Curriculum Structure for
B. Tech. Electrical Engineering Programme

(In light of NEP 2020)

NCrF Level 6

(NEP_Version II)

For students admitted in 2023-24 onwards

Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)
Near Kathora Naka, Amravati, Maharashtra
PIN 444604
www.gcoea.ac.in

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Structure for B. Tech. Programme in light of NEP 2020

For students admitted in 2023-24 onwards

Key Features of Curriculum

1. Multiple entry and exit option after every year.
2. Provision for Open Electives (OE), Vocational and Skill Enhancement Courses (VSE), Ability Enhancement Courses (AE), Indian Knowledge System (IKS), Value Education Courses (VE), Co-Curricular Courses (CC) in addition to program core courses.
3. Mandatory internship of one semester.
4. Credits for Value education courses, Ability Enhancement Courses, Co-Curricular Curricular Activities.
5. Mandatory Non-Credit Courses.
6. Interdisciplinary and multidisciplinary education through single and double minors and open electives.
7. Skill based courses and multiple exit level.
8. Provision for learning in online mode through Swayam / NPTEL etc. courses
9. Provision for B.Tech. Honours with Research degree through research project.
10. Opportunity for learner to choose courses of their interest in all disciplines.
11. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.
12. Flexibility for all types of learners i.e. Good, Normal and Exit

Good Students	Normal Students	Exit
B. Tech. Major with Multidisciplinary Minor	B. Tech. Major with Multidisciplinary Minor	Additional 08 credits in the form of skill-based courses / labs, internship, mini projects shall be offered in 8 weeks.
B. Tech. Honors and Multidisciplinary Minor	--	
B. Tech. Honors with Research and Multidisciplinary Minor	--	
B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	--	

Credit Distribution for each year and Exit Option

NCrFLevel	Year / Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	U. G. Certificate	43	08	51
5.0	Semester III & IV	U. G. Diploma	83	08	91
5.5	Semester V & VI	B. Vocational/B.Sc. Engg.	128	08	136
6.0	Semester VII & VIII	B. Tech. Major with Multidisciplinary Minor	167	--	167
		B. Tech. Honors and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. Honors with Research and Multidisciplinary Minor	167+18=185	--	185
		B. Tech. with Double Minor (Multidisciplinary and Specialization Minor)	167+18=185	--	185

Course Category-wise Credit Distribution

Course Category	As per NEP GR	GCOEA Credits	CC	As per NEP GR	GCOEA Credits
BSC/ESC	30	30	BS	14-18	18
			ES	16-12	12
Program Courses	64-76	67	PC	44-56	47
			PE	20	20
Multidisciplinary Courses	22	22	MM	14	14
			OE	8	8
Skill Courses	8	8	VSE	8	8
Humanities, Social Science & Management (HSSM)	14	14	AE	4	4
			EM	4	4
			IKS	2	2
			VE	4	4
Experiential Courses	22	22	RM	4	4
			FP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**160-176**	**167**		**160-176**	**167**

