic concepts, synthesis, and applications of nanomaterials.		
5	To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules.		
6	To understand the concepts of photophysical and photochemical processes in spectroscopy.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Recall the requirements of water treatment procedures and boiler feed water for industries.		[R]
C101.2	Apply the various corrosion control techniques in real time industrial environments.		[AP]
C101.3	Understand the principle and working of reference electrodes and conductivity meters as an analyzer.		[U]
C101.4	Understand the basic concepts and applications of Nanochemistry.		[U]
C101.5	Use the knowledge of polymers, various energy sources and storage devices in engineering field.		[AP]
C101.6	Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules.		[U]
Course Contents:			
Module 1: Water chemistry and Corrosion: 25 Hrs Water treatment-characteristics of water-hardness-types and estimation of hardness by EDTA method with numerical problems. Boiler feed water–requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process–desalination-reverse osmosis. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.			
Module 2: Electrochemistry and Energy sources: 25 Hrs Electrochemical cells-electrolytic cell-reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Nanochemistry-Basics-Comparison of molecules, nanomaterials and bulk materials; Types – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel cells (H ₂ -O ₂). Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.			

Module 3: Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules: 25 Hrs

Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classification-preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

Field work:

Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

Lab Components:

1	Estimation of hardness of water by EDTA method	[E]
2	Estimation of alkalinity of water sample	[E]
3	Determination of chloride content in bleaching powder	[E]
4	Estimation of dissolved oxygen in water	[E]
5	Potentiometry- determination of redox potentials and emf's	[E]
6	Conductometric titration-mixture of acids vs NaOH	[E]
7	Determination of strength of strong acid by pH metry	[E]
8	Corrosion rate of mild steel in acid medium	[E]
9	Electroplating of nickel over copper	[E]
10	Spectrophotometry-Estimation of iron in water	[E]
11	Separation of mixture of amino acids by thin layer chromatography	[E]
12	Synthesis of Nylon 66	[E]
Total Hours:		90

Understanding the concepts by simple Demonstrations/Experiments:

1	To observe the hardness of given water sample by soap solution test
2	To view the colour of the different medium of given water sample using litmus paper test
3	To detect the chlorine content in tap water using simple chemical method
4	To know the presence of dissolved oxygen in given water sample using glucose by redox principle
5	To illustrate the rate of corrosion in steel nails using acid medium

Text Books:

1	Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
2	Jain P. C. & Monica Jain., "Engineering Chemistry", 16 th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
3	Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994.
4	Physical Chemistry, 11 th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018.
5	Nanochemistry, 2 nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013.
6	N.Krishna Murthy, Vallinayagam D., "Engineering Chemistry" 3 rd Edition by PHI Learning Pvt Ltd., 2014

7	Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013.
8	R.V.Gadag, A.Nithyananda Shetty "Engineering Chemistry" 3 rd Edition PHI Learning Pvt Ltd., 2014.
Reference Books:	
1	Shikha Agarwal., "Engineering Chemistry and Applications", Cambridge University press, 2016.
2	Liliya.,Bazylak.I.,Gennady.E.,Zaikov.,Haghvi.A.K., "Polymers and Polymeric Composites" CRC Press,2014.
3	Lefrou.,Christine.,Fabry.,Pierre.,Poignet.,Jean-claude., "Electrochemistry - The Basics, with examples" 2012 ., Springer.
4	Zaki Ahmad, Digby Macdonald, "Principles of Corrosion Engineering and Corrosion Control", Elsevier Science, 2nd Edition 2012.
5	Perez, Nestor, "Electrochemistry and Corrosion Science", Springer, 2016.
6	Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015.
7	Ghazi A.Karim. "Fuels, Energy and the Environment", CRC Press, Taylor and Francis group, 2012.
Web References:	
1	http://www.analyticalinstruments.in/home/index.html
2	www.springer.com › Home › Chemistry › Electrochemistry
3	https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry
4	www.edx.org/
5	https://www.ntnu.edu/studies/courses
6	www.corrosionsource.com/
Online Resources:	
1	nptel.ac.in/courses/105104102/hardness.htm
2	https://ocw.mit.edu/courses/chemistry
3	nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com -
4	Spectroscopic technique, Colorimetry
5	https://ocw.mit.edu/courses/chemistry
6	nptel.ac.in/courses/113108051

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory		Term End Examination [10 marks]	Practical	
	CIA-I [10 marks]	CIA-II [10 marks]		Rubric based CIA [30 Marks]	
Remember	30	30	30	10	20
Understand	60	50	40	20	50
Apply	10	20	30	40	30
Analyse	-	-	-	30	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

20EE201	Basics of Electrical Circuits		3/1/2/5
Nature of Course:		G (Theory Analytical)	
Course Objectives:			
1	To understand DC and AC circuits		
2	To learn network theorems and two port networks for circuit analysis.		
3	To explore the transient and resonance response of different electrical circuit		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C201.1	Analyse basic DC and AC electric circuits	[A]	
C201.2	Derive the sinusoidal steady-state (single-phase and three-phase) response of AC Circuits	[AP]	
C201.3	Analyse two port circuit behaviour	[A]	
C201.4	Apply network theorems for the analysis of electrical circuits.	[AP]	
C201.5	Analyse the transient and resonance response of electrical circuits	[A]	
Course Contents:			
Module 1: DC Circuits and AC Circuits			25 Hrs
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Resistor in series and parallel, voltage division, Current division, Star-delta transformation, Mesh and Nodal analysis. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Three phase balanced circuits – voltage, current, power relations in star and delta connections.			
Module 2: Network Theorems and Two Port Networks			20 Hrs
Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Concept of duality and dual networks. Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters, hybrid parameters. Two-terminal network synthesis. Properties of Hurwitz polynomial and Positive real function.			
Module 3: Transients and Resonance Analysis			15 Hrs
Steady State and Transient response - DC response of RL, RC and RLC Circuits using Laplace transforms.AC Transients response of RL and RC Circuits. Resonance: Series Resonance - Bandwidth of an RLC circuit, Q factor, Magnification in Resonance. Parallel Resonance - Resonant frequency for a tank circuit factor of parallel resonance, magnification. Self and mutually induced emf, coefficient of coupling, dot convention in coupled circuits.			
Lab Component			
1	Estimation of voltage and current by KVL and KCL in Electric Circuits	[U]	
2	Determination of mesh current and node voltage by Mesh and Nodal Analysis	[U]	
3	Apply Superposition Theorem in Electrical Circuits	[AP]	
4	Apply Reciprocity Theorem in Electrical Circuits	[AP]	
5	Application of thevenin's theorem for Maximum Power Transfer	[AP]	
6	Apply Norton and Compensation Theorem in Electrical Circuits	[AP]	
7	Determination of series and parallel resonance frequency response of circuits.	[U]	
8	Determination of transient current in RI, RC and RLC circuits	[U]	
9	Verification of circuit analysis by simulation	[A]	
10	Measurement of three phase power	[U]	

		Total Hours	90
Text Books:			
1	William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, TMH publishers, 8th edition, New Delhi, 2017		
2	Joseph A. Edminister, Mahmood Nahvi, “Electric circuits”, Schaum’s series, McGraw-Hill, New Delhi, 5 th edition, 2013		
3	M. E. Van Valkenburg, “Network Analysis”, Phi Learning, 3/E 3rd Edition, 2014		
Reference Books:			
1	Charles K. Alexander, Mathew N.O. Sadik, “Fundamentals of Electric Circuits”, 3 rd Edition, McGraw Hill, reprint 2011.		
2	Robins & Miller, ‘Circuit analysis theory and practice’, Delmar Publishers, 5 th edition, 2012		
3	Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2017		
Web References:			
1	http://www.electrical4u.com/circuit-analysis.htm		
2	http://www.technologystudent.com		
3	http://www.allaboutcircuits.com		
4	http://www.nptel.ac.in		

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Rubrics Based Practical Assessment [30 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Remember	50	-	20	20	20
Understand	50	70	40	40	40
Apply		-	20	20	20
Analyse	-	30	20	20	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C201.1	3	3	3	3					1				3		
C201.2	3	3	3	3					1				3		
C201.3	3	3	3	3					1				3		
C201.4	3	3	3	3					1				3		
C201.5	3	3	3	3					1				3		

20ME111	ENGINEERING GRAPHICS		1/0/3/2.5
Nature of Course	Practical application		
Pre Requisites	Basic Drawing and Computer Knowledge		
Course Objectives:			
1	To know the method to construct the conic curves used in engineering applications.		
2	To develop an understanding of Isometric to orthographic views and vice versa.		
3	To learn the basic projection of straight lines and plane surfaces.		
4	To develop the imagination of solids inclined to one reference plane.		
5	To know the development of surfaces used in various fields.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C111.1	Understand the basic concepts of Engineering Graphics.		[U]
C111.2	Sketch isometric, orthographic projections and projection of lines and planes		[Ap]
C111.3	Develop lateral surfaces of solids including prisms and pyramids		[Ap]
C111.4	Construct projections of lines, planes, solids and isometric views using modelling software.		[A]
Course Contents:			
Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.			
S.No	List of Experiments	CO Mapping	RBT
1	Introduction to drafting software.	C111.1	U
2	Construction of conic curves (Ellipse, Parabola and Hyperbola)	C111.1	U
3	Construction of special curves (Cycloid and Involute)	C111.1	U
4	Isometric to orthographic projections – manual sketches	C111.2	Ap
5	Isometric to orthographic projections – software sketches	C111.4	A
6	Projection of lines - inclined to HP, VP and Both HP & VP	C111.4	A
7	Projection of plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes	C111.4	A
8	Projection of solids (Prism and Pyramid) – inclined to HP	C111.3	Ap
9	Projection of solids (Cone and Cylinder) – inclined to VP	C111.3	Ap
10	Development of surfaces (Prism, Pyramid, Cone and Cylinder)	C111.4	A
11	Introduction to perspective projection	C111.2	U
Total Hours:			60
Reference Books:			
1	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50 th Edition, 2014.		
2	K. V. Natarajan, “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, 2018.		
3	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2011.		
4	Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2013.		
Web References:			
1	http://nptel.ac.in/courses/112102101/		
2	www.solidworks.com		

20EE301	ELECTRICAL MACHINES-I		3/0/0/3
Nature of Course		: G (Theory and Analytical)	
Pre-Requisites:		Basics of Electrical Circuits	
Course Objectives:			
1. To study the basic concepts of magnetic field.			
2. To understand the construction, working principle of DC machines and analyse their performance.			
3. To familiarize with the construction details of different types of transformers, working principle and their performance.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C301.1	Examine the basic concepts of magnetic circuits.		[U]
C301.2	Analyse the operation of various DC machine configurations.		[A]
C301.3	Interpret the constructional details of different type of transformers, working principle and their performance		[U]
C301.4	Analyse the performance of single-phase transformer by various testing methods.		[A]
C301.5	Choose an appropriate DC motor for any industrial application and appraise its significance.		[AP]
Course Content			
Module 1: Magnetic Fields and Magnetic Circuits 15 Hrs			
Nature of magnetic field – electromagnetism - Different laws for calculating magnetic Field - Leakage flux and fringing effect - Reluctance and Permeance - BH Characteristics - Analysis of series and parallel magnetic circuit - Force due to electromagnet - Properties of magnetic material - Faraday’s law of electromagnetic induction - Induced voltage and Induction - Eddy current and hysteresis losses - Singly and Double excited magnetic system.			
Module 2: DC Machines 15 Hrs			
DC Generator - construction, principle of operation - emf equation - types, Characteristics, commutation - interpoles - armature reaction - Armature circuit equation for motoring and generation - Open circuit and load characteristics of separately excited DC generator. DC Motor - principle of operation - torque equation - types - electrical and mechanical characteristics - Need for starters - Types of starters - soft starters - Braking - Speed control methods - Testing of DC motors - Case study: selection of DC motors for various industrial application.			
Module 3: Single Phase and Three Phase Transformers 15 Hrs			
Single phase transformers - principle of operation - types - basic construction - equivalent circuit – Phasor diagram - regulation and efficiency - separation of hysteresis and eddy current losses - Testing of transformers - open circuit and short circuit tests, polarity test, back-to-back test. Three -phase transformers - construction - types of connection and their comparative features - Summation Transformers - Auto transformer - all day efficiency - parallel operation of transformers - Phase conversion -Concept of tap changing, on - load and off - load tap changers - Cooling methods of transformers - Case study: procedure for transformer erection in power stations.			
Total Hours			45
Text Books:			
1	Stephen J. Chapman, “Electric Machinery Fundamentals”, Tata McGraw Hill International Edition, New Delhi, 5th Edition 2011		
2	Robert L. Boylestad, “Introductory Circuit Analysis”, Pearson Education India, 13 th		

	Edition, 2016.
3	D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2017
Reference Books:	
1	P. S. Bimbhra, "Electrical Machines", Khanna Publishers, 2 nd edition 2017
2	J B Gupta, "Theory & Performance of Electrical machines", SK Kataria & sons, 2015
3	Allan H. Robbins and Wilhelm C, Miller, "Circuit Analysis Theory and Practice", Cengage Learning, 2013.
Web References:	
1	https://courses.lumenlearning.com/boundless-physics/chapter/magnetism-and-magnetic-fields/
2	https://library.automationdirect.com/selecting-motors-industrial-applications/
3	https://electrical-engineering-portal.com/erection-procedure-for-power-transformer

Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C301.1	Analyse	Classroom Class Presentation/Power point presentation Group Assignment Online Quiz Simulation exercises	20
C301.2	Understand		
C301.3	Apply		
C301.4	Analyse		
C301.5	Apply		

Summative assessment based on Continuous and End Semester Examination					
Bloom’s Level	Continuous Assessment				End Semester Examination (Theory)
	Theory			Formative Assessment	
	CIA-I	CIA-II	CIA-II		
	[10 Marks]	[10 Marks]	[10 Marks]		
Remember		-	20	20	20
Understand	50	50	40	40	40
Apply		50	20	20	20
Analyse	50	-	20	20	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C301.1	3	1	1	1										2	
C301.2	3	2	2	1										2	
C301.3	3	2	1									3		2	
C301.4	3	3	3	2		1	1					2		3	
C301.5	3	3	3	2		1	1					2		3	

20EE302	Digital Circuits		2/1/0/3
Nature of Course		:J (Problem Analytical)	
Pre-Requisites:		Analog Electronics	
Course Objectives:			
1	To understand the working of logic families and logic gates.		
2	To design and implement Combinational and Sequential logic circuits.		
3	To use Programmable Logic Devices to implement the given logical problem.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C302.1	Interpret, convert and represent different number systems.		[U]
C302.2	Manipulate and examine Boolean algebra, logic operations, Boolean functions and their simplification		[A]
C302.3	Explain the different types of memories and Programmable Logic Devices to implement the given logical problem		[U]
C302.4	Design various combinational logic circuits		[A]
C302.5	Design various sequential logic circuits.		[A]
Course Contents:			
Module 1: Fundamentals of Digital Systems and logic families			18 Hrs
Digital Signals - Digital Circuits - Logic Gates - Boolean algebra - Theorems, Number Systems, one's and two's Complements - Codes - Arithmetic Codes, Error Detecting and Correcting Codes - Characteristics of digital ICs - Standard representation for logic functions - K-map representation, simplification of logic functions using K-map and Quine McCluskey method. Digital logic families - TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.			
Module 2: Combinational Digital Circuits, memories and Programmable logic devices			12Hrs
Design of Adders, Subtractors, Carry look ahead adder, serial adder - Multiplexer, De-Multiplexer - Encoder, Decoders, priority encoders, decoders/drivers for display devices. ALU - Elementary ALU design - Digital comparator - Parity checker and generator - code converters - Memories - RAM, ROM, PROM, EPROM, EEPROM, PLDs, FPGA. Introduction to Verilog HDL.			
Module 3: Sequential circuits and systems			15 Hrs
Types of Flip-Flops - Shift Registers - Analysis of Synchronous Sequential Logic circuits - Design of Synchronous Sequential Logic circuits - state table and excitation tables, state diagrams, Moore and Mealy models - Design of counters using flip-flops - synchronous counters, Modulo Counters, Ring Counters, ripple (Asynchronous) counters - Sequence Generator. Analysis of Asynchronous sequential logic circuits - Design of Asynchronous sequential logic circuits - Transition table, flow table, race conditions, circuits with latches, implication table, hazards. Case study: ATM Machine.			
Total Hours			45
Text Books:			
1	M. Morris R. Mano, Michael D. Ciletti, "Digital Logic Design", Prentice Hall, 5th Edition, 2013.		
2	Floyd, "Digital Fundamentals", Pearson education, 11th edition, 2015.		
3	A. Anand kumar, "Fundamental of Digital Circuits", PHI Learning Private Ltd, 4th edition, 2016.		
Reference Books:			
1	R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 4th Edition, 2009.		
2	Tocci R.J., Neal S. Widmer, "Digital Systems: Principles and Applications", Pearson Education Asia, 2014.		
3	Donald P Leach, Albert Paul Malvino, Goutam Sha, "Digital Principles and Applications", Tata McGraw Hill, 7th Edition, 2010.		

Web References:	
1	https://onlinecourses.nptel.ac.in/noc18_ee33
2	http://www.ni.com/example/14493/en/
3	http://electronics-course.com/

Assessment Methods & Levels (based on Bloom's Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcom	Bloom's Level	Assessment Component		Marks
C302.1	Understand	Online Quiz Tutorial Class Presentation Tutorial Group Assignment		20
C302.2	Analyse			
C302.3	Understand			
C302.4	Apply			
C302.5	Apply			
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	
Remember	-	-	-	20
Understand	50	50	20	30
Apply	-	-	-	20
Analyse	50	50	80	40
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C302.1	3	1	1	1										2	
C302.2	3	2	2	1										2	
C302.3	3	2	1									3		2	
C302.4	3	3	3	2		1	1					2		3	
C302.5	3	3	3	2		1	1					2		3	

20EE303	ELECTRIC POWER GENERATION		3/0/0/3
Nature of Course:	D (Theory application)		
Pre Requisites:	Nil		
Course Objectives:			
1. To understand the concepts of thermal power plants and their associated components. 2. To enable students to understand in detail about nuclear and gas turbine power plants which play an important role in power generations. 3. To understand different non-conventional energy sources and their economic aspects to meet desired social requirements.			
Course Outcomes:			
Upon the completion of course, students shall have the ability to			
C303.1	Analyze the concepts of Rankine cycle and various components of thermal, Nuclear and hydro power plant.		[A]
C303.2	Illustrate the safety measures of power plants, operation of binary cycles and cogeneration systems		[U]
C303.3	Illustrate the operation of gas turbine and combined cycle power plants.		[U]
C303.4	Enumerate the concepts of renewable energy systems and their energy scenarios.		[AP]
C303.5	Apply the different types of tariff, consumers and different types of power generation plants		[AP]
Course Contents:			
Module 1: Thermal and Hydro power plants			15 Hrs
Basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, steam and heating rates, binary cycles and cogeneration systems. Hydro Electric Power Plants - classification, typical layout and components. case studies on thermal and hydro power plants			
Module 2: Nuclear and Gas Turbine Power Plants			15 Hrs
Introduction, Layout and subsystems of nuclear power plants, Types of reactors, safety waste disposal for nuclear power plants, case study on nuclear power plant, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems, pollution control technologies.			
Module 3: Renewable Energy Sources			15 Hrs
Construction and working of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems, Comparison of site selection criteria, relative merits and demerits, capital and operating cost of different power plants. DC systems in power plants, station control - switch yard and control room. Economic considerations – types of costs, tariff and consumers.			
Total Hours			45
Text Books:			
1	Rai, G.D, “Non-Conventional Energy Sources”, Khanna Publishers, 2010.		
2	El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.		
3	R.K.Hegde., "Power Plant Engineering", Pearson Publisher Limited Ltd., 2015.		
Reference Books:			
1	P C Sharma, “Power plant engineering”, S.K. Kataria & Sons, New Delhi, 2010.		
2	Deshpande.M.V, “Elements of Electrical Power Station Design”, PHI Learning PVT LTD, 2010.		
3	Wadhwa.C.L, “Generation, Distribution and Utilization of Electrical Energy”, Wiley Eastern Limited, 3rd Edition, 2011		

Web References:	
1	https://nptel.ac.in/courses/108105058/8
2	http://indianpowersector.com/home/power-station/thermal-power-plant/
3	www.altenergy.org/renewables/renewables.html
4	https://www.energy.gov/fe/how-gas-turbine-power-plants-work

Assessment Methods & Levels (based on Bloom's Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom's Level	Assessment Component		Marks
C303.1	Analyse	Case Study Assignments Simulation Technical Quiz		20
C303.2	Analyse			
C303.3	Understand			
C303.4	Apply			
C303.5	Apply			
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	
Remember	-	-	-	-
Understand	50	50	2	20
Apply	-	-	8	50
Analyse	50	50	-	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C303.1	3	1	2	1									2	2	
C303.2	3	2	1	1									2	1	
C303.3	3	2	2	1		1	1							2	
C303.4	3	3	3	2								2	2	1	
C303.5	3	2	2	1								2	2	1	

20EE304	Measuring Instruments and Smart Sensors	3/0/0/3
Nature of Course	D (Theory Application)	
Course Objectives:		
1. To state the fundamental concepts of measurements and instruments. 2. To explore the operation of different bridges and transducers in real time. 3. To design aspects and performance criterion of optical and advanced sensors and instruments employed in industry.		
Course Outcomes:		
Upon completion of the course, students shall have ability to		
C304.1	Summarise the general measurement instruments techniques.	[U]
C304.2	Identify the instruments for measuring various electrical parameters.	[U]
C304.3	Analyse the operating principle of different bridges and transducers.	[A]
C304.4	Analyse the functioning of various optical sensors in real time.	[A]
C304.5	Apply suitable advanced sensors in industry based applications.	[AP]
Course Contents:		
Module 1: Introduction to Measurements and Instruments		15 Hrs
Introduction to measurements and Instruments - classifications, applications, Elements of a generalized measurement system, Static and dynamic characteristics, Analog and Digital Instruments - PMMC, Attraction and Repulsion type Moving Iron Instruments, Induction type-dynamometer type Wattmeters, Single and Three Phase Energy Meter - Instrumentation Transformers - Megger - Tachometer - Torque meter - Flow meter.		
Module 2: Bridges and Transducers		10 Hrs
DC and AC Bridges - Wheatstone bridge, Kelvin's double bridge, Maxwell L/C and Wien bridges. Transducers - Characteristics, Requirements, Classifications, Selection Criteria, Displacement Transducers - LVDT, Potentiometers, Pressure Transducers - Bourdon tube, Strain Gauge, Temperature Transducers - RTD, Thermistors, Thermocouples.		
Module 3: Optical devices and Advanced Sensors in Real Time		20 Hrs
Oscilloscopes - Basic principle, Block diagram of oscilloscope, Types, Digital storage oscilloscope, Introduction to MSO, UV and IR spectrometry, Photo Plethysmo Graphy (PPG), RFID sensors, Introduction to MEMS, Introduction to Metal Oxide (MOS) gas sensors, VR headset and controller, Moisture Sensors, Collision Detection Sensor, Object Detection Sensors. Case Studies - Inertial Sensors (Accelerometer and gyroscope)		
Total Hours		45
Text Books:		
1	A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation",Dhanpatrai& Co., 19 th Edition, 2016.	
2	A.D.Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2016.	
3	D.V.S. Murthy, "Transducers and Instrumentation", PHI Learning, 2nd Edition, 2013.	
Reference Books:		
1	H.S Kalsi, "Electronics Instrumentation", Tata McGraw Hill, Higher education,3 rd edition,2010.	
2	E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 2011.	

3	M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009.
4	J.J. Carr, "Elements of Electronic Instrumentation and Measurement", Pearson Education India, New Delhi, 2011.
Web References:	
1	https://nptel.ac.in/courses/108/105/108105153/
2	https://www.bosch-sensortec.com/
3	http://www.shortcoursesportal.com
4	https://learn.ni.com/teach/resources/1014/measurements-and-instrumentation
5	https://the-eye.eu/public/Books/Electronic%20Archive/OliverCage/ElectronicMeasurementsAndInstrumentation_text.pdf
6	https://lecturenotes.in/subject/265/electrical-measurement-and-instrumentation-emi

Assessment Methods & Levels (based on Bloom's Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom's Level	Assessment Component		Marks
C304.1	Understand	Quiz Class Presentation Assignment Case Study		20
C304.2	Remember			
C304.3	Analyse			
C304.4	Analyse			
C304.5	Apply			
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	
Remember	50	-	20	20
Understand	50	-	20	20
Apply	-	10	20	20
Analyse	-	80	40	40
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C304.1	3	2	1	1									2	2	
C304.2	2	1	1	1	2							2	2		
C304.3	3	3	2	2	2							2		2	
C304.4	2	1	1	1	2							1		2	
C304.5	3	3	3	2	1							1		2	

20MA301	ENGINEERING MATHEMATICS III MECH/MCT/CIVIL/ECE/EEE		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concepts of basic differentiation and Integration	
Course Objectives:			
1	To understand the different possible forms of Fourier series and the frequently needed practical harmonic analysis that an engineer may have to make from discrete data.		
2	To acquaint the student with transform techniques which are used in variety of engineering fields.		
3	To study the concept of mathematical formulation of certain practical problems in terms of partial differential equations and solving for physical interpretation.		
4	To find the numerical solution for partial differential equations.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C301.1	Recall the basic integration concepts and partial derivatives		[R]
C301.2	Interpret Fourier series solutions to the engineering problems		[U]
C301.3	Apply continuous transforms techniques to evaluate definite integrals		[AP]
C301.4	Apply the Z transform techniques in discrete sequences		[AP]
C301.5	Apply analytical methods to solve the partial differential equations		[AP]
C301.6	Apply numerical methods to solve wave and heat equation with boundary conditions		[AP]
Course Contents:			
Module 1: Fourier Series			15 Hrs
Dirichlet's conditions-General Fourier Series-Odd and Even Functions- Half range sine series and cosine series - Parseval's Identity-Harmonic analysis			
Module 2: Fourier Transform and Z Transform			15 Hrs
Fourier Transform: Complex form of Fourier Transforms – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem and Parseval's Identity (Statement only) – Evaluation of integrals using Parseval's Identity. Z- Transform: Convergence of Z transform - Z-transform of Standard functions-Properties -Inverse Z- transform-Convolution theorem(Statement only)-Partial fraction method - Formation of difference equations - Solution of difference equations using Z-transform Techniques.			
Module 3: Partial Differential Equations			15 Hrs
Introduction to PDE – Solving PDE by Lagrange's linear equations-Linear homogeneous partial differential equations of second and higher order with constant coefficients-Classifications-Numerical Solution to Partial differential Equation-Elliptic equations- Laplace equation - Liebmann's Iteration Process -Poisson equation -Parabolic Equation (one dimensional heat equation) - Bender-Schmidt's Difference Scheme – Crank-Nicholson's Difference Scheme- Hyperbolic Equation (one dimensional wave equation).			
Total Hours:			45 Hrs
Course Outcomes: (Laboratory)			
Upon the completion of the course, students shall have ability to			
C301.1	Understand the need for a function or its approximation as an infinite series.		
C301.2	Represent discontinuous function which occurs in electrical circuits and signal processing by using Fourier series		

C301.3	Demonstrate the use of Fourier transform to connect the time domain and frequency domain
C301.4	Understanding Z- transform and analyzing discrete signals by using Z- transform.
C301.5	To describe homogeneous and higher order partial differential equations using PDE techniques.
C301.6	Understanding of basic concepts in application of partial differential equations in one dimensional heat and wave equations.

Laboratory Component:

S.No	List of Experiments	CO Mapping	RBT
1.	To perform symbolic Fourier series calculation of the given full range signals using suitable mathematical software.	C301.1	[AP]
2.	To perform symbolic Fourier series calculation of the given half range signals using suitable mathematical software.	C301.2	[AP]
3.	To plot the Fourier transform of time function using suitable mathematical software.	C301.3	[AP]
4.	To find the Z transform of given expression $f(n)$ using suitable mathematical software.	C301.4	[AP]
5.	To find the inverse Z transform of given expression $f(n)$ using suitable mathematical software.	C301.4	[AP]
6.	To find the solution of homogeneous partial differential equation using suitable mathematical software.	C301.5	[AP]
7.	To find the solution for higher order partial differential equations using suitable mathematical software.	C301.5	[AP]
8.	To solve initial and boundary value problems for systems of partial differential equations in one spatial variable x and time t using suitable mathematical software.	C301.5	[AP]
9.	To perform the solution of Laplace equation using suitable mathematical software.	C301.6	[AP]
10.	To perform the solution of Poisson equation using suitable mathematical software.	C301.6	[AP]
11.	To solve the one-dimensional heat equation using suitable mathematical software.	C301.6	[AP]
12.	To solve the one-dimensional wave equation using suitable mathematical software.	C301.6	[AP]

Text Books:

1	Erwin E., "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, Hoboken, 2020.
2	Grewal. B.S, "Higher Engineering Mathematics", 44th edition, Khanna Publications, Delhi, 2018.
3	Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers, 6th edition, 2016.

Reference Books:

1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix (Laboratory)															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3
1	1	1	-	-	3	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	3	-	-	-	-	-	-	-		-	-
4	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	3	-	-	-	-	-	-	-		-	-
6	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	3	-	-	-	-	-	-	-	0.6	-	-
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

20CS311	DATA STRUCTURES USING C++ (COMMON TO BE ECE & BE EEE)		3/0/2/4
Nature of Course		F (Theory Programming)	
Pre requisites		Nil	
Course Objectives:			
1.	To learn object-oriented programming concepts using C++		
2.	To explain linear data structures lists, stacks, and queues		
3.	To understand various non-linear data structures-Tree, Graph		
4.	To apply efficient data structures in solving real-world problems		
Course Outcomes			
Upon completion of the course, students shall have ability to			
C311.1	Describe the object oriented paradigm with concepts of classes, functions, arrays, data and objects.		R
C311.2	Implement dynamic memory management techniques using pointers, constructors, destructors and the concept of inheritance, polymorphism.		AP
C311.3	Apply appropriate data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.		AP
C311.4	Interpret the applications of stack, queue and use the appropriate data structure in context of solution to a given problem		AP
C311.5	Represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.		U
C311.6	Illustrate and compare various data structures for solving real time problems.		AP
Course Contents:			
Module1: C++ Programming 15 Hrs			
An overview of C++ - Difference between procedure and object oriented programming language, Data Types, Variables, Operators, Expressions and Statements-Functions and Arrays- C++ Class Overview- Class Definition, Objects, Class Members, Access Control, Constructors and destructors, parameter passing methods, Inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deallocation (new and delete) - Inheritance basics, base and derived classes, inheritance types, runtime polymorphism using virtual functions, abstract classes - Generic Programming- Function and class templates.			
Module 2: Linear Data Structures – List, Stack, Queue 15 Hrs			
Abstract Data Types (ADTs) – List ADT – Array based implementation – Linked list implementation – Singly linked lists – Doubly linked lists. Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Linear Queue, Circular Queue – Applications of queue.			
Module 3: Non-Linear Data Structures – Trees, Graphs 15 Hrs			
Trees: Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree –AVL Tree. Graph Algorithms: Breadth First Search (BFS), Depth First Search (DFS), Minimum Spanning Tree (MST)-Prims Algorithm, Kruskal's Algorithm - Single Source Shortest Paths, Bi-connectivity, Cut vertex, Euler circuits.			
Total Hours			45 hours

Laboratory Component:		
S. No	List of Experiments	
1.	Implement basic C++ programs	
2.	Implementation of classes and objects	
3.	Implementation of Inheritance and polymorphism	
4.	Implementation of Linked List	
5.	Implementation of stack using array and Linked List	
6.	Implementation of stack applications	
7.	Implementation of queue using array and Linked List	
8.	Implementation of Binary Search Tree and its traversal	
9.	Implement BFS and DFS Graph Traversal	
10.	Implement a Minimum Spanning Tree Algorithm in a graph	
11.	Design a program to employ a stack for balancing symbols such as parentheses, flower braces and square brackets, in the code snippet given below. <pre> for(i=0;i<n;i++) { if(i<5) { z[i]=x[i]+y[i]; p=(((a+b)*c)+(d/(e+f)*g); } </pre> Ensure that your program works for any arbitrary expression.	
Total Hours		30 Hours

Text Books:	
1.	Herbert Schildt , “ The Complete Reference C++” , Fourth Edition, TMH, 2017.
2.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education India, 3 rd Edition, 2013.
3.	Debasis Samanta, “Classic data structures”, Prentice Hall of India, 2nd edition, 2014.
Reference Books:	
1.	Bjarne Stroustrup, “The C++ programming language”; Addison Wesley, fourth edition.
2.	Seymour Lipschutz, “Data Structures by Schaum Series”, 2nd edition, Tata McGraw Hill, 2013.
3.	Narasimha Karumanchi, ”Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, 5th Edition, CareerMonk,2016.
Web References:	
1.	https://nptel.ac.in/
2.	https://visualgo.net/en
3.	https://www.codechef.com/
Online Resources:	
1.	https://www.coursera.org/learn/c-plus-plus-a
2.	https://www.coursera.org/learn/c-plus-plus-b
3.	https://nptel.ac.in/courses/106/102/106102064/
4.	https://www.hackerrank.com/domains/data-structures

Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA [30 Marks]	
Remember	40	20	10	10	20
Understand	30	30	30	30	30
Apply	30	50	60	60	50
Analyse					
Evaluate					
Create					

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C311.1	2	2	1		1						1	2		2	1
C311.2	3	3	2		2						1	3		2	1
C311.3	2	3	3		3						2	3		3	2
C311.4	2	3	2		1						2	3		3	2
C311.5	2	3	3		1						2	3		3	2
C311.6	3	3	3		2						3	3		3	2

20EE305	Electrical Machines – I Laboratory	0/0/2/1
Nature of Course: M (Practical application)		
Pre Requisites: Basics of Electrical Circuits		
Course Objectives:		
1. To determine the characteristics of DC machines by using simulation and experimental methods.		
2. To know the performance characteristics of transformers based on various tests under no load, loading conditions, open circuit and short circuit conditions.		
3. To analyse the equivalent circuit parameters of transformers.		
Course Outcomes		
Upon completion of the course, students shall have ability to		
C305.1	Analyze the no load and load characteristics of DC Separately excited DC generator.	[A]
C305.2	Illustrate the mechanical and electrical characteristics of Shunt ,Series and Compound motor.	[U]
C305.3	Analyze the OCC characteristics of DC shunt generator using Simulation software.	[A]
C305.4	Sketch the equivalent circuit of Single phase Transformer and calculate the parameters of equivalent circuit.	[AP]
C305.5	Demonstrate the indirect method of testing of DC machine to determine its efficiency.	[AP]
C305.6	Analyze the different types of three phase transformer Connections.	[A]
Course Contents :		
1.	Analysis of open circuit characteristics of DC shunt generator using Simulation software.	[A]
2.	Analysis of no-load and load characteristics of separately excited DC generator.	[A]
3.	Determination of efficiency of DC machine through Hopkinson's Test.	[U]
4.	Examine the effective efficiency and speed-torque characteristic of DC shunt motor, DC series motor.	[U]
5.	Determination the load characteristics of DC compound motor.	[U]
6.	Predetermination of Efficiency using Swinburne's test	[U]
7.	Examine the Speed Control methods of DC shunt motor by following methods i) Field Control ii) Armature control iii) Voltage Control Method / Chopper based Control	[A]
8.	Sketching of the equivalent circuit parameters of a single phase transformer.	[AP]
9.	Testing of transformers using Sumpner's Test.	[AP]
10.	Study of Scott Connection of Two Single phase Transformers.	[R]
11.	Verification of Three phase Transformer connections.	[A]
12.	Separation of No load losses in single phase transformers.	[U]
Total Hours		30
Text Books:		
1	Stephen J. Chapman, "Electric Machinery Fundamentals", Tata McGraw Hill International Edition, New Delhi, 5th Edition 2011.	
2	Matthew N. O. Sadiku, "Elements of electromagnetics", Oxford University Press, 6 th Edition, 2007.	
3	D.P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2010	
Reference Books:		
1	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011	

2	J B Gupta, "Theory & Performance of Electrical machines", SK Kataria and sons, 2015
3	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
Web References:	
1	https://courses.lumenlearning.com/boundless-physics/chapter/magnetism-and-magnetic-fields/
2	https://library.automationdirect.com/selecting-motors-industrial-applications/
3	https://electrical-engineering-portal.com/erection-procedure-for-power-transformer

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	20	20
Apply	30	30
Analyse	40	40
Evaluate	0	0
Create	0	0

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C305.1	3	3	2	2			1	2	2	2			3		3
C305.2	3	2	1	1			1	2	2	2			3		3
C305.3	3	3	2	2	3		1	2	2	2			3		3
C305.4	3	2	1	1			1	2	2	2			3		3
C305.5	3	2	1	1			1	2	2	2			3		3
C305.6	3	3	2	2			1	2	2	2			3		3

20EE306	DIGITAL CIRCUITS LABORATORY		0/0/2/1
Nature of Course:	M (Practical application)		
Pre Requisites:	Basics of Electrical Circuits		
Course Objectives:			
1. To impart the concept of Boolean reduction techniques and verify the output.			
2. To design and verify the output of combinational circuits			
3. To realize the output of Synchronous Sequential circuits			
4. To realize the output of Asynchronous Sequential circuits			
Course Outcomes			
Upon completion of the course, students shall have ability to			
C306.1	Interpret the various Boolean Algebra and Boolean reduction techniques	[U]	
C306.2	Design and verify the output of combinational circuits	[A]	
C306.3	Design and verify the output of Sequential circuits	[A]	
C306.4	Design a simple processor	[A]	
C306.5	Synthesis and simulate the state machines	[AP]	
Course Contents :			
1.	Analysis and Synthesis of Boolean Expressions using Basic Logic Gates	[A]	
2.	Design of Adder and Subtractor using logic gates.	[A]	
3.	Design of Code convertors using logic gates	[A]	
4.	Design of parity generator and checker using logic gates	[A]	
5.	Design of Combinational Circuits: Encoders, Decoders, Multiplexer and Demultiplexer using logic gates.	[A]	
6.	Design and implementation of counters using flip-flops.	[A]	
7.	Design and Implementation of Shift Registers using flip-flops.	[A]	
8.	Design of Arithmetic Logic Unit (ALU) (Simulation)	[A]	
9.	Analysis and Synthesis of Logic Functions using Multiplexers and Decoders (Simulation)	[A]	
10.	Complex state machine design (Simulation)	[A]	
Total Hours			30
Text Books:			
1	M. Morris R. Mano, Michael D. Ciletti, "Digital Logic Design", Prentice Hall,5th Edition,2013.		
2	Floyd, "Digital Fundamentals", Pearson education, 11th edition, 2015.		
3	A.Anand kumar, "Fundamental of Digital Circuits", PHI Learning Private Ltd, 4th edition,2016.		
Reference Books:			
1	R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 4th Edition, 2009.		
2	Tocci R.J., Neal S. Widmer, "Digital Systems: Principles and Applications", Pearson Education Asia, 2014.		
3	Donald P Leach, Albert Paul Malvino, Goutam Sha, "Digital Principles and Applications", Tata McGraw Hill, 7th Edition, 2010.		
Web References:			
1	http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/		
2	https://www.circuitlab.com/editor/#?id=53xa3r		
3	http://vlabs.iitkgp.ac.in/dec/exp3/index.html#		

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	20	20
Apply	30	30
Analyse	40	40
Evaluate	0	0
Create	0	0

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C305.1	3	3	2	1		1	1	2	2	2	1			3	
C305.2	3	3	2	1		1	1	2	2	2	1			3	
C305.3	3	3	2	1		1	1	2	2	2	1			3	
C305.4	3	3	2	1		1	1	2	2	2	2			3	
C305.5	3	3	2	1	3	1	1	2	2	2	2			3	
C305.6	3	3	2	1		1	1	2	2	2	1			3	

20EE401	ELECTRICAL MACHINES - II		3/0/0/3
Nature of Course		: G (Theory & Analytical)	
Course Pre-requisites		Electrical Machines - I	
Course Objectives:			
1	To know the concepts of Rotating Magnetic Field.		
2	To impart the knowledge of Synchronous and Induction Machines.		
3	To analyze the performance of Synchronous and Induction Machines.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C401.1	Illustrate the Construction and Operation of Salient and Non-Salient Pole Alternators and Synchronous Motors.		[U]
C401.2	Examine the Performance of Synchronous Machines by various Methods.		[A]
C401.3	Interpret the Construction and Operation of Single and Three Phase Induction Motor.		[U]
C401.4	Analyze the Performance of Induction Machines by various Methods.		[A]
C401.5	Explain the various types of Starters and Speed Control methods of Induction Motor.		[U]
Course Contents:			
Module 1: Synchronous Machines 20 Hrs Introduction - MMF distribution - Rotating Magnetic Field. Alternators: Constructional details- Principle of operation and types of Rotor- EMF equation- Armature reaction - Voltage regulation - EMF, MMF and ZPF- Two Reaction Theory - Synchronization and Synchronizing Power - Parallel operation and Load sharing, Operation on Infinite bus-bar- typical applications. Synchronous motors: Starting methods, Synchronous Machines on Infinite bus bars, Phasor diagram, V and Inverted - V Curves, Hunting and its suppression, Effect of change in Excitation, Synchronous Condenser.			
Module 2: Induction Machines 15 Hrs Three phase induction motors : Constructional details - Principle of Operation and types of Rotor - Slip - Starting and Maximum torque - Slip-Torque Characteristics, No Load and Blocked Rotor test - Equivalent Circuit- Circle Diagram - Crawling and Cogging- Separation of No-Load losses - Induction Generators - Double Cage Induction Motor. Single- Phase Induction Motors: Constructional details - Principle of Operation and types - Double Field Revolving Theory - Equivalent Circuit and its applications.			
Module 3: Starting and Speed Control Methods of Induction Motors 10 Hrs Need for Starting - Types of Starters - Rotor Resistance, Star- Delta, Autotransformer and Soft Starters, Speed control - Change of Voltage, Frequency, Number of Poles, V/F Control, Slip- Cascaded Connection - Slip Power Recovery Scheme - Braking Methods, Case study on Industry based Soft Starters.			
Total Hours			45
Text Books:			
1	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 5 th Edition, 2017.		
2	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.		
3	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.		
Reference Books:			
1	P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, Third Edition, 2013.		
2	M.G. Say," Alternating Current Machines", Pitman Publishing Ltd., 4 th edition, 2013.		
3	A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 2010.		