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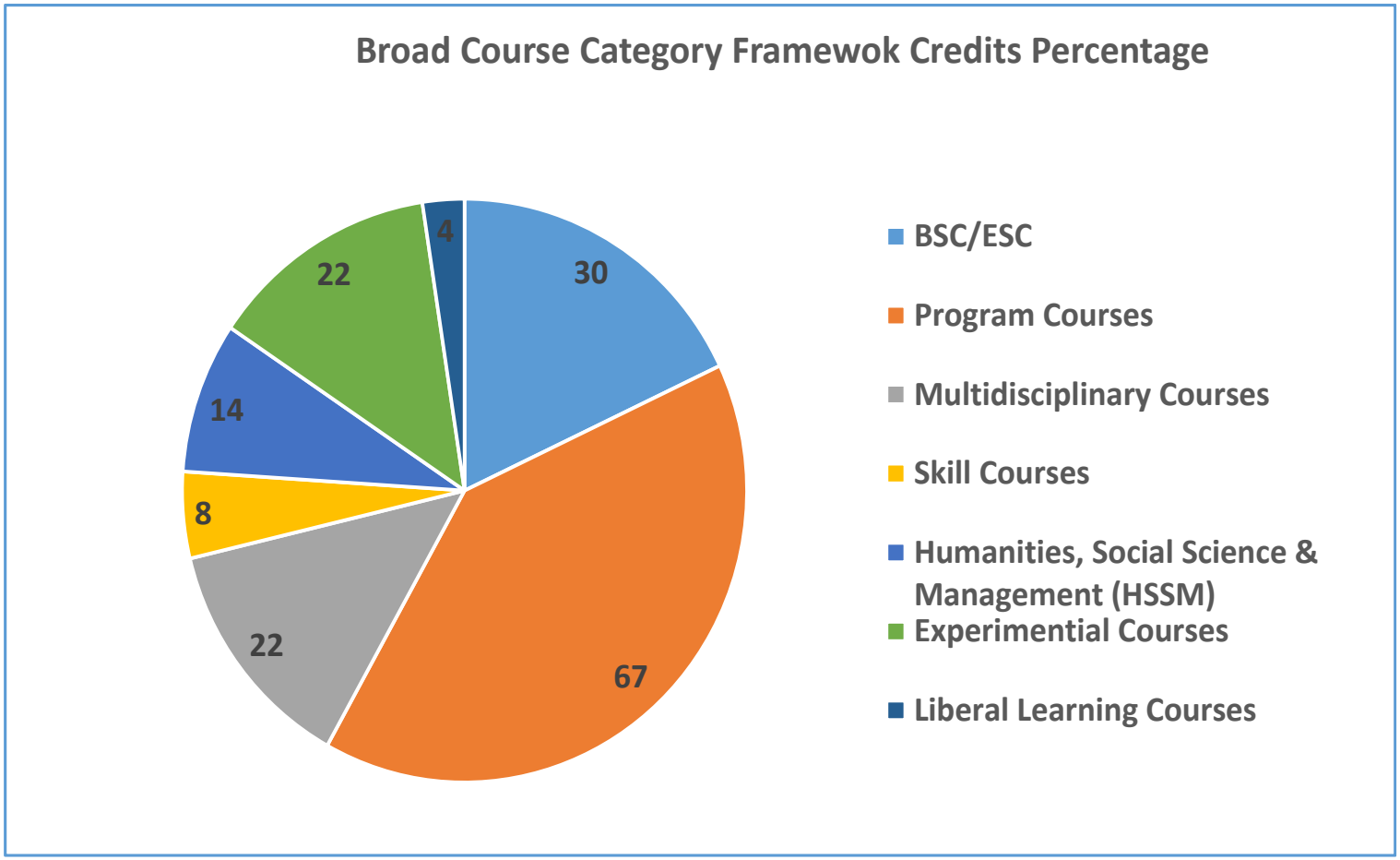
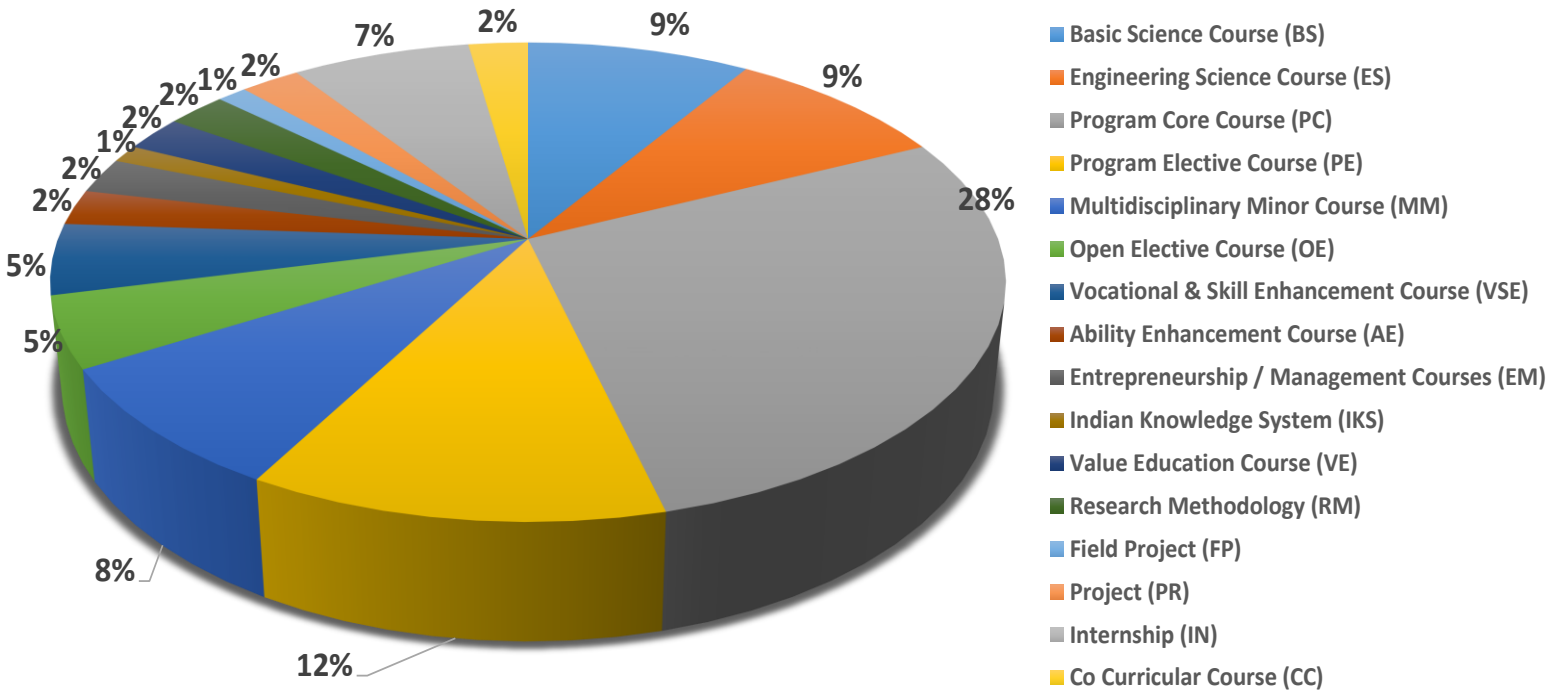

Broad Course Category Framewok Credits Percentage
30
67
22
8
14
22
4
BSC/ESC
Program Courses
Multidisciplinary Courses
Skill Courses
Humanities, Social Science & Management (HSSM)
Experimental Courses
Liberal Learning Courses


Course Category Credits
9%
9%
28%
12%
8%
5%
5%
2%
2%
1%
2%
2%
1%
2%
7%
2%
Basic Science Course (BS)
Engineering Science Course (ES)
Program Core Course (PC)
Program Elective Course (PE)
Multidisciplinary Minor Course (MM)
Open Elective Course (OE)
Vocational & Skill Enhancement Course (VSE)
Ability Enhancement Course (AE)
Entrepreneurship / Management Courses (EM)
Indian Knowledge System (IKS)
Value Education Course (VE)
Research Methodology (RM)
Field Project (FP)
Project (PR)
Internship (IN)
Co Curricular Course (CC)

Semester-wise Credit Distribution

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	Basic Science Course (BS)	8	7	3						18	14-18
2	Engineering Science Course (ES)	8	4							12	12-16
3	Program Core Course (PC)		6	10	11	11	6	3		47	44-56
4	Program Elective Course (PE)					4	8	8		20	20
5	Multidisciplinary Minor Course (MM)			3	3	3	3	2		14	14
6	Open Elective Course (OE)				3	3		2		8	8
7	Vocational & Skill Enhancement Course (VSE)			3	1	2	1	1		8	8
8	Ability Enhancement Course (AE)	1	3							4	4
9	Entrepreneurship / Management Courses (EM)			1					3	4	4
10	Indian Knowledge System (IKS)	2								2	2
11	Value Education Course (VE)	2	2							4	4
12	Research Methodology (RM)								4	4	4
13	Field Project (FP)						2			2	2
14	Project (PR)							4		4	4
15	Internship (IN)								12	12	12
16	Co Curricular Course (CC)				2	2				4	4
	Total Credits	**21**	**22**	**20**	**20**	**25**	**20**	**20**	**19**	**167**	160-176

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General Instructions:

(1) 10% content of syllabus of each theory course shall be completed by the students with self-study. The 10% portion of each course (for self-study) shall be declared by the concerned course-coordinator at the beginning of teaching of the course.

(2) Student can complete **any Course** or programme elective courses PE1 to PE5 in "online" mode, offered through SWAYAM/ NPTEL portal or equivalent platform which provides Evaluation mechanism with the permission of Departmental Faculty Board (DFB). In this case –

(i) Students can register and complete these online courses any time after beginning of third semester, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of respective semester in which the course is being offered.

(ii) In case, if a student registers for a course in online mode but fails in the course, the student will have to register for the course offered by the institute in respective semester as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc.) of the course, and successfully complete the course.

(3) In eighth semester, the students have to complete mandatory internship of one semester in the company/ organization approved by the DFB.

(4) In eighth semester during internship, the students have to complete the theory courses in any one of the two modes:

(i) **Online courses** offered through SWAYAM/ NPTEL or equivalent platform which provides Evaluation mechanism with the permission of DFB: In this case, students can register and complete these online courses any time after beginning of third semester and complete the course and submit the score card/ certificate before declaration of result of eighth semester.

In case if a student registers for a course in online mode but fails in the course, the student will have to register for the course offered by the institute as per curriculum. In this case, the student will have to appear for all the examinations (CT1/CT2, TA, ICA, ESE etc.) of the course personally as per the schedule declared by the institute, and successfully complete the course.

(ii) **Self-study mode:** In this case the student will have to study the course offered by the institute of his/her own. The student shall appear for all the college assessments/ examinations (CT1/CT2, TA and ESE) personally as per the schedule declared by the institute and successfully complete the course.

(5) In addition to program specific courses, the students have to complete vocational skill courses, internship, field projects connected to **major degree**.

(6) Exit Option:
The exit option at the end of each year will be available to students after even semester. i.e. 2nd semester, 4th semester & 6th semester and will commence from AY 2024-25 for UG Certificate, AY 2025-26 for UG Diploma, AY 2026-27 for B. Voc./B. Sc. Engineering degree.

(7) Students opting for exit at any level (after odd semesters or even semester) will have to earn additional eight credits before exit in skill based vocational courses and internship/apprenticeship/mini project to make them eligible to get UG certificate / UG Diploma or B. Voc. /B. Sc. Engineering degree as per eligibility.

(8) Re Entry and Lateral Entry: Students opting for exit at any level after even semester, will have the option to re-enter the programme from where they left off in odd semesters within **four years of exit.** There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(9) Students opting for exit after odd semester, i.e. 1st, 3rd, 5th or 7th semester will have the option to re-enter the programme from where they left off in even semesters only. There shall be a gap of at least **one year** between exit and re-entry to UG programme.

(10) Maximum period for completion of B. Tech. programme:
The student has to complete the degree programme within the stipulated **maximum period of eight years** from the date of admission to first year UG. The maximum duration of the programme includes the period of exit, withdrawal, absence and different kinds of leaves permissible to a student but it shall exclude the period of rustication of the student from the institute. However, genuine cases on confirmation of valid reasons may be referred to Academic Council for extending this limit by **additional one year**.

(11) Eligibility for admission to the UG Bachelor's Degree with Honours/ Research/Double Minor:
Students with minimum **CGPA of 7.5** without backlog courses at the end of fourth semester and should have earned 84**credits** are eligible for admission to the UG Bachelor's Degree with Honours/ Research/ Double Minor.

Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One Yr. UG certificate course in Engg./Tech.	8	2 Months Internship **OR** Online Two skill courses at ITI Level from NSQF/ESSC/ANY Other agency which provides certification/ Evaluation @ (**Electrical Measurement and Wiring & Maintenance and Repairs of Electrical Equipment**) **OR** Technical Project
Exit-2	5.0	Two Yr. UG Diploma in Engg./Tech.	8	2 Months Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification/ Evaluation @ (**Industrial Automation & Electrical Estimating and Costing**) **OR** Technical Project
Exit-3	5.5	Three Yr. Bachelor Degree in Vocation. (B.Voc.) or B.Sc. (Engg./Tech.)	8	2 Months Internship **OR** Online Two skill courses at Degree Level from NSQF/ESSC/ANY Other agency which provides certification/ Evaluation @ (**Solar & LED Technician & Final Assembly Operator - Magnetics**) OR Technical Project

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SEMESTER –III														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
											Practical		Total	
			TH	TU	PR	Total	CT-1	CT-2	TA	ESE	ICA	ESE		
BS5	SH1301(C)	Transform and Differential Equations	3			3	15	15	10	60			100	3
MM1	EE1315/16	Multidisciplinary Minor 1	3			3	15	15	10	60			100	3
PC3	EE1301	Electromagnetic Fields	4			4	15	15	10	60			100	4
PC4	EE1302	Electrical Circuit Analysis	3			3	15	15	10	60			100	3
PC5	EE1303	Signals & Systems	3			3	15	15	10	60			100	3
VSE1	EE1304	Electrical Circuit Analysis Laboratory			2	2					25	25	50	1
VSE2	EE1305	Electrical Measurements and Measuring Instruments Laboratory	1		2	3					25	25	50	2
EM1	EE1306	Innovation, Creativity & Entrepreneurship (Electrical Workshop)			2	2					50		50	1
Total			**16**	**1**	**6**	**23**	**75**	**75**	**50**	**300**	**100**	**50**	**650**	**20**

SEMESTER – IV														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM2	EE1415/16	Multidisciplinary Minor 2	3			3	15	15	10	60			100	3
PC6	EE1401	Electrical Machines - I	3			3	15	15	10	60			100	3
PC7	EE1402	Microprocessors and Microcontrollers	3			3	15	15	10	60			100	3
PC8	EE1403	Power Electronics	3			3	15	15	10	60			100	3
OE1	SH1401	Open Elective 1	3			3	15	15	10	60			100	3
PC9	EE1404	Electrical Machines - I Laboratory			2	2					25	25	50	1
PC10	EE1405	Microprocessors and Microcontrollers Laboratory			2	2					25	25	50	1
VSE3	EE1406	Power Electronics Laboratory			2	2					25	25	50	1
CC1	SH1402	Co-curricular Course			4	4			20				20	2
Total			**15**	**0**	**10**	**25**	**75**	**75**	**70**	**300**	**75**	**75**	**670**	**20**

Co-Curricular Course: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level/ college level cultural activities, Drama, painting, annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc. **Co-Curricular Course Activities minimum hours:** 2 hours per week or 24 hours.