Web Reference:	
1	http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105018
2	http://freevideolectures.com/Course/2335/Basic-Electrical-Technology/23
3	https://www.electrical4u.com/deep-bar-double-cage-induction-motor/
4	https://www.youtube.com/watch?v=b24jORRoxEc
5	http://www.engineeringmatters.com/EngineeringMatters_Project_Maglev.pdf

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C401.1	Understand	Technical Quiz Writing Skills Class Presentation Assignment Group Assignment	20
C401.2	Analyse		
C401.3	Understand		
C401.4	Analyse		
C401.5	Understand		

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination [50 marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA III [10 Marks]		
Remember	50	-	20	25	20
Understand	50	50	40	50	40
Apply		30	20	-	20
Analyse	-	20	20	25	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C401.1	2	1							2			1	3		3
C401.2	3	3	2	2					2			1	3		3
C401.3	2	1							2			1	3		3
C401.4	3	3	2	2					2			1	3		3
C401.5	2	1							2			1	3		3

20EE402	TRANSMISSION AND DISTRIBUTION		3/0/0/3
Nature of Course		: G (Theory analytical)	
Course Pre-requisites		Basics of Electrical Circuits	
Course Objectives:			
1. To introduce the Generation, Transmission and Distribution sector of power system.			
2. To enable the students to understand the calculation of transmission line parameter for different conductors.			
3. To analyse the concepts of modelling, corona loss and efficiency of transmission line.			
4. To learn selection of cables and insulators in power system network.			
5. To realise substation, distribution system and tariff calculation.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C402.1	Evaluate the modelling concepts of the electrical circuit parameters and its losses		[A]
C402.2	Apply the knowledge in Sag calculations, substations and distribution systems and efficiency of transmission line.		[AP]
C402.3	Illustrate the concept of DC distribution, Feeders, Substation layout and its economic aspects with tariff calculations		[U]
C402.4	Analyse the load duration curve and economic power tariff methods.		[A]
C402.5	Explain the overhead line insulator and underground cables and corona		[U]
Course Contents			
Module 1: Transmission line parameters calculation		15 Hrs	
Resistance, inductance, capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing of solid and bundled conductors, effect of earth on capacitance. Introduction to transmission loss, Ferranti effect and corona loss Travelling wave phenomena.			
Module 2: Modelling and performance of transmission lines- substation and distribution system		15 Hrs	
Modelling and simulation of Medium and long transmission lines, efficiency and regulation Mechanical design of transmission lines. Sag Calculation, Load Duration Curve. Introduction to DC distribution system and its losses, Substation layout, radial and ring systems, selection of feeders and distributors, economic aspects and tariff calculations.			
Module 3: Overhead line insulators, Underground cables		15 Hrs	
Selection of Insulators, different types, string efficiency. Selection of cables, rating of cables, constructional details of various types of cables, oil and gas-filled cables, XLPE cable, capacitance grading, sheath loss, thermal ratings.			
Total Hours			45
Text Books			
1	Leonard.L. Grigsby, Electric Power Generation, Transmission and distribution, Third Edition, CRC Press, 2012.		
2	C.L. Wadhwa, Generation, Distribution and Utilization of Electrical Energy, ThirdEdition, New Age International, 2015.		
3	Colin Bayliss, Brain Hardy, Transmission and Distribution Electrical Engineering, Fourth Edition, Newnes Publishers, 2011		
Reference Books			
1	V.K. Mehta, Principles of Power System, S. Chand Publication, 2011.		
2	A. S. Pabla, Electric Power Distribution, McGrawHill International Edition, 2012.		
3	S.N. Singh, Electric Power Generation, Transmission and Distribution, Twelfth Printing (Second Edition) Published by Asoke K. Ghosh, Prentice-Hall of India Private Limited, New Delhi. 2011.		

20EE403	CONTROL SYSTEMS		3/1/0/4
Nature of Course		: G (Theory Analytical)	
Course Pre-requisites		Nil	
Course Objectives:			
1. To understand the methods of systems representation and to derive their transfer function models.			
2. To provide an adequate knowledge of systems in time domain and its stability analysis.			
3. To accord basic knowledge in obtaining the open loop and closed loop frequency responses of systems.			
4. To introduce the design of controllers and compensators.			
5. To impart the concept of state variable representation of physical systems.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C403.1	Construct the mathematical models of various control systems and obtain the transfer function of a system.		[AP]
C403.2	Analyse the first and second order systems in time domain and frequency domain.		[A]
C403.3	Analyse the frequency responses using Bode Plot and Polar plot and examine the stability of the control systems using Root locus, Routh-Hurwitz Criteria methods.		[A]
C403.4	Design and realize the controllers and compensators.		[C]
C403.5	Construct state space model of a system and test its controllability and observability.		[AP]
Course Contents:			
Module 1: System modelling		15 Hrs	
Basic elements of control systems - Open loop and closed loop systems - Transfer function modelling: Electrical systems and Mechanical system - Translational, Rotational - Block diagram reduction using signal flow graph.			
Module 2: Time and frequency response analysis		20 Hrs	
Time domain specifications - Types of test signals - First order system response – Step, Ramp, Impulse - Second Order System Response - Step input-- Steady state error - Generalized error coefficients - Concept of stability - Routh Hurwitz criterion - Root locus technique - Frequency domain specifications - Bode plot - Polar plot - Gain margin and Phase margin.			
Module 3: Controllers, compensators and state variable analysis		25 Hrs	
Controllers: Design of P, PI and PID controllers - Compensators: Introduction to lag, lead and lag-lead networks - Lag, lead and lag - lead compensator design using Bode plot - Concepts of state variables: State space model of Mechanical and Electrical systems - State Variable approach - Controllability and Observability - Introduction to Digital Control Systems: Basic Elements of discrete data control systems, advantages of discrete data control systems.			
Total Hours			60
Text Books:			
1	I. J. Nagrath & M. Gopal, „Control Systems Engineering,, 6 th Edition, New Age International Publishers, 2017.		
2	Katsuhiko Ogata, „Modern Control Engineering', 5 th edition, Pearson, New Delhi, 2015.		
3	Farid Golnaraghi & Benjamin C. Kuo, „Automatic Control systems", 9 th Edition, Wiley, 2014.		

Reference Books:	
1	Norman S. Nise, „Control Systems Engineering', Wiley, New Delhi, 2018.
2	Richard Poley, „Control Theory Fundamentals", 2 nd Edition, Createspace, 2014.
3	Richard C. Dorf, Robert H. Bishop, „Modern Control Engineering', 13 th Edition, Pearson Education, New Delhi, 2016.
4	A. Nagoorkani, "Control Systems Engineering", RBA Publications 2014.
5	S. Palani, "Control Systems Engineering", 2 nd Edition, Tata McGraw-Hill Education, 2010.
Web References:	
1	http://www.nptel.ac.in/courses/108101037/
2	https://nptel.ac.in/courses/108101037/14

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C403.1	Apply	Writing Skill Problem Solving Group Assignment Simulation exercises Quiz	20
C403.2	Analyse		
C403.3	Analyse		
C403.4	Create		
C403.5	Apply		

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination [50 marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA III [10 Marks]		
Remember	-	-	-	-	-
Understand	-	-	20	-	20
Apply	50	25	25	40	20
Analyze	50	75	25	40	40
Evaluate	-	-	-	-	-
Create	-	-	30	20	20

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
C403.1	3	2	1	1						1		2	3		
C403.2	3	3	2	2						1		2	3		
C403.3	3	3	2	2								1	3		
C403.4	3	3	3	3	3			1	2	1		3	3		1
C403.5	3	2	1	1								2	3		

20EE404	LINEAR INTEGRATED CIRCUITS		3/0/0/3
Nature of Course		: G (Theory, Analytical)	
Course Pre-requisites		Nil	
Course Objectives:			
1. To analyse circuit characteristics with signal analysis using Op-amp Ics. 2. To design and construct application circuits with Ics as Op-amp, 555, 566 etc. 3. To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator ICs and DAC/ADCs			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C404.1	Infer the IC fabrication and DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.	[U]	
C404.2	Apply mathematical concepts to characterize and model the circuits using IC 741.	[AP]	
C404.3	Design the A/D and D/A converters and study their characteristics.	[A]	
C404.4	Explain and compare the working of multivibrators using special application IC 555 and general-purpose op-amp.	[U]	
C404.5	Design and troubleshoot simple analog circuits using Op amp, Timer ICs and PLLs.	[A]	
Course Contents:			
Module 1: IC Fabrication and Op-amp Characteristics 15 Hrs Advantages of ICs over discrete components – Manufacturing process of monolithic ICs – Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors – Monolithic Capacitors – Inductors, General operational amplifier stages and internal circuit diagrams of IC 741- Ideal Op-amp characteristics, DC and AC performance characteristics, slew rate, Open and closed loop configurations, Frequency response of Op-amp.			
Module 2: Application of Op-amps 15 Hrs Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters. Analog and Digital Data Conversions: D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type - Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters			
Module 3: Waveform Generators and Special ICs 15 Hrs Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, Function generator circuit, Timer IC 555: Functional block diagram, characteristics & applications - Astable and monostable multivibrator -566 Voltage Controlled Oscillator circuits, IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator - Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.			
Total Hours			45

Text Books:	
1	D. Roy Choudary, S.B. Jain, " Linear Integrated Circuits", Third edition, New Age publishers, 2014.
2	Ramakant A Gayakwad , " Opamps and Linear Integrated Circuits" , IV edition, Pearson Education/ PHI, 2009
3	J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
Reference Books:	
1	Robert F. Coughlin, and Driscoll," Operational Amplifiers and Linear Integrated Circuits", 6/e, Pearson Education. Reprint 2007
2	P. R. Gray and R. G. Meyer," Analysis and Design of Analog Integrated Circuit, John Wiley, 4th Ed, Reprint 2009
3	Sergio Franco,"Design with operational amplifiers and Analog Integrated circuits",Tata McGraw Hill 3rd Edition 2002.
Web References:	
1	Ron Manchini, "Op-Amps for Everyone ", Design Reference-Texas Instruments, August 2002, Available from: http://www.ti.com/lit/an/slod006b/slod006b.pdf
2	www.ti.com/amplifier-circuit/overview.html
3	https://www.ti.com/seclit/ml/ssqu016/ssqu016.pdf
4	http://www.ti.com/lit/ds/symlink/opa2192.pdf

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C404.1	Understand	Quiz Simulation exercises Class Presentation Assignment	20
C404.2	Apply		
C404.3	Analyze		
C404.4	Understand		
C404.5	Analyze		

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination [50 marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA III [10 Marks]		
Remember	20	-	-	20	10
Understand	30	20	40	20	20
Apply	50	40	20	30	30
Analyse	-	40	40	30	40
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C404.1	3	3	2	2	3		1						3	2	
C404.2	3	3	2	2	3		2				2	2	3	2	
C404.3	3	3	2	2	3		2				2	2	3	2	
C404.4	2	1			2		2				2	2	2		
C404.5	2	1			2		2				2	2	2		

20MA403	APPLIED MATHEMATICS EEE		2/1/2/4
Nature of Course		J (Problem analytical)	
Pre requisites		Concepts of basic differentiation and Integration	
Course Objectives:			
1	To find the numerical solutions of large system of differential equations and interpolations of the given numerical data.		
2	To study the concept of fitting a curve of best fit to the given numerical data and to calculate the deviation of the expected value from the observed value		
3	To understand numerical methods when the huge amounts of data are given such as series of measurements to observations or some other empirical information		
4	To give adequate exposure in applying numerical methods in predicting missing data		
5	To study the basic probability concepts		
6	To understand standard distributions which can be used to study digital signal processing and power system		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C403.1	Recall the concepts of basic probability		[R]
C403.2	Fit a polynomial or special function curve for the given data		[U]
C403.3	Apply numerical methods to find the interpolation of numerical data.		[AP]
C403.4	Analyzes the numerical solution of the large system of differential equations		[AP]
C403.5	Apply the probability concept in protocol designing problems		[AP]
C403.6	Use distribution in analysis of power system		[AP]
Course Contents:			
Module 1: Interpolation and Numerical Solution to ODE			18Hrs
Interpolation And Approximation - Lagrangian Polynomials-Divided differences -Newton's forward and backward difference formulas- Numerical Differentiation - Differentiation using Newton forward and Backward interpolation formulae - Numerical solution to first order ordinary differential equations: Single step methods: Taylor series method - Modified Euler's Method – Runge-Kutta Method of fourth order - Multistep method: Milne's Predictor- Corrector Method- Adam-Bashforth Predictor- Corrector Method.			
Module 2: Curve Fitting			10 Hrs
Curve Fitting-Empirical laws -Linear law - Laws reducible to Linear law- Method of group averages - straight line and parabola -Principle of Least squares -Fitting straight line, parabola and exponential curve			
Module 3: Probability			17 Hrs
Basic concepts-Addition and Multiplication law of probability – Conditional probability - Random Variable- One dimensional random variable Discrete and continuous random variables- moment generating functions -Simple problems - Probability mass function - Probability density function - Standard distributions-Discrete distributions -Binomial, Poisson, Geometric– Continuous distributions - Uniform, Exponential, Normal distributions.			
Total Hours:			45 Hrs
Course Outcomes: (Laboratory)			
Upon the completion of the course, students shall have ability to			
C403.1	Use MATLAB visualization tools analyze engineering problems		
C403.2	Use MATLAB in-built functions for numerically solve engineering problems.		

C403.3	Understand and apply basic functions in MATLAB for curve fitting.
C403.4	Use R programming basic functions for fitting a line and curves
C403.5	Able to apply the R programming from a Probability perspective
C403.6	To apply the R programming in-built functions for probability distribution functions

Laboratory Component:

S.No	List of Experiments	CO Mapping	RBT
1.	To Calculating Newton's forward and backward difference Interpolation using MATLAB	C403.1	[AP]
2.	To calculate the value of Numerical Differentiation by Newton forward and Backward interpolation formulae using MATLAB.	C403.1	[AP]
3.	To find the solution of ODE by single step methods using MATLAB	C403.2	[AP]
4.	To find the solution of ODE by Multistep methods using MATLAB	C403.2	[AP]
5.	Use least square fit in MATLAB to find coefficients of a function.	C403.3	[AP]
6.	Use least square fit in R programming to find coefficients of a function.	C403.4	[AP]
7.	To fit straight line and parabola curve Using R programming.	C403.4	[AP]
8.	To fit exponential curve Using R programming.	C403.4	[AP]
9.	To find mean and standard deviation of random variable Using R programming.	C403.5	[AP]
10.	To find the Probability density function Using R programming	C403.5	[AP]
11.	To find the probability of discrete distribution Using R programming.	C403.6	[AP]
12.	To find the probability of continuous distribution Using R programming.	C403.6	[AP]

Text Books:

1	Grewal B.S., Numerical methods in Engineering and Science. 10th edition, Khanna Publishers, 2014.
2	Kreyszig. E, —Advanced Engineering Mathematics, tenth Edition, John Wiley and Sons (Asia) Limited, Singapore, 2014.
3	Gupta, S.C., & Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand & sons, 2000, Reprint 2014.
4	Palaniammal.S.,-Probability and Random Processes, Prentice hall of India, New Delhi, 2014, Reprint 2015

Reference Books:

1	Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012.
2	Jain M.K. Iyengar, K & Jain R.K., Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd, Publishers 2013.
3	Kandasamy.P, Thilagavathy, K, P. Gunavathy, "Numerical Methods", 3rd edition, S.Chand and company Pvt.Ltd., 2013
4	Peebles Jr.P.Z., -Probability Random Variables and Random signals principles, Tata McGraw- Hill Publishers, Fourth edition, New Delhi, 2002.
5	G. Jay Kerns, "Introduction to Probability and Statistics Using R", Lulu Publishers First Edition, 2010.

Web References:

1	https://nptel.ac.in/courses/111/106/111106101/
2	http://nptel.ac.in/courses/112106064/

3	http://nptel.ac.in/courses/111103070/				
Online Resources:					
1	https://ocw.mit.edu/courses/.../18-335j-introduction-to-numerical-methods				
2	www.edx.org/Probability				
3	https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/				
Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical& Project	
	CIA-I [10 marks]	CIA-II [10 marks]	CIA-III [10 marks]	Rubric based CIA [30 Marks]	
Remember	20	20	20	20	20
Understand	30	30	30	30	30
Apply	50	50	50	50	50
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Articulation Matrix (Theory)															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-		-	-
4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-		-	-
6	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	-	-	-	-	-	-	-	-	0.6	-	-
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			
Course Articulation Matrix (Laboratory)															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3
1	1	1	-	-	3	-	-	-	-	-	-	-	1	-	-
2	2	2	-	-	3	-	-	-	-	-	-	-	1	-	-
3	3	3	-	-	3	-	-	-	-	-	-	-		-	-
4	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
5	3	3	-	-	3	-	-	-	-	-	-	-		-	-
6	3	3	-	-	3	-	-	-	-	-	-	-	1	-	-
Avg	2.5	2.5	-	-	3	-	-	-	-	-	-	-	0.6	-	-
1	Reasonably agreed				2	Moderately agreed					3	Strongly agreed			

20IT101	PYTHON PROGRAMMING (COMMON TO CSE / IT / ECE / EEE / MCT)		3/0/2/4
Nature of Course	F (Theory Programming)		
Pre requisites	Nil		
Course Objectives:			
1.	To understand and execute Python script using types and expressions.		
2.	To understand the difference between expressions & statements and to understand the concept of assignment semantics.		
3.	To utilize high level data types such as lists and dictionaries.		
4.	To import and utilize a module and to perform read & write operations on files.		
Course Outcomes			
Upon completion of the course, students shall have ability to			
C101.1	Recognize the general principles and good Algorithmic Problem Solving		[R]
C101.2	Read, write, execute by hand simple Python programs.		[U]
C101.3	Structure simple Python programs for solving problems.		[U]
C101.4	Decompose a Python program into functions.		[AP]
C101.5	Represent compound data using Python lists, tuples and dictionaries.		[AP]
C101.6	Read and write data from / to files in Python Programs.		[AN]
Course Contents:			
ALGORITHMIC PROBLEM SOLVING, DATA, EXPRESSIONS, STATEMENTS: 15 Hours			
Algorithms, Building Blocks of Algorithms (Statements, State, Control Flow, Functions), Notation (Pseudo Code, Flow Chart, Programming Language), Algorithmic Problem Solving, Simple strategies for developing algorithms (Iteration, Recursion). Illustrative Problems: Find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range. Python Interpreter and Interactive Mode; Values and Types: Int, Float, Boolean, String and List; Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules and Functions, Function Definition and Use, Flow of Execution, Parameters and Arguments; Illustrative Programs: Exchange the values of two Variables, Circulate the values of n variables, distance between two points.			
CONTROL FLOW, FUNCTIONS: 15 Hours			
Conditionals: Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: State, While, For, Break, Continue, Pass; Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions and Methods, String Module; Lists as Arrays. Sets -Set Operations, Classes. Illustrative Programs: Sum an array of numbers.			
LISTS, FILES, MODULES, PACKAGES: 15 Hours			
Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple as Return Value; Dictionaries: Operations and Methods; Advanced List Processing - List Comprehension; Files and Exception: Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages; Numpy and			