EXIT CRITERIA FOR U. G. DIPLOMA															
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
EX2	EE1411	**Industrial Automation**									50		50		4
EX2	EE1412	**Electrical Estimating and Costing**									50		50		4
OR															
EX2	EE1413	**Internship / Technical Project**									100 @		100		8

@ Based on seminar, Internship Report, Internship/ Project evaluation

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SEMESTER –V														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
								Theory			Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM3	EE1515/16	Multidisciplinary Minor 3	3			3	15	15	10	60			100	3
PC11	EE1501	Electrical Power - I	3			3	15	15	10	60			100	3
PC12	EE1502	Electrical Machines - II	3			3	15	15	10	60			100	3
PC13	EE1503	Control System	3			3	15	15	10	60			100	3
PE1	EE1504	Program Elective 1	4			4	15	15	10	60			100	4
OE2	SH1501	Open Elective 2	3			3	15	15	10	60			100	3
VSE4	EE1505	Professional Software Lab			2	2					25	25	50	1
VSE5	EE1506	Electrical Power – I Laboratory			2	2					25	25	50	1
PC14	EE1507	Electrical Machines – II Laboratory			2	2					25	25	50	1
PC15	EE1508	Control System Laboratory			2	2					25	25	50	1
CC2	SH1502	Co-curricular Course			4	4			20				20	2
MNC2	SH1503	Soft Skills	2			2			20				20	0
Total			**21**	**0**	**10**	**31**	**90**	**90**	**100**	**360**	**100**	**100**	**840**	**25**

Co-Curricular Course: Active Participation in Activities such as: Sports, Tech-fest, College Club Activity, University level/ college level cultural activities, annual day, department student's association/IE/ISTE, paper presentation, foreign language certificate, NCC etc. **Co-Curricular Course Activities minimum hours:** 2 hours per week or 24 hours.

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ADDITIONAL CRITERIA FOR HONORS															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE			
PEH1	EE1521	Advanced Electrical Drives (NPTEL, IIT Kanpur, Dr. S. P. Das)													3
PEH2	EE1522	Operation and Planning of Power Distribution Systems (NPTEL, IIT Guwahati, Dr. Sanjib Ganguly)													3
	Total														**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH															
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme								Credits
							Theory				Practical		Total		
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE			
PER1	EE1531	Research Project Stage 1			08	08					100		100	4	
Total					08	08					100		100	4	

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ADDITIONAL CRITERIA FOR DOUBLE MINOR (Electrical Engineering) for other branch students														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN1	EE1541	Electrical Circuit Analysis	3				15	15	10	60			100	3
MN2	EE1542	Electrical Machines	3				15	15	10	60			100	3
	Total		6				30	30	20	120			200	6

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SEMESTER –VI														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM4	EE1615/16	Multidisciplinary Minor 4	3			3	15	15	10	60			100	3
PC16	EE1601	Electrical Power - II	3			3	15	15	10	60			100	3
PC17	EE1602	Control System Design	3			3	15	15	10	60			100	3
PE2	EE1603	Program Elective 2	4			4	15	15	10	60			100	4
PE3	EE1604	Program Elective 3	3	1		4	15	15	10	60			100	4
VSE6	EE1605	Electrical Power – II Laboratory			2	2					25	25	50	1
FP	EE1606	Minor Project			4	4					25	25	50	2
MNC3	EE1607	Electrical Estimation and Costing	2			2	15	15	20				50	0
MNC4	SH1601	NCC/NSS							20				20	0
Total			**17**	**2**	**6**	**25**	**90**	**90**	**90**	**300**	**50**	**50**	**670**	**20**

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EXIT CRITERIA FOR EXIT CRITERIA FOR B. VOC.														
Category	Course Code	Name of the Course @	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
EX3	EE1611	**Solar & LED Technician**									50		50	4
EX3	EE1612	**Final Assembly Operator - Magnetics**									50		50	4
OR														
EX3	EE1613	**Internship / Technical Project**									100@		100	8

@ Based on seminar, Internship Report, Internship/ Project evaluation

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ADDITIONAL CRITERIA FOR HONORS

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PEH3	EE1621	Transmission Lines and Electromagnetic Waves (NPTEL IIT Madras, Ananth Krishnan)												3
PEH4	EE1622	Industrial Automation and Controls (IIT Kharagpur, Alok Kanti Deb)												3
	Total													**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PER2	EE1631	Research Project Stage 2			12	12					100	100	200	6
Total					12	12					100	100	200	6

ADDITIONAL CRITERIA FOR DOUBLE MINOR (Electrical Engineering) for other branch students														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN3	EE1641	Electrical Power	3			3	15	15	10	60			100	3
MN4	EE1642	Power Electronics	3			3	15	15	10	60			100	3
	Total		6			6	30	30	20	120			200	6

SEMESTER –VII														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MM5	EE1715/16	Multidisciplinary Minor 5			4	4					100		100	2
PC18	EE1701	Electrical Drives and Control	3			3	15	15	10	60			100	3
PE4	EE1702	Program Elective 4	3	1		4	15	15	10	60			100	4
PE5	EE1703	Program Elective 5	4			4	15	15	10	60			100	4
OE3	SH1701	Open Elective 3	2			2	15	15	10	60			100	2
VSE7	EE1704	Electrical Drives and Control Laboratory			2	2					25	25	50	1
PR	EE1705	Project			8	8					50	50	100	4
MNC 5	EE1706	Electrical Power Utilization & Safety	2			2	15	15	20				50	0
Total			**14**	**1**	**14**	**29**	**75**	**75**	**60**	**240**	**175**	**75**	**700**	**20**

Note: Project Guide Teaching load: 8hrs/week.

Students can register for the elective in seventh semester under Multidisciplinary Minor 4 using **SWAYAM/NPTEL** etc. portal. Courses will be of completely student's choice but approved by DFB of concerned department (other than MM1 to MM3) and should be **at least of 12 weeks** including tutorials, which will be considered as **4 credit course**.

Students can register and complete online courses for Multidisciplinary Minor 4any time after completion of semester IV, however, the student must successfully complete and pass the course, and submit the score card/certificate before declaration of result of VII semester.

ADDITIONAL CRITERIA FOR HONORS														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Thoery				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PEH5	EE1721	Digital Control Systems (NPTEL, IIT Guwahati, Indrani Kar)												3
PEH6	EE1722	Power Quality (NPTEL, IIT Delhi, Bhim Singh)												3
	Total													**6**

ADDITIONAL CRITERIA FOR HONORS WITH RESEARCH														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
PER3	EE1731	Research Project Stage 3			16	16					100	200	300	8
Total					16	16					100	200	300	8

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ADDITIONAL CRITERIA FOR DOUBLE MINOR (Electrical Engineering) for other branch students														
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE		
MN5	EE1741	Control Systems	3			3	15	15	10	60			100	3
MN6	EE1742	Electrical Drives and Control	3			3	15	15	10	60			100	3
	Total		6			6	30	30	20	120			200	6

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SEMESTER –VIII														
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**							**Credits**
								Theory			**Practical**		**Total**	
			TH	TU	PR	Total	CT1	CT2	TA	ESE	ICA	ESE	Total	
RM	SH1801	Research Methodology (Online through SWAYAM/NPTEL)	4			4	15	15	10	60			100	4
EM2	EE1801	Principles of Management (Online through NPTEL, IIT Roorkee, Prof. Usha Lenka) https://onlinecourses.nptel.ac.in/noc23_mg33/preview	3			3	15	15	10	60			100	3
IN	EE1802	Internship (Online reviews - one in each month)									100	200	300	12
		Total	7			7	30	30	20	120	100	200	500	19

Note: Internship Guide Teaching load: 4 hrs/week.

LIST OF PROGRAM ELECTIVES					
	PE1-EE1504	**PE2-EE1603**	**PE3-EE1604**	**PE4-EE1702**	**PE5-EE1703**
A	Computer aided Design of Electrical Machines (NPTEL)	Power System Protection	EHV AC Transmission	HVDC and FACTS	Power System Dynamics and Stability
B	Energy Efficiency in Electrical Utilities	Energy Resources, Environment and Economics	Introduction to Renewable Energy	Power Generation and Systems Planning	Energy Management
C	Electric and Hybrid Electric Vehicles	EV Battery and Chargers	EV Motors and Power Converters	Super Capacitors and Fuel Cell Technology	Electric Vehicles: Design, Dynamics & Testing
	SWAYAM/NPTEL etc. related to vertical approved by DFB	**SWAYAM/NPTEL** etc. related to vertical approved by DFB	**SWAYAM/NPTEL** etc. related to vertical approved by DFB	**SWAYAM/NPTEL** etc. related to vertical approved by DFB	**SWAYAM/NPTEL** etc. related to vertical approved by DFB

SWAYAM/ NPTEL etc. portal Courses for PE1 to PE5 should be related to concerned vertical approved by DFB and should be at least of **12 weeks** including tutorials.

LIST OF MULTIDICIPLINARY MINOR COURSES:

Sr. No.	Offering Department	Name of Programme /Minor Course	Students from Department who can register
1	CSE	Data Science	CE,ME,EE,ENTC,INST
		Artificial Intelligence	CE,ME,EE,ENTC,INSTR
2	IT	Machine Learning	CE,ME,EE,ENTC,INST
		Software Engineering	CE,ME,EE,ENTC,INST
3	ENTC	IOT	CE,ME,EE,CSE,IT,INST
		Electronics and Telecommunication Engg.	CE,ME,EE,CSE,IT,INST
4	ME	Mechanical Engineering	CE,EE,ENTC,CSE,IT,INS
		Automation & Robotics	CE,EE,ENTC,CSE,IT,INS
		Industrial Management	ME,CE,ENTC,CSE,IT,EE,INST
5	CE	Building Construction and Management	ME,EE,ENTC,CSE,IT,INST
		Business Economics	ME,EE,ENTC,CSE,IT,INST,CE
6	EE	Energy Engineering	ME,CE,ENTC,CSE,IT,INST
		Electrical Motors & Drives	ME,CE,ENTC,CSE,IT,INST
7	INST	Instrumentation and Control	ME,CE,ENTC,CSE,IT,EE
		Banking and Finance	ME,CE,ENTC,CSE,IT,EE,INST

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Name of Programme /Minor Course	Course Code	Civil Engineering		Mechanical Engineering			Electrical Engineering	
		Building Construction and Management (TRACK-I)	Business Economics (TRACK-II)	Mechanical Engineering (TRACK-I)	Automation & Robotics (TRACK-II)	Industrial Management (TRACK-III)	Energy Engineering (TRACK-I)	Electrical Motors & Drives (TRACK-II)
MinorCourse-1	XX1315/16/17	CE1315 Basics of Civil Engineering	CE1316 Principles of Macroeconomics	ME1315 Production Technology	ME1316 Hydraulics and Pneumatics	ME1317 Organizational Behaviour	EE1315 Introduction to Renewable Energy	EE 1316 Electrical Motors
MinorCourse-2	XX1415/16/17	CE1415 Building Construction	CE1416 Principles of Microeconomics	ME1415 New and Renewable Energy Sources	ME1416 Automation in Manufacturing	ME1417 Human Resource Management	EE1415 Energy Resources, Environment and Economics	EE 1416 Special Electrical Machines
MinorCourse-3	XX1515/16/17	CE1515 Building Planning & Drawing	CE1516 Business Statistics	ME1515 Automobile Engineering	ME1516 Mechatronic Systems	ME1517 Material Management	EE1515 Energy Efficiency in Electrical Utilities	EE 1516 Power Electronics
MinorCourse-4	XX1615/16/17	CE1615 Building Estimates & Tendering	CE1616 Financial Accounting	ME1615 Basic of Product Design	ME1616 Industrial Robotics	ME1617 Marketing Management	EE1615 Energy Management	EE 1616 Electrical Drives and Control
MinorCourse-5	XX1715/16/17	CE1715 Construction Management	CE1716 Minor Project	ME1715 Industrial Management and Quality Control	ME1716 Computer Integrated Manufacturing	ME1717 Corporate Financial Reporting and Analysis	EE1715 Project	EE 1716 Project