Numpy Operations, Pandas and pandas operations, Matplotlib: types of plots. Case study: Analyze the academic performance of students and plot a graph.	
Total Hours:	45
Laboratory Component:	
S. No	List of Experiments
1.	Compute the GCD of two numbers.
2.	Find the square root of a number (Newton's method).
3.	Exponentiation (power of a number).
4.	Find the maximum of a list of numbers.
5.	Linear search and Binary search.
6.	Selection sort, Insertion sort.
7.	Merge sort.
8.	First n prime numbers.
9.	Multiply matrices.
10.	Programs that take command line arguments (word count).
11.	Plotting datasets.
12.	File handling and plotting.
Total Hours:	30
Text Books:	
1.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2 nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).
2.	Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3.	Tony Gaddis, "Starting out with Python", 2nd edition, Addison Wesley, Pearson, 2012
Reference Books:	
1.	Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2.	Timothy A. Budd, "Exploring PythonII", Mc-Graw Hill Education (India) Private Ltd., 2015.
3.	John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.
Web References:	
1.	http://nptel.ac.in/courses/106106145/

2.	https://www.codecademy.com/learn/learn-python				
3.	https://www.coursera.org/learn/python-data-analysis#syllabus				
Online Resources:					
1.	https://www.programiz.com/python-programming				
2.	https://www.fullstackpython.com/best-python-resources				
Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy					
Summative assessment based on Continuous and End Semester Examination					
Revised Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA [30 Marks]	
Remember	30	30	20	-	20
Understand	40	30	30	30	30
Apply	30	40	50	70	50
Analyse					
Evaluate					
Create					

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	3	3	3	3	3	3	1	1			1	1	3	3	3
C101.2	3	3	3	3	3	3	1	1			1	1	3	3	3
C101.3	3	3	3	3	3	3	1	1			1	1	3	3	3
C101.4	3	3	3	3	3	3	1	1			1	1	3	3	3
C101.5	3	3	3	3	3	3	1	1			1	1	3	3	3
C101.6	3	3	3	3	3	3	1	1			1	1	3	3	3

20EE405	ELECTRICAL MACHINES - II LABORATORY		0/0/2/1
Nature of Course:		M (Practical Application)	
Course Pre-requisites		Electrical Machines - I Laboratory	
Course Objective:			
To expose the operation of Synchronous and Induction Machines and give them experimental skills.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C405.1	Evaluate the performance of Synchronous Generator by conducting various tests.		[A]
C405.2	Obtain the characteristics of V and inverted V curves in Synchronous Motor.		[U]
C405.3	Analyse the performance of Induction Machines.		[A]
C405.4	Simulate and analyse the performance Induction Machines using Software.		[A]
C405.5	Experiment a specific Braking for Induction Machines.		[AP]
List of Experiments			
1.	Performance characteristics of Three Phase Alternator by direct loading.		[U]
2.	Regulation of Three Phase Alternator by EMF and MMF methods.		[A]
3.	Regulation of Three Phase Alternator by ZPF method.		[A]
4.	Regulation of Three Phase Salient Pole Alternator by Slip test.		[A]
5.	V and Inverted V curves of Three Phase Synchronous Motor.		[AP]
6.	Load test on Single and Three Phase Induction Motor.		[AP]
7.	No Load and Blocked Rotor tests on Single Phase and Three Phase Induction Motor (Determination of Equivalent Circuit parameters).		[A]
8.	Separation of No-Load losses of Three Phase Induction Motor.		[A]
9.	Performance characteristics of Single Phase and Three Phase Induction Motors using Simulation.		[U]
10.	Braking of Three Phase Induction Motor.		[U]
Total Hours			30
Text Books:			
1	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education 5 th Edition, 2017.		
2	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.		
3	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.		
Reference Books:			
1	P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, Third Edition, 2013.		
2	M.G. Say, "Alternating Current Machines", Pitman Publishing Ltd., 4 th edition, 2013.		
3	A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 2010.		
Web Reference:			
1	http://nptel.ac.in/syllabus/syllabus.php?subjectId=108105018		
2	http://freevidelectures.com/Course/2335/Basic-Electrical-Technology/23		
3	https://www.electrical4u.com/deep-bar-double-cage-induction-motor/		
4	https://www.youtube.com/watch?v=b24jORRoxEc		
5	http://www.engineeringmatters.com/EngineeringMatters_Project_Maglev.pdf		

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 marks]	End Semester Examination [40 marks]
Remember	10	10
Understand	20	20
Apply	30	30
Analyse	40	40
Evaluate	0	0
Create	0	0

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C405.1	2	1							2			1	3		3
C405.2	2	1							2			1	3		3
C405.3	2	3	2	2					2			1	3		3
C405.4	2	1			3				2			1	3		3
C405.5	3	2	1	1					2			1	3		3

20EE406	CONTROL SYSTEMS LABORATORY		0/0/2/1
Nature of Course		M (Practical application)	
Course Pre-requisites		20EE403 – Control Systems	
Course Objective:			
To enable the students to strengthen their understanding of the design and analysis of control systems using modern software resources.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C406.1	Construct the transfer function a DC separately excited generator and obtain its characteristics		[AP]
C406.2	Construct the transfer function of the given DC Motor for Armature controlled and Field controlled cases		[AP]
C406.3	Demonstrate Servo and stepper motor System also to set up a closed loop position control system and study the system performance		[U]
C406.4	Analyse the time response and stability of first and second order Systems		[A]
C406.5	Design a Controllers and lag compensator for uncompensated system using simulation software		[C]
Course Contents:			
List of Experiments			
1.	Determination of transfer function of separately excited DC Generator		[AP]
2.	Determination of transfer function of Armature Controlled DC Motor		[AP]
3.	Determination of transfer function of Field Controlled DC Motor		[AP]
4.	Servo motor position control systems		[U]
5.	Stepper motor position control systems		[U]
6.	Simulation of first and Second order system for different test inputs		[A]
7.	Time response analysis for a second order system using simulation software		[A]
8.	Stability analysis of linear systems using digital s simulation software		[A]
9.	Design of P,PI,PD and PID controllers for type-0 and type-1 system using		[C]
10.	Design of lag, lead and lag-lead compensator for uncompensated system using simulation software.		[C]
Total Hours			30
Text Books:			
1	I. J. Nagrath & M. Gopal, “Control Systems Engineering”, 6 th Edition, New Age International Publishers , 2017.		
2	Katsuhiko Ogata, “Modern Control Engineering”, 5 th edition, Pearson, New Delhi, 2015.		
3	Farid Golnaraghi & Benjamin C. Kuo, “Automatic Control systems”, 9 th Edition, Wiley, 2014.		
Reference Books:			
1	Norman S. Nise, “Control Systems Engineering”, Wiley, New Delhi, 2018.		
2	Richard Poley, “Control Theory Fundamentals”, 2 nd Edison, Createspace, 2014.		
3	Richard C. Dorf, Robert H.Bishop, “Modern Control Engineering”, 13 th Edition, Pearson Education, New Delhi, 2016.		
4	A.Nagoorkani, “Control Systems Engineering”, RBA Publications 2014.		
5	S.Palani, “Control Systems Engineering”, 2 nd Edition, Tata McGraw-Hill Education,2010.		

Web References:

1	http://www.nptel.ac.in/courses/108101037/
2	http://www.nptel.ac.in/courses/108102043/
3	https://nptel.ac.in/courses/108101037/14

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	0	0
Understand	20	20
Apply	30	30
Analyse	30	30
Evaluate	0	0
Create	20	20

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C406.1	3	2	1	1						2			3		
C406.2	3	2	1	1						2			3	1	
C406.3	2	1											2	1	
C406.4	3	3	2	2	3			2	2	1		2	2	1	
C406.5	3	3	3	3	3			2		1	1	2	2		2

20EE407	LINEAR INTEGRATED CIRCUITS LABORATORY		0/0/2/1
Nature of Course		M (Practical application)	
Course Pre-requisites		20EE404 – Linear Integrated Circuits	
Course Objective:			
To enable the students to strengthen their understanding of the design and analysis of OPAMP circuits.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C407.1	Evaluate the linear and non-linear applications of Op-amp circuits	[A]	
C407.2	Examine the electrical parameters of Op-amp and the input/output voltage relations of the precision circuits	[A]	
C407.3	Design Waveform generator using OPAMP circuits	[A]	
C407.4	Design oscillator circuit using IC-741	[A]	
C407.5	Construct A/D and D/A converter using OPAMP	[A]	
Course Contents:			
List of Experiments			
1	Implementation of Inverting and Non inverting Amplifier using Op-amp.	[AP]	
2	Implementation of Zero crossing detector, Peak Detector using Op-amp	[AP]	
3	Implementation of Adder and subtractor using Op-amp	[AP]	
4	Implementation of Comparator, Integrator and Differentiator using Op-amp	[AP]	
5	Design of Astable and Monostable multi vibrators using 555 timers	[A]	
6	Design and testing of precision rectifier and peak detector circuits using Op-amp.	[A]	
7	Design of square wave generator for a specified frequency and duty cycle, using OPamp IC741	[A]	
8	Design of triangular wave generator from square wave generator.	[A]	
9	Design of a sinusoidal oscillator for specified frequency based on Wien bridge and RC phase shift oscillators using IC-741	[A]	
10	Design of A/D and D/A converters using Op-amp.	[A]	
11	Implement the design of voltage regulator in 78XX and 79XX series	[AP]	
Total Hours			30
Text Books:			
1	D. Roy Choudary, S.B. Jain, " Linear Integrated Circuits", Third edition, New Age publishers, 2014.		
2	Ramakant A Gayakwad , " Opamps and Linear Integrated Circuits" , IV edition, Pearson Education/ PHI, 2009		
3	J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.		
Reference Books:			
1	James M.Fiore, "Opamps and Linear Integrated Circuits", Cengage Learning India Pvt Ltd, 1st edition, 2010.		
2	P. R. Gray and R. G. Meyer," Analysis and Design of Analog Integrated Circuit, John Wiley, 4th Ed, Reprint 2009		
3	Jacob MillmanChristos, HalkiasChetan D Parikh, "Integrated Electronics: Analog and		

	Digital Circuits and Systems”, McGraw Hill, 2nd edition, 2011
Web References:	
1	www.ti.com/amplifier-circuit/overview.html
2	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-101-introductory-analog-electronics-laboratory
3	https://electricvlab.com/vtu-analog-electronics-lab/

Assessment Methods & Levels (based on Bloom’s Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom’s Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	0	0
Understand	20	20
Apply	30	30
Analyse	30	30
Evaluate	0	0
Create	20	20

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C407.1	3	2	1	1						2			3		
C407.2	3	2	1	1						2			3	1	
C407.3	2	1											2	1	
C407.4	3	3	2	2	3			2	2	1		2	2	1	
C407.5	3	3	3	3	3			2		1	1	2	2		2

20EE501	Power Electronics		3/0/0/3
Nature of Course		G (Theory and Analytical)	
Course Pre-requisites		Analog Electronics	
Course Objectives:			
1. To understand the characteristics of Power Semiconductor devices.			
2. To provide adequate knowledge of DC choppers.			
3. To impart the concepts of PWM inverters.			
4. To illustrate the operation of AC voltage regulators.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C501.1	Analyze the operation and characteristics of various power electronic devices.		[A]
C501.2	Design a DC-DC converter.		[AP]
C501.3	Implement various types of controlled rectifiers.		[A]
C501.4	Explain the operation of voltage and current source inverters.		[A]
C501.5	Illustrate the working principle of AC-AC Converter.		[U]
C501.6	Acquire and analyze various applications of power electronic circuits		[AP]
Course Contents:			
Module 1: DC to DC Converter			15 Hrs
Silicon carbide power devices, MOSFET and its characteristics, protection and gate drive circuits - Circuit Configuration and analysis - Buck, boost, buck - boost converter- Cuk and SEPIC converter - SMPS - Introduction to Resonant Converters- classification: ZVS and ZCS.			
Module 2: Rectifiers			15 Hrs
SCR and its characteristics - Single phase half and full wave rectifiers with R, RL, RLE load - Three phase half and full wave rectifiers with R, RL, RLE load - Design of filters - Dual Converter - Power factor improvement - Effect of source impedance.			
Module 3: Inverters and AC Voltage Controllers			15 Hrs
IGBT and its characteristics, gate drive circuits and heat sink - Single phase Half bridge and full bridge inverter - three phase inverters - constant voltage source and constant current source inverters - PWM control of inverters - single pulse, multi pulse, sinusoidal, space vector modulation techniques - AC to AC voltage controller - Introduction to Multilevel inverters - Role of power converters in Renewable energy and Electric vehicles.			
Total hours			45
Text Books:			
1.	Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics - Converters, Applications and Design", John Wiley & Sons edition 2011.		
2.	M.H. Rashid, "Power Electronics Circuits, devices and applications", Pearson Education, Inc. Edition 2014.		
3.	P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018.		
Reference Books:			
1.	Vedam Subramanian, "Power Electronics" New age international Second edition 2018.		
2.	M.D.Singh, "Power Electronics", Tata McGraw-Hill, 2 nd Edition 2014		

3.	Bimal K. Bose, “Modern Power Electronics & AC Drives”, Pearson,2015
Web References:	
1.	https://nptel.ac.in/courses/108101038/
2.	https://www.tutorialspoint.com/power_electronics/index.htm
3.	https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulinkautomatically-generating-controller-code-for-implementation-on-embedded-processor1535540362783.html
4.	https://in.mathworks.com/videos/series/developing-dc-dc-converter-control-with-simulink.html

Assessment Methods & Levels (based on Bloom’s Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom’s Level	Assessment Component		Marks
C501.1	Analyze	Quiz Simulation exercises Class Presentation Group Assignment		20
C501.2	Apply			
C501.3	Analyze			
C501.4	Analyze			
C501.5	Understand			
C501.6	Apply			
Summative assessment based on Continuous and End Semester Examination				
Bloom’s Level	Continuous Assessment			End Semester Examination [50 Marks]
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]	
Remember	-	-	-	-
Understand		-	20	20
Apply	50	40	50	50
Analyze	50	60	30	30
Evaluate	-	-	-	-
Create	-	-	-	-
Formative Assessment	Summative Assessment		Total	
	Continuous Assessment	End Semester Examination		
20	30	50	100	

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C501.1	3	3	2	2			1						3	2	
C501.2	3	2	1	1	2		2				1	2	3	3	
C501.3	3	3	2	2	2		2				1	2	3	3	
C501.4	3	3	2	2	1		2				1	2	3	2	
C501.5	2	1			1							2	3	2	
C501.6	3	2	1	1	2		3		2		2	3	3	3	

20EE502	Microcontrollers		3/0/0/3
Nature of Course		F (Theory Programming)	
Course-Prerequisites		Digital Circuits	
Course Objectives:			
1. Understand the architecture of Microcontrollers. 2. Analyze the working of various interfacing ICs. 3. To develop application-based Assembly Language programs.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C502.1	Illustrate the architecture of 8051 Microcontroller		[U]
C502.2	Develop assembly language programs using 8051 for various applications		[AP]
C502.3	Analyze the architecture of PIC Microcontroller		[A]
C502.4	Infer the architecture of ARM controller		[A]
C502.5	Construct the simple programs using ARM and PIC Microcontroller		[C]
Course Contents:			
Module 1: 8051 Microcontroller			15 Hrs
Overview of Microprocessors - 8051: Functional block diagram - Instruction set - addressing modes - Interrupt structure - Timer - I/O ports - Serial Communication, Simple programming - Key board and display interface - DC motor control - Stepper motor control.			
Module 2: PIC Microcontroller			15 Hrs
PIC18FXXX: Architecture - Data and program memory organization - Addressing modes - Instruction set - Move / Copy instructions, Arithmetic instructions, Logic instructions, Branches instructions, Bit Manipulation instructions, Read/Write instructions, Machine Control instructions - Timers - Interrupt, ISR, priority - Speed Control of Induction Motor.			
Module 3: ARM Controller			15 Hrs
ARM7TDMI: Features - Block diagram - Architecture - Addressing modes - Instruction set - Thumb instructions - Data processing instructions, Data transfer instructions, Branch and control instructions, Register load and store instructions, Multiple register load and store instructions, Status register access instructions, Coprocessor instructions - Seven Segment Display Interfacing with ARM Controller.			
Total Hours:			45
Text Books:			
1	Kenneth Ayala, "The 8051 Microcontroller", Cengage Learning Publications, 2 nd Edition, 2017.		
2	John. B.Peatman , " Design with PIC Microcontroller" , Prentice hall, 2012.		
3	Subrata Ghoshal, 8051 Microcontroller Internals, Instructions, Programming and Interfacing, Second edition, Pearson Education Asia, 2014.		
4	Myke Predko, "Programming and customizing the PIC microcontroller", Tata McGraw Hill Publishing Company Limited, Third Edition, 2008.		
5	Steve Furber, " ARM System –On – Chip architecture " , Addison Wesley, 2009.		
Reference Books:			
1	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", Prentice Hall Publications, 2nd Edition, 2008.		
2	Krishna Kant, "Microprocessor and Microcontrollers" Eastern Company Edition, Prentice Hall of India, New Delhi, 2 nd edition, 2013.		
3	Joseph Yiu, 'The Definitive Guide to the ARM Cortex-M0' Newnes – Elsevier, 2011		

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C502.1	Understand	Quiz Class Presentation Group Assignment Case study	20
C502.2	Apply		
C502.3	Analyze		
C502.4	Analyze		
C502.5	Create		

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

[illegible]

20EE503	Power System Analysis		3/1/0/4
Nature of Course		G (Theory Analytical)	
Course Pre-requisites		Transmission and Distribution	
Course Objectives:			
1. To understand the concepts of power systems and its components.			
2. To apply various numerical methods to analyze a power system in steady state and fault conditions.			
3. To analyze the stability concepts of power systems.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C503.1	Model the various power system components and calculate the per unit quantities.		[AP]
C503.2	Construct the bus admittance and impedance matrices.		[AP]
C503.3	Analyze various load flow conditions and calculate the load flow results.		[A]
C503.4	Classify the types of faults and analyze the power system on different fault conditions.		[A]
C503.5	Compute the stability of the system with the help of equal area criteria and Modified-Euler and Runge - Kutta methods.		[AP]
Course Contents:			
Module 1: Modelling of Power System and Load Flow Analysis			21 Hrs
Modelling of power, Single line diagram, per unit analysis, Formation of admittance matrix with and without mutual admittance, Study on sparse technique, Z - bus building algorithm without mutual system components impedances. Power flow analysis - Formation of load flow equations, load flow analysis - Gauss-Seidel, Newton-Raphson (polar form) and fast decoupled method. IEEE standard 3002 series (IEEE 3002.2, 3002.3 & 3002.9) and IEC standard 60909.			
Module 2: Short Circuit Analysis			21 Hrs
Short circuit analysis - Symmetrical fault - behavior of short circuit transients in generator and transmission line - Symmetrical fault analysis using Z bus algorithm - Current limiting reactors, Sequence components, sequence networks, Unsymmetrical fault analysis - Line to Ground, Line to Line, Double Line to Ground faults.			
Module 3: Power System Stability			18 Hrs
Power angle equation, Synchronizing power co-efficient, steady state, dynamic and transient stability, Equal area criterion, power swing curve, Swing equation - Solution using Rangekutta and Euler's method, Multi machine stability.			
Total Hours:			60

Text Books:				
1	Hadi Saadat, " Power System Analysis", Tata McGraw Hill, 2015			
2	John J. Grainger and Stevenson Jr. W. D, "Power System Analysis", McGraw Hill International edition, 2016			
3.	Kothari D. P and Nagrath I. J., "Modern Power System Analysis",3 rd Edition., Tata McGraw- Hill Publishing Company Limited.2011			
Reference Books:				
1	J. Duncan Glover, M.S Sarma & Thomas J Over bye, "Power System Analysis and Design" Cengage Learning , 5 th Edition 2011.			
2	Pai M. A., "Computer Techniques in Power System Analysis", 3 rd Edition, Tata McGraw- Hill Publishing Company Limited. 2014.			
3	Prabha Kundur.,"Power System Stability and Control" 5 th Edition., Tata McGraw-Hill Publishing Company Limited 2008,			
4	Abhijit Chakrabarti and Sunita Halder, "Power System Analysis Operation and Control", 3 rd Edition, PHI Publications.2010			
Web References:				
1	https://nptel.ac.in/courses/108105067/			
2	https://www.vlab.co.in/broad-area-electrical-engineering			
3	https://youtu.be/TdAqh20DDhE			
4	https://cosmolearning.org/courses/power-system-analysis-304/video-lectures/			
5	https://www.youtube.com/watch?v=biApXHVSRa8			
Assessment Methods & Levels (based on Bloom’s Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom’s Level	Assessment Component		Marks
C503.1	Apply	Quiz Problem Solving Case Study Simulation Tutorial		20
C503.2	Apply			
C503.3	Analyze			
C503.4	Analyze			
C503.5	Apply			
Summative assessment based on Continuous and End Semester Examination				
Bloom’s Level	Continuous Assessment			
	Theory			End Semester Examination (Theory) [50 Marks]
	CIA- I [10 Marks]	CIA-II [10 Marks]	CIA III [10 Marks]	
Remember	10	-	10	10
Understand	20	20	20	10
Apply	70	40	40	40
Analyse	-	40	30	40
Evaluate	-	-	-	-
Create	-	-	-	-
Formative Assessment				
Formative Assessment	Summative Assessment			Total
	Continuous Assessment	End Semester examination		
20	30	50		100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C503.1	3	2	1	1	2				1				2		
C503.2	3	2	1	1	2				1				2		
C503.3	3	3	2	2	3				1				3		
C503.4	3	3	2	2	3	1			1	1			3		
C503.5	3	2	1	1	2	1			1	2			3		