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Name of Programme /Minor Course	Course Code	Electronics Engineering		Computer Engineering		Information Technology		Instrumentation Engineering	
		Internet of Things (TRACK-I)	Electronics and Telecommunication Engg. (TRACK-II)	Data Science (TRACK-I)	AI (TRACK-II)	Machine Learning (TRACK-I)	Software Engineering (TRACK-II)	Instrumentation and Control (TRACK-I)	Banking and Finance (TRACK-II)
MinorCourse-1	XX1315/16	ET1315 Introduction to internet of things	ET1316 Digital Circuits	CS1315 Fundamentals of data science	CS1316 Introduction to Artificial Intelligence	IT1315 Essential math for machine learning	IT1316 Data Structure & Algorithms	IN1315 Industrial Measurement I	IN1316 Bank operations Management
MinorCourse-2	XX1415/16	ET1415 IoT Architecture & Protocols	ET1416 Communication Engineering	CS1415 Computational Data Analytics	CS1416 Data Mining	IT1415 Artificial Intelligence	IT1416 Software Engineering	IN1415 Industrial Measurement II	IN1416 Strategic management and innovation in banking
MinorCourse-3	XX1515/16	ET1515 Programming with Arduino and Raspberry-Pi	ET1516 Microprocessor &Embedded System	CS1515 Natural Language Processing	CS1516 Introduction to Machine Learning	IT1515 Machine learning	IT1516 Object Oriented Design & Programming	IN1515 Control system Engineering	IN1516 Security analysis and portfolio management
MinorCourse-4	XX1615/16	ET1615 Industrial Internet of Things	ET1616 Wireless Communication	CS1615 Application of data science	CS1616 Optimization Methods in Machine Learning	IT1615 Deep Learning	IT1616 Software Testing	IN1615 Industrial Automation	IN1616 Spreadsheet based data analysis
MinorCourse-5	XX1715/16	ET1715 Project	ET1716 Project	CS1715 Marketing Analytics for Big Data	CS1716 Human Applications of AI	IT1715 Minor Project	IT1716 Minor Project	IN1715 Programming for PLAC,DCS & SCADA	IN1716 IT operations &Management

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LIST OF OPEN ELECTIVE COURSES			
	OPEN ELECTIVE-I	**OPEN ELECTIVE-II**	**OPEN ELECTIVE-III**
COURSE CODE	SH1401	SH1501	SH1701
A	**Appreciating Indian Music**	**Environmental law**	**Operational Research**
B	**Introduction to Human Psychology**	**Cyber law**	**Digital Marketing**
C	**Nanotechnology, Science and Application**	**Introduction to Mass Communication**	**Biology for Engineers**
D	**Introduction to Exercise Physiology & Sports Performance**	**Foreign Language Japanese (N5) /German (A1)**	**Foreign Language Japanese (N4) /German (A2)**
	SWAYAM/NPTEL https://onlinecourses.nptel.ac.in/noc22_hs57/preview https://onlinecourses.nptel.ac.in/noc24_hs39/preview https://onlinecourses.nptel.ac.in/noc19_mm21/preview https://onlinecourses.nptel.ac.in/noc24_hs86/preview	**SWAYAM/NPTEL**	**SWAYAM/NPTEL**

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LIST OF PROGRAM ELECTIVES HONOR'S COURSES (Swayam/NPTEL)	
COURSE CODE	**<Name of Area >**
EE1521	Advanced Electrical Drives (NPTEL, IIT Kanpur, Dr. S. P. Das) https://nptel.ac.in/courses/108104011
EE1522	Operation and Planning of Power Distribution Systems (NPTEL, IIT Guwahati, Sanjib Ganguly) https://nptel.ac.in/courses/117103149
EE1621	Transmission Lines and Electromagnetic Waves (NPTEL, IIT Madras, Ananth Krishnan) https://onlinecourses.nptel.ac.in/noc24_ee42/preview
EE1622	Industrial Automation and Controls (NPTEL, IIT Kharagpur, Alok Kanti Deb) https://onlinecourses.nptel.ac.in/noc24_ee56/preview
EE1721	Digital Control Systems (NPTEL, IIT Guwahati, Dr. Indrani Kar) https://nptel.ac.in/courses/108103008
EE1722	Power Quality (NPTEL, IIT Delhi, Bhim Singh) https://nptel.ac.in/courses/108102179

LIST OF MINOR COURSES FOR DOUBLE MINOR (Electrical Engineering)	
COURSECODE	**Electrical Engineering**
EE1541	Electrical Circuit Analysis
EE1542	Electrical Machines
EE1641	Electrical Power
EE1642	Power Electronics
EE1741	Control Systems
EE1742	Electrical Drives and Control

Sample Guidelines for the Honour with Research Project

The purpose of this course is to introduce students to the process of conducting research projects/work. The students will be helped to conceptualise, design and execute a research project by a teacher guide.

Stage-1:

- Student have to complete online course related to topic/perquisite course prescribed by the assigned guide/BoS
  OR
- The focus will be on discussions and analysis of assignments. Learners will be encouraged to read books and research journals related to his/her research topic (literature review, theory and hypotheses etc.) and share them in the seminars and evaluated by two members Team of department and same to be enter in ICA format.