20EE504	Power Electronics Laboratory		0/0/2/1
Nature of Course	M (Practical application)		
Course Pre-requisites	Analog Electronics		
Course Objectives:			
1. To provide an opportunity to understand the operation, function and interaction between various components 2. To impart the knowledge in design, modelling and simulation of Power Electronic Converter based systems			
Course Outcomes			
Upon completion of the course, students shall have ability to			
C504.1	Examine the operation and characteristics of various power electronic components.	[AP]	
C504.2	Analyze the working of single - phase converter.	[A]	
C504.3	Analyze the characteristics of DC to DC chopper.	[A]	
C504.4	Illustrate the working operation of Three phase AC voltage controller.	[A]	
C504.5	Select the suitable simulation tool for constructing power converters	[A]	
C504.6	Examine the power converter application in DC drives.	[AP]	
Course Contents			
List of Experiments			
1.	V-I characteristics of SCR and TRIAC.	[AP]	
2.	V-I characteristics of MOSFET and IGBT.	[AP]	
3.	Switching characteristics of SCR and IGBT.	[AP]	
4.	Single-phase half and fully controlled Rectifiers.	[A]	
5.	Design a buck converter and boost converter circuit using power MOSFET.	[A]	
6.	Single phase IGBT based Inverter performance verification.	[A]	
7.	ZVS and ZCS converter.	[A]	
8.	AC-AC Voltage controller.	[A]	
9.	(a) Three phase fully Controlled rectifier.	[A]	
	(b) Three phase bridge inverter.	[A]	
10.	Speed control of DC and AC motors using power converter circuits	[AP]	
11.	Simulation of PE circuits (1 Φ and 3 Φ Semiconverter, 1 Φ and 3 Φ Full converter, DC-DC converters , AC voltage controller)	[E]	
Total Hours			30
Text Books:			

1	Ned Mohan, Tore M. Undeland & William P. Robbins, "Power Electronics – Converters, Applications and Design", John Wiley & Sons edition 2011.
2	M.D.Singh, "Power Electronics", Tata McGraw-Hill, 2 nd edition 2014
3	P.S. Bhimbra, "Power Electronics", Khanna Publishers edition 2018.
Reference Books:	
1	Vedam Subramanian, "Power Electronics" New age international Second edition 2018.
2	P.C. Sen, "Modern Power Electronics", Tata McGraw-Hill, edition 2018.
3	Bimal K. Bose, "Modern Power Electronics & AC Drives", Pearson, 2015
Web References:	
1.	https://nptel.ac.in/courses/108101038/
2.	https://www.tutorialspoint.com/power_electronics/index.htm
3.	https://in.mathworks.com/videos/developing-dc-dc-converter-control-with-simulinkautomatically-generating-controller-code-for-implementation-on-embedded-processor1535540362783.html
4.	https://in.mathworks.com/videos/series/developing-dc-dc-converter-control-withsimulink.html

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Rubric based Continuous Assessment [60 Marks]	End Semester Examination [40 Marks]	
Remember	-	-	
Understand	-	-	
Apply	60	60	
Analyze	30	30	
Evaluate	10	10	
Create	-	-	
Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C504.1	2	1			3								3	2	
C504.2	3	3	2	2	3	2	2		2		2	2	3	3	

C504.3	3	3	2	2	3	2	2		2		2	1	3	3	
C504.4	3	3	2	2	3	2	2		2		2	2	3	3	
C504.5	3	2	1	1	2	2	2				2	3	2	2	
C504.6	3	2	1	1	3	2	2		2		2	2	3	3	

20EE505	Microcontrollers Laboratory		0/0/2/1
Nature of Course		M (Practical application)	
Course Pre-requisites		Digital Circuits	
Course Objectives:			
1. To illustrate the arithmetic and logical operations.			
2. To interface the external devices with the Microcontroller.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C505.1	Develop the ALP to solve the arithmetic operations using Microcontroller.	[AP]	
C505.2	Analyze various Logical and Control operations using 8051.	[A]	
C505.3	Analyze on various interfacing ICs according to the users requirements.	[A]	
C505.4	Design and verify the output of Assembly Language Programs using motors.	[AP]	
C505.5	Apply the knowledge for real-time problems using ARM and PIC	[AP]	
Course Contents:			
List of Experiments			
1.	Arithmetic operation using 8051 Microcontroller.	[A]	
2.	Minimum, maximum and sorting data using 8051 Microcontroller.	[A]	
3.	Code conversion using 8051 Microcontroller.	[A]	
4.	8279 Keyboard & display interfacing with 8051 Microcontroller.	[AP]	
5.	Stepper motor control using 8051.	[AP]	
6.	DC motor speed measurement and control using 8051.	[AP]	
7.	Simple arithmetic operations: Addition/Subtraction/Multiplication/Division using PIC Controller	[A]	
8.	Simulation based Speed control of Induction Motor using PIC controller.	[AP]	
9.	ARM Assembly program for Arithmetic and Logical Operations.	[A]	
10.	Simulation based Seven Segment Display Interfacing with ARM Controller.	[AP]	
Total Hours:			30
Reference Books:			
1	Krishna Kant, "Microprocessors and Microcontrollers, Architecture, Programming and System Design - 8085, 8086, 8051, 8096", Prentice Hall India Ltd Publications, 1st Edition, 2010.		
2	Kenneth Ayala, "The 8051 Microcontroller", Cengage Learning Publications, 3rd Edition, 2017.		
3	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay "The 8051 Microcontroller and Embedded Systems using Assembly and C", Prentice Hall Publications, 2nd Edition, 2008.		
Web References:			
1	https://www.youtube.com/watch?v=nPi3fmJpM8Y		
2	https://nptel.ac.in/courses/108105102/59		
3	https://nptel.ac.in/downloads/106108100/		

Assessment Methods & Levels (based on Bloom's Taxonomy)			
Summative assessment based on Continuous and End Semester Examination			
Bloom's Level	Rubric based Continuous Assessment [60 Marks]	End Semester Examination [40 Marks]	
Remember	-	-	
Understand	-	-	
Apply	60	60	
Analyse	40	40	
Evaluate	-	-	
Create	-	-	
Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C505.1	3	3	3	3	3	2	1	1	3	2	1	3		3	
C505.2	3	3	2	1	3	2			3	2	1	3		3	
C505.3	3	3	2	1	3	2			3	2	1	3		3	
C505.4	3	3	3	3	3	2	1	1	3	2	1	3		3	1
C505.5	3	2	1	1	3	2	1	1	3	2	1	3		3	1

20EE506	Power System Simulation Laboratory	0/0/2/1
Nature of Course	M (Practical application)	
Pre Requisites:	Transmission and Distribution	
Course Objectives:		
1. To know and study about the transmission line parameters.		
2. To apply iterative techniques for power flow analysis.		
3. To Impart Knowledge on stability.		
Course Outcomes:		
Upon completion of the course, students shall have ability to		
C506.1	Construct the bus admittance and impedance matrices.	[AP]
C506.2	Examine the Load flow problems and calculate the load flow results.	[A]
C506.3	Classify the types of faults and analyze the power system on different faulted conditions.	[AP]
C506.4	Illustrate the concepts of transient and steady state stability in power systems.	[A]
C506.5	Analyze the multi machine stability	[E]
COURSE CONTENTS		
1.	Computation and Modelling of Transmission Line Parameters.	[AP]
2.	Formation of Bus Admittance Matrix with and without mutual element.	[AP]
3.	Formation of Bus Impedance Matrix.	[AP]
4.	Load Flow Analysis by Gauss - Seidel Iterative Technique.	[A]
5.	Load Flow Analysis by Newton Raphson Technique.	[A]
6.	Symmetrical Fault Analysis.	[A]
7.	Unsymmetrical Fault Analysis.	[A]
8.	Steady State Stability Analysis.	[A]
9.	Transient Stability by point by point method.	[A]
10.	Stability analysis of Multi-Machine Infinite Bus System.	[E]
11.	State Estimation of Weighted-Least-Square State Estimation	[AP]
Total Hours:		30
Text Books:		
1	Tharangika Bambaravanage, Asanka Rodrigo, Sisil Kumarawadu, "Modeling, Simulation, and Control of a Medium-Scale Power System", Springer Nature Singapore Pte Ltd, 2018.	
2	Hadi Saadat, " Power System Analysis", Tata McGraw Hill, 2015.	
3	John J. Grainger and Stevenson Jr. W. D, "Power System Analysis", McGraw Hill International edition, 2016..	
4	Kothari D. P and Nagrath I. J., "Modern Power System Analysis", 3rdEd., Tata McGraw-Hill Publishing Company Limited, 2011.	
Reference Books:		
1	J.Duncan Glover, M.S Sarma & Thomas J Overbye, "Power System Analysis and design" Cengage Learning , 5 th edition 2011.	
2	Pai M. A., "Computer Techniques in Power System Analysis", 3 rd Ed., Tata McGraw-Hill Publishing Company Limited. 2014.	
3	Prabha Kundur., "Power System Stability and Control" 5 th Ed., Tata McGraw -Hill Publishing Company Limited 2008,	
Web References:		
1	https://nptel.ac.in/courses/108105067/	
2	https://www.vlab.co.in/broad-area-electrical-engineering	
3	https://youtu.be/TdAqh20DDhE	
4	https://www.youtube.com/watch?v=BaKC7v8bRsg&t=3099s	

Online Resources:	
1	https://cosmolearning.org/courses/power-system-analysis-304/video-lectures/
2	https://www.youtube.com/watch?v=biApXHVSRa8

Assessment Methods & Levels (based on Bloom's Taxonomy)		
Summative assessment based on Continuous and End Semester Examination		
Bloom's Level	Rubric based Continuous Assessment [60 Marks]	End Semester Examination [40 Marks]
Remember	10	10
Understand	20	20
Apply	30	30
Analyse	20	20
Evaluate	20	20
Create	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	60	40	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C506.1	3	2			3				1				3		
C506.2	3	3	2	2	3			2	1				3		2
C506.3	3	2	1	1	3				1				3		
C506.4	3	3	2	2	2			2	1				3		2
C506.5	3	3	3	3	3			2	1				3		2

PROFESSIONAL ELECTIVE COURSES

20EE907	Renewable Energy and Storage Systems		3/0/0/3
Nature of Course		D (Theory Application)	
Course Pre-Requisites		Nil	
Course Objectives:			
1. To study different non-conventional energy systems and its applications.			
2. To enhance student's knowledge and assimilate new technologies.			
3. To learn techno-economical storage methods of renewable energy systems.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C907.1	Enumerate the need of renewable energy and Analyze the concept of Kyoto protocol, energy scenario in India and Integrated Resource Plan		[U]
C907.2	Assess the role of Solar and wind energy in power plants		[A]
C907.3	Apply the ideas of renewable energy sources to perform case studies		[AP]
C907.4	Assess the role of biomass, tidal and geothermal in power plants		[A]
C907.5	Illustrate the operation and importance of different energy storage methods		[U]
C907.6	Investigate the integration of renewable energy systems in Power plants		[AP]
Course Contents:			
Module 1: Introduction		15 Hrs	
Over View of Conventional Power Plants - Importance of Sustainable energy source - Types of Sustainable Energy sources - Limitations of Sustainable Energy sources - Present Indian and international energy scenario of conventional and sustainable energy sources – Kyotoprotocol - Concept of clean development mechanism and proto type carbon funds - Integrated resource plan.			
Module 2: Wind Energy and Solar Energy		15 Hrs	
Power in the Wind - Types of Wind Power Plants (WPPs) - Components of WPPs-Working of WPPs - Site selection of WPPs - Grid integration issues of WPPs. Solar Power, Radiation Measurement, Solar thermal, solar photovoltaic, Cells, Module and array types - series and parallel connections - Maximum power point tracking, grid interactive solar PV systems - Applications. Case studies on solar PV system, wind energy system.			
Module 3: Other Energy Sources and Storage Methods		15 Hrs	
Methods to generate - Biomass energy, tidal energy, geothermal energy, fuel cells and Ocean thermal energy conversion its applications - Storage methods of mechanical, chemical, electromagnetic, electrostatic and thermal energy - Selection and significance of Batteries - Hybrid energy systems and hybrid electric vehicles.			
Total Hours:			45
Text Books:			
1	John T widwell and Tony Weir, "Renewable Energy Resources",4 th Edition, Routledge, 2021.		
2	B.H.Khan, "Non-Conventional Energy Resources",3 rd Edition, Tata McGraw Hill New Delhi, 2017.		
3	G D Rai, 'Non-conventional Energy sources', Khanna Publishers, 5th Edition, 2014.		

Reference Books:			
1	Sukhatme, “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.		
2	Aldo Vieira DaRosa ,“ Fundamentals of Renewable Energy Processes”, Academia Press ,2013		
3	G.Masters, “Renewable and Efficient Electric Power Systems”, IEEE-Wiley Publishers, 2013.		
Web References:			
1	http://unfccc.int/kyoto_protocol/items/2830.php		
2	https://www.coursera.org/learn/wind-energy		
3	https://www.edx.org/course/solar-energy-delftx-et3034x-0		
Assessment Methods & Levels (based on Bloom’sTaxonomy)			
Formative assessment based on Capstone Model (Max.Marks:20)			
Course Outcome	Bloom’sLevel	AssessmentComponent	Marks
C907.1	Understand	Quiz	20
C907.2	Analyze	GroupAssignment	
C907.3	Apply	Classpresentation	
C907.4	Analyze	Group Assignment	
C907.5	Understand	Quiz	
C907.6	Apply	Classpresentation	

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination [50 Marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Remember	10			5	10
Understand	60	10	10	15	60
Apply	-	40	50	30	-
Analyse	30	50	40	50	30
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C907.1	2	1				2	2	2				1			1
C907.2	3	3	2			2	3	1				3	1	2	2
C907.3	3	3	2	1		2	3	1		1		3	1	2	1
C907.4	3	3	2			2	3	1				3	1	2	1
C907.5	2	1				2	3	1				3	1	1	1
C907.6	3	3	2	2		2	3	2		1		3	1	2	2

20EE909	HVDC Transmission Systems		3/0/0/3
Nature of Course		D (Theory application)	
Pre-requisites		Transmission and Distribution	
Course Objectives:			
1. To understand the concept, planning of DC power transmission and comparison with AC power transmission.			
2. To acquire the knowledge about HVDC Converters and HVDC System Control.			
3. To analyze Harmonics of HVDC system.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C909.1	Summarize the basic concepts of AC and DC power transmission.	[U]	
C909.2	Enumerate the configuration of converters in HVDC Transmission.	[U]	
C909.3	Analysis of VSC topologies and firing schemes.	[A]	
C909.4	Explain the Principles of DC link control, Firing angle control, Current and Extinction angle control for HVDC system.	[U]	
C909.5	Analysis of AC and DC filters for Reactive power and Harmonic controlling HVDC system.	[A]	
Course Contents:			
Module 1: Introduction to HVDC Transmission 15 Hrs			
Need for DC power transmission, Comparison of AC and DC Transmission, Components of HVDC transmission system ,Types of HVDC System, Modern trends in HVDC Technology, HVDC Transmission Based on Voltage Source Converters and Line commutated converters MTDC System-Types and applications of MTDC systems, Analysis of HVDC Converters - Analysis of Graetz circuit with and without overlap , Pulse number, Choice of converter configuration, Converter bridge characteristics, Multiple pulse Converters - Analysis of VSC and LCC topologies, Firing schemes.			
Module 2: HVDC System Control 15 Hrs			
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, Control of VSC based HVDC link.			
Module 3: Reactive Power and Harmonics Control 15 Hrs			
Reactive power requirements in steady state - Sources of reactive power - SVC and STATCOM - Generation of harmonics - Design of AC and DC filters - Active filters.			
Total Hours:			45
TextBooks:			
1	Padiyar,K.R, "HVDC Power Transmission System", New Age International Pvt Ltd, New Delhi, Third Edition,2017.		
2	S Kamakshaia,H,V.Kamaraju., "HVDC Transmission" McGraw-Hill Education, 2011		
ReferenceBooks:			
1	Vijay K. Sood, Gil-Soo Jang, Seong-Joo Lim, Seok-Jin Lee, Chan-KiKim, "HVDC Transmission: Power Conversion Applications in Power Systems" Springer Publication, 2013		
2	Dragan Jovcic,"High Voltage Direct Current Transmission: Converters, Systems and DC Grids", John Wiley and Sons Ltd, Second Edition,2019		
3	Edwart, K., "Direct Current Transmission (Vol.1)", John Wiley and Sons,2008.		
4	Jos Arrillaga, Y. H. Liu, Neville R. Watson " Flexible Power Transmission: The HVDC Options". Wiley 2007		

Web References:	
1	https://nptel.ac.in/courses/108104013/
2	https://www.gegridolutions.com/PowerD/catalog/hvdc.htm
3	https://www.youtube.com/watch?v=ZOTGuWCfS-A
4	https://www.youtube.com/watch?v=OMn653OhbLg
5	https://in.mathworks.com/videos/active-power-factor-correction-1546869199547.html

Assessment Methods & Levels (based on Blooms' Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom's Level	Assessment Component		Marks
C909.1 & C909.2	Analyze	Quiz		20
C909.3 & C909.5	Analyze	Group Assignment		
C909.4	Understand	Class Presentation/Power point presentation		
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination
	CIA1 (10 Marks)	CIA2 (10 Marks)	CIA3 (10 Marks)	(50 Marks)
Remember	30	20	20	20
Understand	50	35	30	30
Apply	20	25	50	30
Analyze	-	20	-	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C909.1	2	1										1	2		
C909.2	2	1										2	2		
C909.3	3	3	2	2	1								3	2	1
C909.4	2	1											1	1	
C909.5	3	3	2	2	1							1	2	1	1

20EE911	Automotive Electronics		3/0/0/3
Nature of Course:		D (Theory application)	
Course Pre-requisites		Analog Electronics	
Course Objectives:			
1. To instil a fundamental understanding of various electronic functionalities in automotive.			
2. To make them gain knowledge on lighting system, sensors and accessories employed in automotive.			
3. To make them familiar with Digital Engine Control System and electronic dashboard instruments			
4. To broaden the importance of vehicle intelligence system and future of autonomous cars			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C911.1	Explore the principles and construction of automotive batteries and charging system.		[U]
C911.2	Comprehend the functions of starting, ignition and injection system pertaining to electronic management techniques.		[U]
C911.3	Categorize the functionalities and types of lighting system and accessories of automotive systems.		[A]
C911.4	Articulate the function of automotive sensors in suitable monitoring applications.		[AP]
C911.5	Assess the role of electronic dashboard instruments and vehicle intelligence technology in advanced design of automotive.		[E]
Course Contents:			
Module 1: Charging, Starting, Injection and Ignition System		15 Hrs	
Automotive fundamentals, Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries, Types of batteries used in electric vehicles, Advanced charging system technology. Types, Construction and working of Starting system, Electronic Ignition systems, Distributor less ignition system, Electronic fuel injection systems and Digital Engine Control System.			
Module 2: Lighting System, Accessories and Sensors		15 Hrs	
Lighting System – Overview of interior and exterior lights, Headlight dazzling and preventive methods, Intelligent lighting system Accessories - Electrical fuel pump, Speedometer, Fuel, oil and temperature gauges, Horn, Wiper system, Automotive alarms, Parking System. Sensors - Basic sensor arrangement, Oxygen sensor, Crank angle position sensor, Vehicle speed sensor, Detonation sensor, Altitude sensor, Mass Air Flow sensor and Throttle position sensors.			
Module 3: Electronic dashboard instruments and Vehicle Intelligence		15 Hrs	
On-board diagnosis system, security and warning system - anti - lock braking system, Tyre pressure monitoring system, Collision avoidance system, Key less entry system and Electronic power steering system - Vehicle Intelligence - Introduction - Basics of OBD-II, CAN and LIN Protocols - Case Study: Architecture for vision based autonomous road vehicles features and applications.			
Total Hours:			45
Text Books:			
1	Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall,		

	London, 2012.
2	Vinal. G.W., Storage Batteries, John Wiley & Sons Inc., New York, 4 th edition, 2012.
3	Bosch Automotive Electrics and Automotive Electronics, Springer, 5 th Ed, 2014
Reference Books:	
1	William B. Ribbens, Understanding Automotive Electronics, 6th Edition, Butterworth, Heinemann Woburn, 2003.
2	Automotive Hand Book, Robert Bosch, Bently Publishers, 2004.
3	Hod Lipson, Melba Kurman, Driverless: Intelligent Cars and the Road Ahead, MIT Press, 2016
Web References:	
1	www.boschindia.com/.../automotive_electronics.../automotive-electronics.html
2	www.innovianttechnologies.com/automotive-electronics
3	https://www.electronicweekly.com/market-sectors/automotive-electronics

Assessment Methods & Levels (based on Bloom's Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom's Level	Assessment Component		Marks
C911.1	Understand	Quiz Case Study Class Presentation Group Assignment		20
C911.2	Understand			
C911.3	Analyse			
C911.4	Apply			
C911.5	Evaluate			
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	
Remember	50	-	-	-
Understand	50	-	50	50
Apply	-	50	-	20
Analyse	-	50	40	20
Evaluate	-	-	10	10
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C911.1	3	3	2	2	3		1						3	2	
C911.2	3	3	2	2	3		2				2	2	3	2	
C911.3	3	3	2	2	3		2				2	2	3	2	
C911.4	2	1			2		2				2	2	2		
C911.5	2	1			2		2				2	2	2		

20EE912	Virtual Instrumentation		2/0/2/3
Nature of Course:		E (Theory skill based)	
Course Pre-requisites		Measuring Instruments and Smart sensors	
Course Objectives:			
1. To understand the architecture of VI and basic programming concepts in software tool.			
2. To learn different Data Acquisition system concepts.			
3. To develop real time applications using software tool.			
4. To study various Instrument Interfacing protocols.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C912.1	Explain the architecture and features of Virtual Instrument		[U]
C912.2	Create the graphical programming in LabVIEW software.		[C]
C912.3	Illustrate the basic concepts of PC based data acquisition		[U]
C912.4	Analyze the Control system design and PID Controller toolkits in LabVIEW		[A]
C912.5	Demonstrate the use of LabVIEW Toolkit in Image Processing and Machine vision applications		[A]
Course Contents:			
Module 1: VI Programming Techniques			10 Hrs
Block diagram and Architecture of VI - Graphical System Design (GSD) model - Comparison with conventional programming - LabVIEW Software environment VI's and sub -VI's - Loops - Arrays - Clusters - Graphs and charts - Case and sequence structures - Formula nodes - Local and global variable - String and File I/O.			
Module 2: DAQ and Analysis Tools			10 Hrs
Concept of PC based data acquisition - DAQ Software Architecture-DAQ Assistant - Analog Input and Analog Output - Digital Input and Digital Output - Timers-Counters - Grounding: Differential and Single Ended - Increasing Measurement Quality of DAQ - Temperature based data acquisition system			
Module 3: LabVIEW Tools and Applications of VI			10 Hrs
Control Design and Simulation Tools – PID Control Toolkit- IMAQ: Image processing and analysis - Machine Vision- Motion Control- Web Publishing Tools -Simple programming with Arduino Uno- LabVIEW interface			
Lab Component			
1	Creating Virtual Instrumentation for simple applications		[A]
2	Programming exercises for loops		[A]
3	Programming exercises for arrays		[A]
4	Programming exercises for clusters		[A]
5	Build a VI using Graphs and Charts		[A]
6	Build a VI using Case and sequence structures		[A]
7	Programming exercises for Strings & File I/O		[A]
8	Real time temperature-based data acquisition system.		[A]
9	Programming exercises for Control Design Toolboxes		[E]
10	Programming exercises for IMAQ Toolboxes.		[E]
11	Programming exercises for Arduino Uno.		[E]
Total Hours:			45
Text Books:			
1	Jovitha Jerome, “Virtual Instrumentation using LabVIEW”, Prentice Hall, 2010.		

2	Gary W. Johnson, Richard Jennings, "Lab-view Graphical Programming", Tata McGraw Hill Professional Publishing, IV Edition, 2011.
3	Steve Mackay, Edwin Wright, John Park, and Deon Reynders, "Industrial Data Networks", Elsevier, 2010.
4	Marco Schwartz and Oliver Manickum "Programming Arduino with LabVIEW", Kindle Edition, 2015.

Reference Books:

1	P.Surekha, S.Sumathi, "LabVIEW based Advance Instrumentation", Springer, 2007.
2	Sanjay Gupta and Joseph John, "Virtual Instrumentation using LabVIEW", Tata McGraw-Hill Inc, 2017.
3	Behzad Ehsani, "Data Acquisition Using LabVIEW", Kindle Edition, 2016.
4	Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement Instrumentation and Control", Newness, 2000.

Web References:

1	http://www.ni.com/academic/students/learn-labview/
2	http://www.ni.com/academic/students/learn-daq/
3	https://www.electronicshub.org/labview-projects/
4	https://learn.ni.com/teach/resources

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination [50 marks]
	Theory			Rubrics based Practical Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA III [10 Marks]		
Remember	20	-	-	-	10
Understand	30	50	40	40	40
Apply	50	20	30	40	30
Analyse	-	-	-	-	-
Evaluate	-	-	30	20	10
Create	-	30	-	-	10

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
0	50	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C912.1	2	1													
C912.2	3	3	3	3	3			2	2	2		3	2		2
C912.3	2	1						2	2	2		2	2	2	
C912.4	3	2	1	1						2		2	2	2	
C912.5	3	3	2	2	3			2	2	2		3	3		2

20EE913	Design of Electrical Machines		3/0/0/3
Nature of Course:	G (Analytical)		
Course Pre-requisites	Electrical Machines I and Electrical Machines II		
Course Objectives:			
1. To learn the basic design concepts. 2. To design DC machines, Transformers, Induction and Synchronous machines. 3. To apply the design procedures in CAD of electrical machines.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C913.1	Discuss the basic parameters and design considerations of electrical machines.		[U]
C913.2	Categorize the design of core, yoke and windings of DC machines and transformers.		[A]
C913.3	Analyze the design of squirrel cage and slip ring induction machines.		[A]
C913.4	Illustrate the design of synchronous machines.		[A]
C913.5	Apply the design procedures in CAD of electrical machines.		[AP]
Course Contents:			
Module 1: Basic Design Concepts			15 Hrs
Considerations and Limitations in design; Choice of specific electric and magnetic loadings; Concept of magnetic circuit; MMF calculation for various types of electrical machines; Real and apparent flux density of rotating machines; Thermal considerations, heat flow, temperature rise, rating of machines. Design of DC machines Output Equation; Main Dimensions; Choice of number of poles; Armature design; Design of air gap; Design of field poles and field coil; Design of commutator and brushes.			
Module 2: Design of Transformers			15 Hrs
Output rating of single phase and three phase transformers; Optimum design of transformers; Design of core, yoke and windings for core and shell type transformers; Design of tanks and cooling tubes of transformers. Introduction to Computer Aided Design of Electrical Machines - Method of design optimization - Introduction to FEM based design - Use of open source FEM software for 2D design - Computation of performance parameters of machine using FEM software.			
Module 3: Design of AC Machines			15 Hrs
Design of Induction Machine: Output Equation; Main dimensions; Design of stator; Design of squirrel cage and slip ring rotor; Design of Synchronous Machines - Output Equation; Main dimensions; Short circuit ratio - Design of stator and rotor of cylindrical pole and salient pole machines; Design of damper winding; Design of field coil; Cooling of large alternators.			
Total Hours:			45
Text Books:			
1	A.K.Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, New Delhi, 2013.		

2	S.K.Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing,2013.
3	M.V.Deshpande "Design and Testing of Electrical Machine Design", Wheeler Publications,2010.

Reference Books:

1	R.K.Agarwal, "Principles of Electrical Machine Design", S.K.Kataria and Sons,Delhi,2014.
2	M.G. Say, "Theory and Performance and Design of A.C. Machines", ELBS London,3 rd edition,2005.
3	K.M.V. Murthy, "Computer Aided Design of Electrical Machines",B.S.Publications, 2008.

Web References:

1	https://cusp.umn.edu/electric-machine-design-videos https://www.youtube.com/watch?v=LATwaGHEVbg
2	https://motorsolver.com/workshops/electric-machine-design-lectures/
3	http://www.ppi-engineering.com/design/
4	https://www.youtube.com/watch?v=P1l4pz7ohpA
5	https://www.youtube.com/watch?v=Caj6t5H1Jc4 -Three - Phase Induction Motor Model Design in ANSYS

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model(Max.Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C913.1	Understand	Class room Quiz Online Quiz Design based problem solving Tutorial Class Presentation Group Assignment	20
C913.2	Analyse		
C913.3	Analyse		
C913.4	Analyse		
C913.5	Apply		

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	ContinuousAssessment				End Semester Examination (Theory) [50 Marks]
	Theory			Formative Assessment [20 Marks]	
	CIA I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Remember	50	20	20	20	20
Understand	50	30	30	30	30
Apply	-	50	50	50	50
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-
Formative Assessment		Summative Assessment			Total
		Continuous Assessment		End Semester Examination	
20		30		50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C913.1	2	1											3		
C913.2	3	3	2	2									3		
C913.3	3	3	2	2									3		
C913.4	3	3	2	2									3		
C913.5	3	2	1	1	3							1	3		

20EE914	Special Electrical Machines		3/0/0/3
Nature of Course		D (Theory application)	
Course Pre-requisites		Nil	
Course Objectives:			
1. To learn the working operation and performance characteristics of Stepper motor			
2. To realize the performance characteristics of Switched reluctance motors.			
3. To impart knowledge on the performance of Permanent Magnet Brushless DC and Permanent Magnet Synchronous motors.			
4. To know about the control strategies of Linear and Servo motor.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C914.1	Enumerate the principle of operation and performance of Stepper motors.		[U]
C914.2	Analyze the performance of Switched reluctance motors.		[A]
C914.3	Apply the principle of Permanent magnet brushless D.C motor in appropriate field.		[AP]
C914.4	Illustrate the construction and operation of Permanent magnet synchronous motors.		[AP]
C914.5	Analyze the construction and operation of Linear and Servomotor.		[A]
Course Contents:			
Module 1: Stepping Motors and Switched Reluctance Motor			15 Hrs
Stepping Motors - Constructional features - Principle of operation - Variable reluctance motor - Hybrid motor - Permanent Magnet Stepper motor - Torque equations - Modes of excitations - Characteristics - Microprocessor control of stepping motors - Closed loop control. Switched Reluctance motor: Rotary and Linear SRMs - Constructional features - Principle of operation - Torque production mechanism- Power Converters and their controllers - Methods of Rotor position sensing - Sensor less operation - Closed loop control of SRM.			
Module 2: Permanent Magnet Motors			18 Hrs
Permanent Magnet Brushless DC motors - Introduction -Principle of operation, Permeance coefficient - Types - Magnetic circuit analysis - EMF and torque equations - Commutation - Power controllers - Motor characteristics and control. Permanent Magnet Synchronous Motor - Principle of operation - Ideal PMSM - EMF and Torque equations - Armature reaction MMF - Synchronous Reactance - Sine wave motor with practical windings - Phasor diagram - Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements. Torque Controllers, Self-control, Vector control, Current control schemes Application aspect related to vehicle and house hold.			
Module 3: Linear and Servomotors			12 Hrs
Linear Induction motor (LIM) classification - construction - Principle of operation - DC Linear motor (DCLM) types - circuit equation - DCLM control applications. Servomotor-Constructional features, Principle of operation, Types, Characteristics, Control strategies, linear actuators with DC servo motors. Application of linear and servo motor in automation industries. Principle of operation and characteristics of Hysteresis motor - AC series motors - Flux switching and Flux reversal motors.			
Total Hours:			45
Text Books:			
1	Berker Bilgin, James Weisheng Jiang, AliE madi, “ Switched Reluctance Motor Drives: Fundamentals To Applications” CRC press,2018		
2	T.J.E.Miller,” Switched Reluctance Motors and their Control” Magna Physics Publishing,2008.		

3	Dr.Duanek Hansel man," Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors" E-Man Press LLC,2012
4	T.Kenjo,S.Nagamori,"Permanent magnet and brushless DC motors" Oxford science publications,2003
5	E.G Janardanan, "Special Electrical Machines" Prentice Hall India Learning Private Limited,2014.

Reference Books:

1	Ahmed Tahor, Abdel Ghani Aissabui," Switched Reluctance Motor- Concept, Control and Applications", In Tech Open, 2017
2	Riazollah Firoozian,"Servo Motors and Industrial Control Theory" Springer International Publishing AG; 2nd edition, 2014
3	V.V. Athani," Stepper Motors: Fundamentals, Applications and Design", New Age publisher,2nd edition,2014.
4	R. Krishnan,"Permanent Magnet Synchronous and Brushless DC Motor Drives", T and F India,2016

Web References:

1	https://www.elprocus.com/stepper-motor-types-advantages-applications/
2	https://electrical-engineering-portal.com/characteristics-and-work-principles-of-switched-reluctance-sr-motor
3	https://www.edn.com/design/sensors/4406682/Brushless-DC-Motors---Part-I--Construction-and-Operating-Principles
5	https://www.simpletecautomatics.com/company-video.html#product
6	http://www.ebs-automation.com/news/video/

Assessment Methods & Levels(based on Bloom's Taxonomy)

Formative assessment based on Capstone Model(Max.Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C914.1	Understand	Quiz Technical presentation Class Presentation Group Assignment	20
C914.2	Analyse		
C914.3	Apply		
C914.4	Apply		
C914.5	Analyse		

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination[10 marks]
	CIA-I [10 marks]	CIA-II [10 marks]	CIA III [10 marks]	
Remember	40	20	20	20
Understand	60	60	40	40
Apply	-	20	20	20
Analyse	-	-	20	20
Evaluate	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

[illegible]

OPEN ELECTIVE COURSES

20EE001	Power Generation Systems		3/0/0/3
Nature of Course		D (Theory application)	
Course Objectives:			
1. To compare the working of different types of Conventional Power Plants. 2. To interpret in detail about the necessity and importance of Combined Operation of Power Plants. 3. To understand the Power Generation Techniques using different non-conventional energy sources and Major Electrical Equipment in Power Plants.			
Course Outcomes: Upon completion of the course, students shall have ability to			
C001.1	Interpret the working of thermal and Hydro Power Plant and analyze various techniques for Pollution Control in Steam Power Plant.	[AP]	
C001.2	Illustrate the operation and subsystems of Nuclear and Gas Turbine Power Plant.	[U]	
C001.3	Compare the various aspects of different Conventional Power Generation Methods and discuss its merits and Demerits	[A]	
C001.4	Model New Combined Power Generation Cycle Options	[AP]	
C001.5	Discuss the Power Generation using renewable energy and their energy scenarios.	[U]	
Course Contents:			
Module 1: Thermal and Hydropower plants		15 Hrs	
Layout of modern coal power plant- Operational Circuits of Thermal Power Plant, Selection of site, Pollution Control Techniques, Steam Turbines, Control and auxiliaries, Binary cycles. HydroElectric Power Plants - typical layout and components, classification, Selection of site, Water Turbines, Pumped Storage Plants. Case studies on thermal and hydro power plants.			
Module 2: Nuclear and Gas Turbine Power Plants		15 Hrs	
Layout and subsystems of nuclear power plants, Types of reactors, Selection of site, safety waste disposal for nuclear power plants, case study on nuclear power plant, Layout of Gas turbine power plant, Types of Gas Turbine Power Plant, Combined Operation of Different power plants - Integrated Gasifier based Combined Cycle(IGCC) systems, Hydro Electric Plant in combination with Steam Plant, Pumped Storage Plant with Nuclear Power Plant			
Module 3: Renewable Energy Sources		15 Hrs	
Construction and working of Wind, Tidal, solar PV and solar thermal, Geothermal, Biogas and Fuel cell systems.Major Electrical equipment in power plants- switchgear, control room, Substations - Classifications.			
			Total Hours:45
Text Books:			
1	Rai,G.D,“Non-Conventional Energy Sources”, Khanna Publishers,2011.		
2	El Wakil M.M., “Power Plant Technology”, Tata McGrawHill,2013.		
3	R.K.Hegde,,"Power Plant Engineering", Pearson Publisher Limited Ltd.,2015.		
Reference Books:			
1	PC Sharma, “Power Plant Engineering ”, S.K.Kataria and Sons, New Delhi,2013.		
2	Deshpande.M.V, “Elements of Electrical Power Station Design”, PHI Learning Pvt Ltd, 2018.		
3.	Wadhwa.C.L,“ Generation, Distribution and Utilization of Electrical Energy”, Wiley Eastern Limited,3 rd Edition, 2011.		

Web References:	
1	https://nptel.ac.in/courses/108105058/8
2	http://indianpowersector.com/home/power-station/thermal-power-plant/
3	www.altenergy.org/renewables/renewables.html
4	https://www.energy.gov/fe/how-gas-turbine-power-plants-work

Assessment Methods & Levels (based on Blooms' Taxonomy)				
Formative assessment based on Capstone Model (Max. Marks:20)				
Course Outcome	Bloom's Level	Assessment Component		Marks
C001.1 & C001.2	Analyze	Case Studies		20
C001.3 & C001.4	Analyze	Quiz and Group Discussion		
C001.5	Understand	Class Presentation/Power point presentation		
Summative assessment based on Continuous and End Semester Examination				
Bloom's Level	Continuous Assessment			End Semester Examination (50 Marks)
	CIA I (10 Marks)	CIA II (10 Marks)	CIA III (10 Marks)	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	30	50	30
Analyze	-	20	-	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester examination	
20	30	50	100

[illegible]

20EE002	Energy Auditing, Conservation and Management	3/0/0/3
Nature of Course:	G (Theory)	
Course Objectives:		
1. To introduce about Energy Management Systems (EMS). 2. To enable the students to understand the scope for energy saving in residential sector, industries and commercial establishments. 3. To analyses the concepts of New technologies and new products are coming up in the market, for energy saving. 4. To learn the Knowledge of thermodynamic principles, usage of thermal insulation in buildings, lighting devices and new electric motor. 5. To realize energy conservation is better way to meet demand in short span of time rather than constructing new power plant.		
Course Outcomes:		
Upon completion of the course, students shall have ability to		
C002.1	Comprehend the role of energy managers in industries	[U]
C002.2	Evaluate total Energy systems in energy audit.	[A]
C002.3	Analyze the concepts of energy conservation in centrifugal pumps, fans & blowers, air compressor.	[A]
C002.4	Demonstrate energy consumption, energy saving potentials and design	[AP]
C002.5	Perceive knowledge about organizational background desired for energy management motivation.	[U]
C002.6	Articulate the function of Bureau of energy efficiency and the importance of energy efficient appliances.	[AP]
Course Contents:		
Module 1: Energy Scenario and Conservation		12 Hrs
Energy Scenario - Energy conservation and its importance - Energy Conservation Act-2001 and its features. Economics of various Energy Conservation schemes - Case studies - Energy conservation in Centrifugal pumps, Fans and Blowers, Air compressor.		
Module 2: Energy Systems, Management and Auditing		18 Hrs
Energy monitoring, auditing & targeting- Role of Energy Managers in Industries -Energy auditing- needs & types- energy audit instruments - Energy management approach understanding energy costs, bench marking, energy performance- maximizing system Efficiencies-Simple Payback calculation.		
Module 3: Energy Efficiency and Case studies		15 Hrs
Bureau of Energy Efficiency- Efficiency and it's role - Energy efficient motors, energy efficient transformers - energy efficiency in lighting - Soft starters with energy saver- Case studies.		
Total Hours:		45
Text Books:		
1	Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, 'Guide to Energy Management', 8th Edition, The Fairmont Press, Inc., 2016.	
2	Book I - General aspect of energy management and energy audit, Fourth Edition 2015, By Bureau of Energy Efficiency, Ministry of Power, India.	
3	Book III - Energy efficiency in electrical utilities, Fourth Edition 2015, By Bureau of Energy Efficiency, Ministry of Power, India.	