Stage-2:

Sample steps:

- Research design/Methodology
- Sampling tool of data collection
- Data processing and analysis
- Plan of research report
- Publish review paper in peer view journal/Scopus indexed journal and seminar on it
- The faculty supervisor will assess the method and procedures used by the learner
- At end evaluated by two member Team of department

Stage-3:

- If applicable initiate Actual implementation
- Data Analysis and Interpretation: The outcome of the research is presented in tabular form with the help of statistical procedures. The data are analysed and interpreted and presented in the form of a research report and presentation /seminar.
- Report writing
- Publish paper on findings in peer view journal/Scopus indexed journal.
- Two member Team of department will assess the Findings method and procedures
- The faculty supervisor will assess the presentation of major findings depending on the methodology used, presentation of results, interpretation of the results with discussion, summary of the proposed research problem and conclusion.
- Two member Team of department (may evaluated by Guide and external expert) will assess the Findings method and procedures etc

Note: Guide Teaching load: 4 Hrs. per student in Research stage - 1/2/3

Equivalence Scheme

Programme Name:- B. Tech. Electrical Engineering

III Semester

S. N.	Course code with Name of course (OLD) Revised Curriculum 2019-20			Course code with Name of course(NEW) (NEP Version-II)		
	Code	Name	Credit	Code	Name	Credit
1	SHU321C	Transform and Statistical Methods	--	SH1301(C)	Transform and Differential Equations	3
2	--	--	--	EE1315/16	Multidisciplinary Minor 1	3
3	EEU423	Electromagnetic Fields	4	EE1301	Electromagnetic Fields	4
4	EEU322	Electrical Circuit Analysis	4	EE1302	Electrical Circuit Analysis	3
5	EEU422	Signals & Systems	4	EE1303	Signals & Systems	3
6	EEU325	Electrical Circuit Analysis Lab	1	EE1304	Electrical Circuit Analysis Laboratory	1
7	EEU424	Electrical Measurement and Instrumentation Lab	3	EE1305	Electrical Measurements and Measuring Instruments Laboratory	2
8	--	--	--	EE1306	Innovation, Creativity & Entrepreneurship (Electrical Workshop)	1

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Equivalence Scheme

Programme Name:-B. Tech. Electrical Engineering

IV Semester

S. N.	Course code with Name of course (OLD) Revised Curriculum 2019-20			Course code with Name of course(NEW) (NEP Version-II)		
	Code	Name	Credit	Code	Name	Credit
1	--	--	--	EE1415/16	Multidisciplinary Minor 2	3
2	EEU321	Transformers and DC Machines	3	EE1401	Electrical Machines - I	3
3	EEU524	Microprocessor and Microcontrollers	3	EE1402	Microprocessors and Microcontrollers	3
4	EEU521	Power Electronics	3	EE1403	Power Electronics	3
5	--	--	--	SH1401	Open Elective 1	3
6	EEU324	Electrical Machines – Lab I	1	EE1404	Electrical Machines - I Laboratory	1
7	EEU530	Microprocessor and Microcontrollers Lab	1	EE1405	Microprocessors and Microcontrollers Laboratory	1
8	EEU527	Power Electronics Lab	1	EE1406	Power Electronics Laboratory	1
9	--	--	--	SH1402	Co-curricular Course	2

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SEMESTER – III

Course Code	SH1301(C)	Course category	BS
Course Name	TRANSFORM AND DIFFERENTIAL EQUATIONS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2 hrs. 30 min.	--	--	100	03

Course Objectives:

1. To study solution of partial differential equations and apply it to solve wave and heat equations.
2. To learn Laplace transform and its properties. Apply it to solve differential equation
3. To equip students with Vector spaces mostly used in varied applications in engineering and science.
4. To learn inner product spaces and related processes.
5. To learn vector calculus and their applications

Course Contents:

Partial differential equations and its applications:

Definition, formation of partial differential equation, Lagrange's linear equation, nonlinear equations of the first order. method of separation of variables for solving second order Partial differential equations, Solutions of wave equation, one dimensional heat flow equation and two-dimensional heat flow equation in steady state (Laplace equation)

Laplace Transform:

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic Functions, Inverse Laplace Transform, Convolution theorem. Unit step function, unit impulse function. Applications of Laplace transforms to linear differential equations and simultaneous linear differential equations

Vector Spaces:

Vector spaces and Subspaces, Linear dependence and Independence of vectors, Bases and dimensions, Coordinate vectors, Linear transformation, Algebra of linear transformation, Representation of linear transformation of matrices relative to basis.

Random Variables and Probability Distributions:

Random variables, Discrete and Continuous random variables, Distribution functions, Probability distribution of continuous random variable. Joint distribution of discrete and continuous random variables, Conditional distribution, Mathematical expectation, Mean, moments and variance. Variance for joint distribution and Covariance

Vector Calculus:

Scalar and vector fields, line and surface integrals, gradient, divergence and curl, directional derivative, line integral independent of path, Green's, Gauss divergence and Stoke's theorems (Without proofs) and their simple applications

Text books:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers,2020, 44th edition.
2. Advanced Engineering Mathematics, H. K. Das, S. Chand & Company Pvt.Ltd,2014.
3. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Volume-I and Volume-II Laxmi Publications, Reprint,2023

Reference books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hill Publishing company Ltd. New Delhi,2008, 6th edition.
3. Advanced Engineering mathematics, Reena Garg, Khanna book publishing company, 2021
4. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).
5. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India,2002.
6. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968

Course Outcomes:

After the successfully completion of the course the student will able to

SH1301C.1 Study solution of partial differential equations and apply it to solve wave and heat equations.

SH1301C.2 Study Laplace transform and its properties. Apply it to solve differential equation

SH1301C.3 Equip students with Vector spaces mostly used in varied applications in engineering and science.

SH1301C.4 Study inner product spaces and related processes.

SH1301C.5 Solve vector calculus problems and their applications

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1301C.1	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C.2	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C.3	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
SH1301C.4	3	3	3	3	3	-		-	-	-	-	-	2	-	-
SH1301C.5	3	3	3	3	3	-	-	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	EE1315	Course category	MM
Course Name	INTRODUCTION TO RENEWABLE ENERGY		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. Energy scenario, energy sources and their utilization.
2. Society's present needs and future energy demands.
3. Principles of renewable energy conversion systems.
4. Energy conservation methods.
5. Different renewable energy technologies

Course Contents:

Energy Scenario: Indian energy scenario, different forms of energy, principles of renewable energy, renewable energy availability in India, renewable energy sources and features.