Reference Books:			
1	Turner .W.C, “Energy Management Handbook”, 8th Edition, 2012.		
2	IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 1996.		
3	John D Mc Donald, “Electric Power Substation Engineering” CRC Press, 3rd edition, 2012.		
Web References:			
1	http://nptel.ac.in/video.php?subjectId=108102047		
2	http://textofvideo.nptel.iitm.ac.in/108102047/lec20.pdf		
3	https://www.edx.org/course/Energy management system		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:20)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C002.1	Remember	Group Assignment Assignment Technical Quiz Class Presentation	20
C002.2	Analyse		
C002.3	Analyse		
C002.4	Apply		
C002.5	Understand		
C002.6	Apply		

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C002.1	2	1						2		2		1	2		2
C002.2	3	3	3	3								1	2	1	
C002.3	3	3	3	3				1		2		1	2	1	1
C002.4	3	2	2	2						2		1	2	1	
C002.5	2	1										1	3		

20EE003	Smart Grid		3/0/0/3
Nature of Course :		D (Theory Application)	
Pre-requisites		:Nil	
Course Objectives:			
1. To study the concept,benefit and function of smart grid and its international view on smart grid.			
2. To learn smart grid technologies, smart meters and advanced metering infrastructure.			
3. To know the power quality management issues in smart grid.			
4. To realize the high performance computing for smart grid applications.			
Course Outcomes:			
Upon completion of the course,students shall have ability to			
C003.1	Enumerate the benefits and functions of smart grid		[U]
C003.2	Analyze the power quality management issues using smart meters.		[A]
C003.3	Examine the role of Automation in Transmission and Distribution systems.		[AP]
C003.4	Illustrate the operation and importance of PMUs, IED and AMI in Micro Grids.		[AP]
C003.5	Investigate the integration of renewable energy systems in smart grid		[AP]
Course Contents:			
Module1: Introduction		12 Hrs	
Introduction and architecture of smart grid - Difference between conventional grid and smart grid, Concept of Resilient and Self - Healing Grid, Need, Benefits and functions of Smart Grid, opportunities and challenges of smart grid Electricity - Present development and international policies of smart grid.National and International Standards of Smart Grid.			
Module2: Smart Grid Technologies		15 Hrs	
Smart energy resources,Smart substations,Substation Automation,Feeder Automation,e Storage - Transmission systems: EMS, FACTS and HVDC, Wide area monitoring Protection and control - DMS, Volt/VAR control, Fault Detection, Outage management, High-Efficiency DistributionTransformers,Phase Shifting Transformers.Plug in Hybrid Electric Vehicles(PHEV):Role of big data and IoT,Cyber Security for Smart Grid. Impacts of Smart Grid.			
Module3: Smart Grid Components and Power Quality Management		18 Hrs	
Introduction to Smart Meters - Advanced Metering infrastructure (AMI) drivers and benefits - PhasorMeasurement Unit (PMU) - Intelligent Electronic Devices (IED) and their applications for monitoring and protection - PowerQuality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources - Power Quality Conditioners for Smart Grid - Web based Power Quality Monitoring - Local Area Network (LAN), House Area Network (HAN),Wide Area Network(WAN) - Basics of Web Service and CLOUD Computing for Smart Grids.			
Total Hours:			45
Text Books:			
1	Janaka Ekanayake, Kithsiri Liyanage, Jianzhong.Wu, Akihiko Yokoyama, Nick Jenkins ,“ Smart Grid: Technology and Applications”,Wiley Publications, 2013.		
2	James Momoh, “Smart Grid: Fundamentals of Design and Analysis”, Wiley Publications, 2012.		
3	Nouredine Hadjsaïd, Jean-Claude Sabonnadière,“Smart Grids”,Wiley-ISTE, May2012.		
4	Stuart Barlose, “Smart Grid Infrastructure, Technology and Solutions”, CRC Press-2012.		
Reference Books:			
1	LarsT.Berger,Krzysztof Iniewski, “Smart Grid Applications, Communications, and Security”,Wiley Publications,2015.		
2	Chen-chingg Liu,Stephen Mc Arthur and Seung-Jae Lee,“Smart Grid Handbook”, 3volume Set, Wiley-Blackwell publications,2016.		

3	SalmanK.Salman“Introduction to the Smart Grid:Concepts,Technologies and Evolution”, Institute of Engineering and Technology publications,2017.		
Web References:			
1	http://whatis.techtarget.com/reference/Smart-Grid-Technology-Overview		
2	https://nptel.ac.in/courses/108107113/		
3	https://www.youtube.com/watch?v=dD1vybH-uFI		
4	https://www.youtube.com/watch?v=rHZ557mu7D0		
5	https://www.youtube.com/watch?v=1OWRsAUmDo8		
Assessment Methods & Levels (based on Bloom’sTaxonomy)			
Formative assessment based on Capstone Model(Max.Marks:20)			
Course Outcome	Bloom’sLevel	Assessment Component	Marks
C003.1	Understand	Assignments Technical Online Quiz Class Presentation Group Presentation	20
C003.2	Analyse		
C003.3	Analyse		
C003.4	Apply		
C003.5	Apply		

Summative assessment based on Continuous and End Semester Examination					
Bloom'sL evel	Continuous Assessment				End Semester Examination (Theory) [50 marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIA-III [10 Marks]		
Understand	10	10	10	20	20
Analyze	60	60	70	60	60
Apply	30	30	20	20	20
Apply	-	-	-	-	-
Apply	-	-	-	-	-
Create	-	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

No.of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C003.1	2	1	1										2		
C003.2	3	3	2	2				1	2	2	2		3		
C003.3	3	2	2	2						2			3		
C003.4	3	2	1	2	2		2			1		1	3	2	2
C003.5	3	2	1	1	3					1		2	3	2	2

20EE004	Renewable Energy Sources		3/0/0/3
Nature of Course:	D (Theory application)		
Pre Requisites:	Nil		
Course Objectives:			
1. To study different non- conventional energy systems and its applications.			
2. To enhance student's knowledge and assimilate new technologies.			
3. To learn techno-economical storage methods of renewable energy systems.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C004.1	Enumerate the need of renewable energy and Analyze the concept of Kyoto protocol, energy scenario in India and Integrated Resource Plan	[U]	
C004.2	Assess the role of Solar and wind energy in power plants	[A]	
C004.3	Apply the ideas of renewable energy sources to perform case studies	[AP]	
C004.4	Assess the role of biomass, tidal and geothermal in power plants	[A]	
C004.5	Illustrate the operation and importance of different energy storage methods	[U]	
C004.6	Investigate the integration of renewable energy systems in Power plants	[AP]	
Course Content:			
Module1: Introduction		15 Hrs	
Importance and types of renewable sources of energy, Limitations of RE sources, Present Indian and international energy scenario of conventional and renewable energy sources, Kyoto protocol, concept of clean development mechanism and prototype carbon funds, Integrated resource plan.			
Module2: Wind Energy and Solar Energy		15 Hrs	
Power in the Wind, Types of Wind Power Plants (WPPs) - Components of WPPs - Working of WPPs - Site selection of WPPs, Solar Power, Solar thermal, Solar photovoltaic - Module, panel and array - series and parallel connections. Maximum Power Point Tracking, Applications. Case studies on solar PV system, wind energy system.			
Module3: Other Energy Sources and Storage Methods		15 Hrs	
Methods to generate - Biomass energy, tidal energy, geothermal energy and Fuel cell, applications, Storage methods of mechanical, chemical, electromagnetic, electrostatic and thermal energy - Selection and significance of Batteries - Hybrid energy systems and hybrid electric vehicles.			
Total Hours:			45
Text Books:			
1	John T. Widwell and Tony Weir, "Renewable Energy Resources", 4 th Edition, Routledge, 2021.		
2	B.H. Khan, "Non-Conventional Energy Resources", 3 rd Edition, Tata McGraw Hill, New Delhi, 2017.		
3	G D Rai, 'Non-conventional Energy sources', Khanna Publishers, 5th Edition, 2014.		
Reference Books:			
1	G.N. Tiwari, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.		
2	Aldo Vieira Da Rosa, "Fundamentals of Renewable Energy Processes", Academia Press, 2012.		
3	G. Masters, "Renewable and Efficient Electric Power Systems", IEEE-Wiley Publishers, 2013.		

Web References:				
1	http://unfccc.int/kyoto_protocol/items/2830.php			
2	https://www.coursera.org/learn/wind-energy			
3	https://www.edx.org/course/solar-energy-delftx-et3034x-0			
Assessment Methods & Levels(based on Blooms'Taxonomy)				
Formative assessment based on Capstone Model(Max.Marks:20)				
Course Outcome	Bloom'sLevel	Assessment Component	Marks	
C004.1	Understand	Quiz	20	
C004.2	Analyze	Group Assignment		
C004.3	Apply	Class presentation		
C004.4	Analyze	Group Assignment		
C004.5	Understand	Quiz		
C004.6	Apply	Class presentation		
Summative assessment based on Continuous and End Semester Examination				
Bloom'sLevel	Continuous Assessment			End Semester Examination [50 Marks]
	CIAI [10 Marks]	CIAII [10 Marks]	CIAIII [10 Marks]	
Remember	10			5
Understand	60	10	10	15
Apply	-	40	50	30
Analyse	30	50	40	50
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

No. of the CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C004.1	2	1				2	2	2				1			1
C004.2	3	3	2			2	3	1				3	1	2	2
C004.3	3	3	2	1		2	3	1		1		3	1	2	1
C004.4	3	3	2			2	3	1				3	1	2	1
C004.5	2	1				2	3	1				3	1	1	1
C004.6	3	3	2	2		2	3	2		1		3	1	2	2

20EE005	Servo and Robot Drives		3/0/0/3
Nature of Course :		G (Theory)	
Course Objectives:			
1. To impart the knowledge of servo motors drives and power transmission. 2. To understand the concepts sensors and vision systems. 3. To understand the concepts of robots in various industries for automation			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C005.1	Interpret the basic laws and concepts of robots.		[U]
C005.2	Explain the classification of robots and degrees of freedom of serial and parallel manipulators		[U]
C005.3	Analyze the sensor systems to the robotic system.		[A]
C005.4	Analyze the power transmission systems in the robotic system.		[A]
C005.5	Apply the Robots in Manufacturing and Processing Industries.		[AP]
Course Contents:			
Module 1: Introduction to Fundamental Concepts of Robotics			15 Hrs
History, Present status and future trends in Robotics and automation - Laws of Robotics- Robot definitions - Robotics systems and robot anatomy - Structure of a Robot, Classification of Robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA - Specification of Robots - Degrees of Freedom of Serial and Parallel Manipulators- resolution, repeatability and accuracy of a manipulator.			
Module 2: Sensors and Vision Systems			15 Hrs
Principle of operation, types and selection of position and velocity sensors, Potentiometers, Encoders, Resolvers, LVDT, Tacho-generators, Internal and External State Sensors, Proximity sensors. Limit switches-Tactile sensors -Touch sensors -Force and torque sensors, Robot End Effectors. Vision Systems. Vision Systems for Robotics: Robot vision systems, Image capture- solid state cameras-Image Representation-Grey scale and colour images, image sampling and quantization - Image processing and analysis - Image data reduction Segmentation - Feature extraction – Object Recognition.			
Module 3: Motors Drives and Factory Automation			15 Hrs
Types Constructional features – Principle of operation- Feedback system - Robot drive mechanisms, hydraulic-electric servomotor- stepper motor - pneumatic drives. Control of Electrical Drives: Introduction-Parts of Electrical Drives- Fundamental Torque Equations-Speed Torque Conventions and Multi - quadrant Operation-Nature and Classification of Load Torques - Modes of Operation-Closed - Loop Control of Drives. Factory Automation: Flexible Manufacturing Systems concept - Automatic feeding lines, transfer lines, automatic inspection - Computer Integrated Manufacture-CNC, intelligent automation.HMI Systems, DCS and SCADA, Wireless controls.			
Total Hours:			45
Text Books:			
1.	Deh SR., "Robotics Technology and Flexible Automation", Tata Mc Graw Hill Publishing, CompanyLtd.,2 nd edition, 2017.		
2.	Mikel IP Grooveret.al.," Industrial Robots- Technology, Programming and Applications", Mc Graw Hill, NewYork, 2017.		
3.	Saeed B Niku,"Introduction to Robotics Analysis, Systems, Applications", PHI Pvt Ltd,		

20EE006	Special Purpose Machines		3/0/0/3
Nature of Course :		D (Theory application)	
Course Objectives:			
1. To learn the working operation and performance characteristics of Stepping and Switched reluctance motors.			
2. To realize the constructional features of Synchronous reluctance motor.			
3. To impart knowledge on the performance of Permanent Magnet Brushless DC and Permanent Magnet Synchronous motors.			
4. To know about the control strategies of Servo motor.			
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C006.1	Enumerate the principle of operation and performance of Stepper motors	[U]	
C006.2	Apply the principle of operation and performance of Switched reluctance And Servomotors	[AP]	
C006.3	Analyze the construction and operation of Permanent magnet brushless DC motor	[A]	
C006.4	Illustrate the construction and operation of Permanent magnet synchronous motors.	[U]	
C006.5	Analyze the characteristics and select special motors for specific applications	[A]	
Course Contents:			
Module 1: Stepping Motors and Switched Reluctance Motor 15 Hrs Stepper motor: Constructional features, Principle of operation, Special features of stepper motors, Variable reluctance, Permanent magnet stepping motor, Torque versus stepping rate characteristics ,Linear actuators with Stepper Motors. Application aspects related to textile industries and integrated circuit fabrications. Switched Reluctance Motor: Constructional features, Principle of operation, Torque equation, Characteristics, Control Techniques and Drive Concept.			
Module 2: Permanent Magnet DC and Synchronous Motors 15 Hrs Brushless DC. Motors - Commutation in DC motors, Difference between mechanical and electronic commutators, Torque and EMF equation, Rotor position sensors, Multiphase Brushless DC motor, Square wave permanent magnet brushless DC motor drives and their torque-speed characteristics. Application aspect related to vehicle and house hold-Permanent Magnet Synchronous Motor - Principle of operation, EMF, Power input and torque expressions, phasor diagram, Power Controllers, Torque speed characteristics.			
Module 3: Servomotor 15 Hrs Servomotor - Constructional features, Principle of Operation, Types, Characteristics, Control strategies. Applications of servomotor requiring precise position control - AC Tachometer Operating principle and its schematic diagram, Case study-Selection of motors for hydraulic and Pneumatic systems - Gear, Piston and Vane motors.			
Total Hours:			45
Text Books:			
1	Berker Bilgin, James Weisheng Jiang, Ali Emadi “Switched Reluctance Motor Drives: Fundamentals to Applications” CRC press, 2018		
2	R.Krishnan, “Permanent Magnet Synchronous and Brushless DC Motor Drives” T&F India, 2016		

3	Dr.DuaneK Hanselman,“Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors” E-Man Press LLC,2012		
Reference Books:			
1	Ahmed Tahor, Abdel Ghani Aissabui “Switched Reluctance Motor Concept, Control and Applications”,InTech Open,2017		
2	Riazollah Firoozian “Servo Motors and Industrial Control Theory“ Springer International Publishing AG;2nd edition.2014		
3	V.V. Athani, ”Stepper Motors: Fundamentals, Applications and Design” New Age publisher, 2nd edition,2014		
Web References:			
1	https://www.elprocus.com/stepper-motor-types-advantages-applications/		
2	https://electrical-engineering-portal.com/characteristics-and-work-principles-of-switched-reluctance-sr-motor		
3	http://machineryequipmentonline.com/hydraulics-and-pneumatics/applications-on-pneumatic air-motors/		
4	https://www.site.uottawa.ca/~rhabash/ELG2331SPM.pdf		
5	https://www.simpletecautomatics.com/company-video.html#product		
6	http://www.ebs-automation.com/news/video/		
7	http://www.shenoyengineering.com/spm		
Assessment Methods & Levels (based on Bloom’sTaxonomy)			
Formative assessment based on Capstone Model(Max.Marks:20)			
Course Outcome	Bloom’sLevel	AssessmentComponent	Marks
C006.1	Understand	Case Study Assignment Technical Quiz Class Presentation	20
C006.2	Apply		
C006.3	Analyse		
C006.4	Understand		
C006.5	Analyse		

Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [50 marks]
	Theory			Formative Assessment [20 Marks]	
	CIA-I [10 Marks]	CIA-II [10 Marks]	CIAIII [10 Marks]		
Remember	50	-	20	40	20
Understand	50	50	40	40	40
Apply		50	20	20	20
Analyse	-	-	20	-	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-
Formative Assessment		Summative Assessment			Total
		Continuous Assessment		End Semester Examination	
20		30		50	100

[illegible]

20MC101	INDUCTION PROGRAMME (FOR ALL BRANCHES OF B.E / B.TECH PROGRAMMES)		2/0/0/0
Nature of Course	Induction Programme		
Pre requisites	Nil		
Course Objectives:			
1.	To have broad understanding of society and relationships		
2.	To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being		
3.	To incorporate meta skills and values		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C101.1	Explore academic interest and activities		[AP]
C101.2	Work for excellence		[AP]
C101.3	Promote bonding and give a broader view of life and character		[AP]
Course Contents:			
PHYSICAL ACTIVITY Yoga			
CREATIVE ARTS (students can select any one of their choice) Painting, sculpture, pottery, music, dance, craft making and so on			
UNIVERSAL HUMAN VALUES Enhancing soft skills			
LITERARY AND PROFICIENCY MODULES Reading, writing, speaking – debate, role play etc. Communication and computer skills			
LECTURES BY EMINENT PEOPLE Guest lecture by subject experts			
VISIT TO LOCAL AREAS Meditation centre/orphanage/Hospital			
FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION Lectures by Department's Head and senior faculty members			

20MC102		ENVIRONMENTAL SCIENCES		2 /0 /0 /0	
Nature of Course		Theory Concept			
Pre requisites		Basics in Environmental Studies			
Course Objectives:					
1	To learn the integrated themes on various natural resources.				
2	To gain knowledge on the type of pollution and its control methods.				
3	To have an awareness about the current environmental issues and the social problems.				
Course Outcomes:					
Upon completion of the course, students shall have ability to					
C102.1	Recall and play an important role in transferring a healthy environment for future generation.				[R]
C102.2	Understand the importance of natural resources and conservation of biodiversity.				[U]
C102.3	Understand and analyze the impact of engineering solutions in a global and societal context.				[U]
C102.4	Apply the gained knowledge to overcome pollution problems.				[AP]
C102.5	Apply the gained knowledge in various environmental issues and sustainable development.				[AP]
Course Contents:					
Module 1: Natural Resources				10 Hrs.	
Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study-Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.					
Module 2: Environmental Pollutions				10 Hrs.	
Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Greenhouse effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.					
Module 3: Social issues and the Environment				10 Hrs.	
Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.					
				Total Hours:	30
Text Books:					
1	AnubhaKaushik and C P Kaushik “Perspectives in Environmental Studies”4 th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi				
2	Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2015.				
Reference Books:					
1	Tyler Miller, Jr., “Environmental Science”. Brooks/Cole a part of Cengage Learning, 2014.				

2	William Cunningham and Mary Cunningham, “Environmental Science”, 13 th Edition, McGraw Hill, 2015.		
3	Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2014.		
Web References:			
1	http://nptel.ac.in/courses/104103020/20		
2	http://nptel.ac.in/courses/120108002		
3	http://nptel.ac.in/courses/122106030		
4	http://nptel.ac.in/courses/120108004/		
5	http://nptel.ac.in/courses/122102006/20		
Online Resources:			
1	https://www.edx.org/course/subject/environmental-studies		
2	www.environmentalscience.org		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C102.1	Remember	Quiz	30
C102.2	Understand	Mini project based on environmental aspect	30
C102.3	Understand	Class Presentation	20
C102.4 C102.5	Apply	Group Assignment	20

20MC103	SOFT SKILLS		2/0/0/0
Nature of Course	Theory Concept		
Pre requisites	Technical Communication Skills		
Course Objectives:			
1.	To develop the students competency level and their capabilities.		
2.	To teach the students to be effective in workplace and social environments.		
3.	To create self confidence among the students and to resolve stress and conflict within themselves.		
4.	To help the students to enhance their career skills by increasing their productivity and performances.		
5.	To concentrate more on conversation skills, presentation skills, verbal ability, critical and creative thinking.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C103.1	Remember the principles of soft skills required for their profession.		[R]
C103.2	Understand the importance of Interpersonal communication Skills among individuals, groups and cultures.		[U]
C103.3	Apply verbal and non-verbal communication skills in corporate environment.		[AP]
C103.4	Analyze and apply creativity skills, critical thinking skills and problem solving skills.		[A]
C103.5	Articulate oral and written messages in an appropriate and persuasive manner to suit specific purposes, audiences and contexts at work place.		[AP]
C103.6	Apply good teamwork skills and Leadership Skills		[AP]
Course Contents:			
Module 1: Professional Communication Skills			10 Hrs
Introduction to the Soft Skills, Performance Evaluation 1 –Significance of Soft Skills- Understanding the basic Communication Principles –Listening Skills- Listening Exercises- Speaking Skills- How to start and Sustain a Conversation- Speaking in Groups- Understanding self and Personal Branding, attitude, types of attitude, Positive Attitude, Self Confidence and Self-Motivation - Personal Application/Action Taken.			
Advanced Writing Skills-Principles of Business Writing- E mails- Writing Reports- Types of Reports- Strategies for Report Writing- Personal Application/Action Taken.			
Verbal Ability- Analogy- Classification- Odd One Out- Idioms and Phrases- Sentence Correction- Empathy and its importance in career -Personal Application/Action Taken.			
Module 2: Interpersonal Communication			10 Hrs
Nonverbal Communication- Individual, Groups and Cultures- Body Language- Attire and Etiquettes- Interpersonal Skills- dealing with diverse People- Networking- Emotional Intelligence and its importance. Personal Application/Action Taken. Developing Creativity- Critical Thinking and Problem Solving Skills- Making the Right Choice- Never Give Up- Begin to Grow- Personal Application/Action Taken.			
Interviews- Facing Job Interviews - Planning and Preparing- Effective Resume along with Covering Letter- Planning and Preparing- Personal Application/Action Taken.			
Self-Discipline - Self Presentation - Personal Application/Action Taken.			

Module 3: Teamwork and Leadership Skills		10 Hrs
Industry Expectations- Universal Hiring Rule- Personal Application/Action Taken. Importance of Human Values-Importance of Team Work- Developing Key Traits in Motivation, Persuasion, Negotiation and Leadership Skills- Being an Effective Team Player- Personal Application/Action Taken. Planning- Prioritization - Delegation- Conflict Management- Decision and its necessity in crucial situations- Group Discussion- Personal Application/Action Taken. Essential Skills in working Strategies- Presentation and Interaction Skills- What to Present and How- Being Assertive- Multimedia Presentation-Making Effective Presentations. Interview Skills- Do's and Don'ts - Body Language – Answering the Common Questions of Interview- Performance Evaluation 2- Mock Interview		
Total Hours:		30
Text Books:		
1.	Business Communication for managers: An advanced approach, by Penrose, Cengage learning.	
2.	Professional Communication in Engineering. by H.E. Sales. Palgrave Macmillan 2009.	
3.	Communication for professional engineers by W. P. Scott, Bertil Billing. Thomas Telford, 1998.	
Reference Books:		
1.	Reason and professional ethics by Peter Davson-Galle. Ashgate Publishing, Ltd., 2009.	
2.	Cross Cultural and Inter Cultural Communication. by William B. Gudykunst. Sage Publications India Pvt Ltd, New Delhi.2003.	
3.	Corporate Communications: Theory and Practice. ByJoepCornelissen. Sage Publications India Pvt Ltd, New Delhi.2004.	
Web References:		
1	https://onlinecourses.nptel.ac.in/noc16_hs15/preview	
2	https://www.getinternship.switchidea.com/NTAT/syllabus/Interpersonal-Communication .	
3	https://smude.edu.in/smude/programs/bca/soft-skills.html	
Online Resources:		
1	https://swayam.gov.in/course/4047-developing-soft-skills-and-personality	
2	https://www.clearias.com/interpersonal-skills-including-communication-skills-for-csat/	
3	https://www.bizlibrary.com/soft-skills-training/	

Assessment Methods & Levels (based on Revised Bloom's Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Revised Bloom's Level	Assessment Component	Marks
C103.1	Remember	Group Discussion	30
C103.2 & C103.3	Understand	Listening Skills	20
C103.4	Apply	Interview	20
C103.5 & C103.6	Apply	Formal Presentation	30

20MC104	MANAGEMENT ORGANIZATIONAL BEHAVIOUR		2/0/0/0
Nature of Course		Theory Concept	
Pre requisites		Nil	
Course Objectives:			
1.	The objective of the course is to provide basic knowledge about management to familiarize the students with the management principles and organizational behavior.		
2.	The course is designed to enable the students to adapt & apply theoretical concepts in business		
3.	To know about the role of manager in the area of management.		
4.	To create and implement team building strategies for organization building.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C104.1	Identify and understand different management principles techniques in business environment.		[U]
C104.2	Apply management fundamentals and planning to solve organization problems and make effective decisions.		[AP]
C104.3	Understand and analyze the changes within an individual will change the group as well as the organization		[AN]
C104.4	Understand and analyze the leadership style and organization theories to create a productive environment to workforce.		[AN]
C104.5	Analyze the organizational climate and change management strategies and tactics		[AN]
C104.6	Apply the empowerment strategy and tactics for productivity		[AP]
Course Contents:			
Module 1: Fundamentals of Management, Planning and Decision Making10 Hrs			
Introduction to Management- Concept and functions- Thought Managerial roles and styles- Principles of Management - Levels of Management- Theories of Management - Classical, Scientific, Administrative, Behavioral, Management Sciences Theories. Organizational planning - Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Behavioural influences on decision making - Group decision making - Vroom's Participative decision-making model.			
Module 2: Individual, interpersonal and group behavior10 Hrs			
Definition, need and importance of Organizational behavior –Learning-Nature -Importance of Learning- Introduction and theories Motivation: Content and process theories-Leadership: Styles and Theories - Perception-Personality – Attitudes- Definition, need and importance - Nature and scope-Importance of Groups and Teams- Role relationships and conflict-Group dynamics- Work values. Organization Theories: Maslow's needs hierarchy theory, two factor theory of motivation, McGregor's theory, ERG theory, McClelland's needs theory, Valance Theory.			
Module 3: Organizational Development 10 Hrs			
Organizational culture: Elements - Organizational climate– Factors affecting organizational climate-Organizational Commitment, Organizational schange- Importance- Stability Vs Change- Proactive Vs Reaction change- Change process– Resistance to change- Managing changes- Managing International Workforce – Productivity- Alternative change management approaches and cultural contingencies - power to manage effectively; Empowerment and Participation strategies and tactics.			

		Total Hours:	30 Hrs
Text Books:			
1.	Nelson, Quick, Khandelwal, “Organizational Behavior”, 2nd edition, Cengage Learning, 2016.		
2.	Williams, Tripathy, “Principles of Management”, Cengage Learning, 2016.		
3.	Aswathappa, K, “Organizational Behavior”, 12th Edition, Himalaya Publication, 2016.		
4.	Stephen Robbins, Timothy A. Judge, “Organizational Behavior”, 16th edition, Prentice Hall India Pvt. Ltd, 2014.		
Reference Books:			
1.	Chandrani Singh, Aditi Khatri, “Principles and Practices of Management and Organizational Behavior”, Sage Publications, 2016.		
2.	Richard L. Daft, “Understanding the Theory and Design of Organizations”, 11th edition, Cengage Learning, 2013.		
3.	John M Ivancevich and Robert Konopaske, “Organizational Behavior and Management”, McGraw-Hill Education, 2013.		
4.	UdaiPareek, Sushama Khanna, “Organization Behavior”, 3rd edition, Oxford Publishing, 2012.		
Web References:			
1.	https://iedunote.com/fundamental-concepts-of-organizational-behavior		
2.	https://nscpolteksby.ac.id/ebook/		
3.	https://ebooks.lpude.in/management/mba/term_1/DMGT402_MANAGEMENT_PRACTICES_AND_ORGANIZATIONAL_BEHAVIOUR.pdf		
4.	https://www.studocu.com/in/document/vellore-institute-of-technology/organizational-behaviour/lecture-notes/ob-notes/3208134/view		
Online Resources:			
1.	https://nptel.ac.in/syllabus/110105034/		
2.	https://nptel.ac.in/courses/110/105/110105033/		
3.	https://freevideolectures.com/course/3502/organizational-behaviour-i		
4.	https://nptel.ac.in/courses/110/106/110106145/		
Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Revised Bloom’s Level	Assessment Component	Marks
C104.1	Understand	Quiz	30
C104.2 C104.6	Apply	Listening Skills	20
C104.3	Analyze	Group Discussion	20
C104.4 C104.5	Apply	Formal Presentation	30

20MC105		GENERAL APTITUDE		2 /0 /0 /0	
Nature of Course		Theory Concept			
Pre requisites		NIL			
Course Objectives:					
1	To improve the verbal ability.				
2	To improve the mathematical skills.				
3	To develop problem solving skills.				
4	To equip them to face interview & Group Discussion.				
5	To inculcate critical thinking process.				
Course Outcomes:					
Upon completion of the course, students shall have ability to					
C105.1	Apply the concepts of aptitude and develop problem solving skills.				[AP]
C105.2	Analyze on the critical problems and solve them.				[A]
C105.3	Understand the verbal and mathematical basics				[U]
Course Contents:					
C105.1	To teach the basics of Quantitative Techniques in a graded manner.				[R]
C105.2	Understand the verbal and non-verbal nature of problems in reality and know the shortcut methods of solving it.				[U]
C105.3	Solve problems using their general mental ability.				[AP]
C105.4	To give intense focus on improving and increasing the ability of solving real problems.				[AP]
C105.5	Think critically about mathematical models for relating different quantities to reach conclusion.				[AP]
C105.6	Enable effective use of data interpretation, formulas, graphs and assumptions.				[AP]
Module 1: Number Theory and Statistics					14 Hrs
Number Systems– HCF and LCM of Numbers – Decimal Fractions – Simplification – Square Root and Cube Root of a number – Surds and Indices – Problems on numbers – Percentage – Ratio and Proportion – Divisibility – Mixtures – Averages- Polynomials – Solving Equations and Inequalities – Discard’s rule of signs – Problems on ages – Chain rule – Time and Work – Time and Distance – Problems on Trains – Problems on Boats and Streams- Measures of central tendency – Mean, Median and Mode – Variance and Standard deviation Logarithms – Profit and Loss – Simple Interest – Compound Interest.					
Module 2: Logic and Decision Making					8 Hrs
Analogy – Classification – Series completion – Coding and Decoding – Blood Relations – Puzzle Test – Direction Sense test – Logical Venn Diagrams - Number Ranking and Time Sequence Test – Decision Making – Assertion and Reason– Inserting the missing one – Logical Sequence of words – Syllogisms.					
Module 3: Reasoning					8 Hrs
Logic – Statement and Arguments – Statements and Assumptions – Statements and Course of Action – Statements and Conclusions – Deriving conclusions from passages – Functions – Different kinds of functions – Miscellaneous sets- Series – Analogy – Classifications – Analytical Reasoning – Problems on Cubes and Dice – Mirror Images – Water Images – Rule Detection.					
					Total Hours: 30
Text Books:					
1	Aggarwal R. S. “Quantitative Aptitude” Revised Edition, S. Chand Publication.				
2	Abhijit Guha “Quantitative Aptitude” 5 th Edition, McGraw Hill Education.				
Reference Books:					

1	Edgar Thorpe “Mental Ability & Quantitative Aptitude” 3 rd Edition, McGraw Hill Education.		
Web References:			
1	https://www.wiziq.com/tutorial/815468-quantitative-aptitude-reasoning-data-interpretation-video-lectures		
2	https://learningpundits.com/contest?referrer=harsh.cse15@nituk.ac.in		
3	https://nptel.ac.in/courses/114106041/8		
4	https://nptel.ac.in/courses/111103020/2		
Online Resources:			
1	http://aptitudetraining.in/home/index.php		
2	https://www.udemy.com/vedicmaths/		
3	https://www.youtube.com/channel/UCtmn-DsF4BhPug-ff9LiDAA?disable_polymer=true		
Reference Books:			
1	R.S. Aggarwal, "Quantitative Aptitude", S.Chand Publishers		
2	R.S. Aggarwal, "A Modern Approach to Verbal & Non-verbal reasoning", S.Chand Publishers		
3	Face Aptipedia - Aptitude Encyclopedia - Wiley		
4	Dinesh Khattar, "The pearson guide to Quantitative Aptitude for Competitive examinations, Pearson Education		
Web References:			
1	https://www.geeksforgeeks.org/placements-gq/		
2	https://www.indiabix.com/aptitude/questions-and-answers/		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C105.1	Remember	Quiz	30
C105.2 & C105.3	Understand	Formal presentation	20
C105.4, C105.5 & C105.6	Apply	Formal interview tests	50

20MC106	LIFE SKILLS AND ETHICS		2 /0 /0 /0
Nature of Course		Theory Concept	
Pre requisites		NIL	
Course Objectives:			
1	To develop communication competence in prospective engineers.		
2	To enable them to convey thoughts and ideas with clarity and focus.		
3	To develop report writing skills.		
4	To equip them to face interview & Group Discussion.		
5	To inculcate critical thinking process.		
6	To prepare them on problem solving skills.		
7	To provide symbolic, verbal, and graphical interpretations of statements in a problem description.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C106.1	Define and Identify different life skills required in personal and professional life.		[U]
C106.2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.		[AP]
C106.3	Explain the basic mechanics of effective communication and demonstrate these through presentations.		[AN]
C106.4	Use appropriate thinking and problem solving techniques to solve new problems.		[AP]
C106.5	Understand the basics of teamwork and leadership		[U]
Course Contents:			
Communication Skill: Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Writing Skills, Technical Writing, Letter Writing, Job Application, Report Writing, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication.			
Critical Thinking & Problem Solving: Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping & Analytical Thinking. Teamwork: Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.			
Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE. Leadership Skills: Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation			
Total Hours:			30
Reference Books:			
1	Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.		
2	Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.		
3	Larry James (2016); "The First Book of Life Skills"; First Edition; Embassy Books.		
4	ShaliniVerma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company		

5	John C. Maxwell (2014); “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc		
Web References:			
1	https://www.coursera.org/courses?query=ethics		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C106.1	Remember	Quiz	20
C106.2	Understand	Assignment	20
C106.3	Understand	Presentation	30
C106.4 C106.5	Apply	Group Discussion	30

20MC107	STRESS MANAGEMENT		2 /0 /0 /0
Nature of Course		Theory Concept	
Pre requisites		NIL	
Course Objectives:			
1	Understand the basic principles of stress management		
2	Recognize your stress triggers and how to manage them		
3	Develop proactive responses to stressful situations		
4	Use coping tips for managing stress both on and off the job		
5	Learn to manage stress through diet, sleep and other lifestyle factors		
6	Develop a long term action plan to minimize and better manage stress		
7	Understand the basic principles of stress management		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C107.1	Understand the basic principles of stress management		[U]
C107.2	Apply the concept of recognizing your stress triggers and find ways to manage them.		[AP]
C107.3	Develop proactive responses to stressful situations		[AN]
C107.4	Develop a long term action plan to minimize and better manage stress		[AP]
Course Contents:			
Scientific Foundations of Stress: What is stress? – Sources of Stress – Types of Stress – Personality Factors and stress – Stress and the college student. Stress Psychophysiology: Stress and nervous system – Hypothalamic – Pituitary – Adrenal (HPA) Axis – Effect of Stress on Immune system – Health risk associated with chronic stress – Stress and Major Psychiatric disorders.			
Developing Resilience to Stress: Understanding your stress level – Role of personality pattern, Self-esteem, Locus of control – Role of Thoughts Beliefs and Emotions – I & II – Life situation Intrapersonal: (Assertiveness, Time Management).			
Strategies for Relieving Stress: Developing cognitive coping skills – Autogenic training, imagery and progressive relaxation – Other relaxation techniques – Exercise and Health – DIY strategies stress management.			
Total Hours:			30
Reference Books:			
1	Jonathan C. Smith; (2011), "Stress Management: A Comprehensive Handbook of Techniques and Strategies", First Edition; Springer Publishing Company.		
2	Bob Stahl, Elisha Goldstein, Jon Kabat-Zinn (2019); "A mindfulness-based stress reduction workbook"; Second Edition; New Harbinger Publications.		
3	Ryan M. Niemiec (2019), " The Strengths-based workbook for stress relief", First edition. New Harbinger Publications.		

Web References:			
1	https://thiswayup.org.au/courses/coping-with-stress-course/		
2	https://www.classcentral.com/course/swayam-stress-management-14309		
Assessment Methods & Levels (based on Bloom’s Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C107.1	Remember	Quiz	20
C107.2	Apply	Group Discussion	30
C107.3	Apply	Class Presentation	30
C107.4	Understand	Assignment	20

20MC108	CONSTITUTION OF INDIA		2/0/0/0
Nature of Course Theory			
Pre Requisites NIL			
Course Objectives:			
1	To familiarize with basic information about Indian constitution		
2	To understand the fundamental rights and duties as citizens of India		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C108.1	Explain the objectives of the Constitution of India and its formation	[U]	
C108.2	Recall state and central policies (Union and State Executive), fundamental Rights and their duties.	[R]	
C108.3	Make use of legal directions in developing solutions to societal issues	[AP]	
C108.4	Utilized for competitive exams that requires knowledge of Indian Constitution	[AP]	
Course Contents:			
Module 1		10 Hours	
Historical perspective, The making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Citizenship Article 5-11.			
Module 2		10 Hours	
Federal structure, Powers of the Union and the states, Centre-State Relations, Union Executive – President, Prime Minister, Union Cabinet, Parliament, Supreme Court of India, State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Elections, Electoral Process, and Election Commission of India, Election Laws. Powers and Functions of Municipalities and Panchayat			
Module 3		10 Hours	
Amendments - Methods, Emergency Provisions, National Emergency, President Rule, Financial Emergency, Provisions for SC & ST, OBC, women, children and backward classes, Right to Property, Freedom of Trade and Commerce. Agricultural Law			
Total Hours:			30
Text Books:			
1	Dr.D.D.Basu, "Introduction to the Constitution of India", LexisNexis, New Delhi, 22 nd Edition, 2016.		
2	"Bare act-constitution of India", The universal Publications, LexisNexis 2020, New Delhi, India.		
Reference Books:			
1	Subhash.C.Kashyap, "Our Constitution: An Introduction to India's Constitution and Constitutional Law", National Book Trust, India, 5 th edition, 2019.		
2	M. Laxmikanth, "Constitution of India", Cengage Learning India. 1 st edition 2018.		
Web References:			
1	https://unacademy.com/course/the-indian-constitution/NSKQ8XXQ		
2	https://unacademy.com/goal/upsc-civil-services-examination-ias-preparation/KSCGY		
Assessment Methods & Levels (based on Blooms' Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom's Level	Assessment Component	Marks
C108.1	Remember	Test	20
C108.4	Understand	Quiz	40
C108.3	Apply	Presentation	20
C108.2	Apply	Group Assignment	20

20MC109	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE		2/0/0/0
Nature of Course	Theory Concept		
Pre Requisites	NIL		
Course Objectives:			
1	To make understand the contribution of Indian mind in various fields.		
2	To cultivate critical appreciation of the thought content and provide insights relevant for promoting cognitive ability, health, good governance, aesthetic appreciation and right values.		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C109.1	Relate classical Indian traditions with contemporary traditions and culture.		[R]
C109.2	Outline the thoughts of Indians in different disciplines.		[U]
C109.3	Apply the knowledge to the present context.		[AP]
C109.4	Develop a better appreciation and understanding of Indian traditions.		[C]
Course Contents:			
Indian Ethics: Individual and Social – Society state and Polity (Survey) - Education systems – Agriculture (Survey) – Early & Classical Architecture – Medieval & Colonial Architecture.			
Astronomy in India – Martial Arts Traditions (Survey) - Indian Literatures - Indian Philosophical Systems - Indian Traditional Knowledge on Environmental Conservation			
Ayurveda for Life, Health and Well-being - The Historical Evolution of Medical Tradition in Ancient India- Music in India - Classical & Folk			
Total hours:			30
Text Books:			
1	Kapil Kapoor and Michel Danino, Textbook of “Knowledge Traditions andPractices of India”, Central Board of Secondary Education, 2017.		
2	Yogesh Atal, “Indian Society: Continuity and Change”, Pearson Education India, 2016.		
Reference Books:			
1	Douglas Osto, “An Indian Tantric Tradition and Its Modern Global Revival”, Routledge publications, 2020.		
2	Rao C.N. Shankar, “Sociology: Principles of Sociology with an Introduction to Social Thoughts”, S Chand Publisher, 2019.		
Web References:			
1	http://nopr.niscair.res.in/handle/123456789/43		
2	https://nptel.ac.in/courses/109/104/109104102/		
Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative assessment based on Capstone Model (Max. Marks:100)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C109.1	Remember	Quiz	20
C109.2	Understand	Group Assignment	20
C109.3	Apply	Presentation	20
C109.4	Create	Survey	40