Solar Thermal Systems: Introduction to Solar and Thermal Systems, Energy conversion Principle and applications, solar water heaters, space cooling, solar distillation, solar cooking, solar green house, solar production of hydrogen, simple illustrative numerical.

Solar Photovoltaic Systems: Operating principle, concept of PV cell, module, array and array combination. Applications, battery charging, pumping, lighting. Simple illustrative numerical.

Wind energy system: Principle of wind energy conversion. Basic components of wind energy conversion system, classification of wind energy conversion system and design concepts. Extraction of power. Simple illustrative numericals.

Energy Storage systems: Mechanical energy storage, electrical energy storage, chemical energy storage, electromagnetic energy storage, thermal energy storage, biological storage.

Energy conservation: Economic concept of energy, Principle of energy conservation, energy conservation technology, energy audit and co-generation.

Text Books:

1. S. P. Sukhatme, Solar Energy - Principles of Thermal Collection and Storage, Second Edition, Tata McGraw-Hill, New Delhi 1996.
2. G. D. Rai, Non-conventional Sources of Energy, Khanna Publications.
3. H. P. Gargand Jaipraksh, Solar Energy Fundamentals and Applications, Tata McGraw-Hill Publications
4. D. Mukharjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age international Publication.
5. L. Umanand, Non-conventional Energy System, Web course: NPTEL, Course No. 22. Electrical Engineering Email: ums@cedt.iiisc.ernet.in.

Course Outcomes:

After completion of the course students will able to:

EE1315.1 Understand present energy scenario of India, energy sources/resources.
EE1315.2 Understand Society's present needs and future energy demands.
EE1315.3 Understand the Principles of renewable energy conversion systems.
EE1315.4 Understand energy conservation methods,
EE1315.5 Know about the energy auditing techniques.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1315.1	2	-	-	-	-	2	3	1	-	--	-	-	2	-	-
EE1315.2	2	2	1	2	2	2	2	1	-	2	3	-	2	-	1
EE1315.3	2	2	1	2	2	2	2	1	-	2	3	-	2	-	1
EE1315.4	2	2	1	2	2	2	3	1	-	2	3	-	2	-	1
EE1315.5	2	-	-	2	2	2	2	1	-	2	3	2	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

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Course Code	EE1316	Course category	MM
Course Name	ELECTRIC MOTORS		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs30min	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. Constructional features and operating principle of ac and dc motors.
2. Characteristics of ac and dc motors for different operating conditions
3. Testing of ac and dc motors and calculation of performance parameters

Course Contents:

DC motor: Working principle, constructional details, classifications, voltage equation, Toque equation, speed equation, Factors affecting speed, speed control, Starting of DC motors, and different types of starters.Characteristics of DC motors – electrical characteristics, mechanical characteristics, performance characteristics. Losses and efficiency - Condition for maximum efficiency, Testing of DC motor, load test on DC motors, Swinburne's test, and Application of DC motors.

Induction Motor: Rotating magnetic field, motor construction, motor specifications, and types of motor, principle of operation, Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit, PhasorDiagram, Losses and Efficiency.Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, and frequency). Methods of starting, braking and speed control for induction motors. Doubly-Fed Induction Machines.

Single Phase Induction Motor: Types, double field revolving theory, equivalent circuit, determination of motor parameters, methods of starting, applications.

Synchronous Motor: Principle of operation, constructional features and types, Principle of reversibility, voltage equation, phasor diagram, torque and power equations, steady state operating characteristic, 'V' and inverted 'V' curves, starting, hunting, damper windings and its effect, synchronous condenser, working principle of auto synchronous motor.

Text Books/References:

1. P. S. Bhimbra, Electrical Machinery, Khanna Publishers.
2. I. J. Nagrath and D. P. Kothari, Electrical Machines, Tata McGraw-Hill.
3. M. G. Say, Performance and Design of Alternating Current Machines, CBS Publishers.
4. B. L. Theraja, Electrical Technology, Vol. – II, S. Chand & Co.
5. E. Fitzgerald, Electric Machinery, Tata McGraw-Hill.
6. NEMA, IEC and IS Standards.

Course Outcomes:

After completion of the course, the students will able to:

EE1316.1 Illustrate constructional features and operating principle of ac and dc motors.
EE1316.2 Analyze characteristics of ac and dc motors for different operating conditions.
EE1316.3 Analyze performance of ac and dc machine
EE1316.4 Test ac and dc motors and calculate its performance parameters,
EE1316.5 Analyze and select machine for specific application

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1316.1	3	1	1	3	--	--	--	--	--	--	--	--	1	3	--
EE1316.2	3	3	3	2	2	--	--	--	--	--	--	--	2	3	--
EE1316.3	3	3	3	2	2	--	--	--	--	--	--	--	2	3	--
EE1316.4	3	3	1	3	3	--	--	--	--	--	--	--	--	2	--
EE1316.5	3	3	2	3	1	--	--	--	--	--	--	--	--	3	--

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Course Code	EE1301	Course Category	PC
Course Name	ELECTROMAGNETIC FIELDS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
04	--	--	04	15	15	10	60	2 hrs 30 min	--	--	100	04

Course Objectives:

To make the students aware and understand:

1. The Vector calculus.
2. The static electric fields and magnetic fields.
3. The time varying fields.

Course Contents:

Module-I: Review of Vector Calculus

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

Module-II: Static Electric Field

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

Module-III: Conductors, Dielectrics and Capacitance

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

Module-IV: Static Magnetic Fields

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Module-V: Magnetic Forces, Materials and Inductance

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

Module-VI: Time Varying Fields and Maxwell's Equations

Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

Reference Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Course Outcomes:

On completion of the course, students will be able to:

EE1301.1 To apply the vector calculus on the static electric fields.
EE1301.2 To understand conductors, dielectrics and capacitance.
EE1301.3 To apply the vector calculus on the static magnetic fields.
EE1301.4 To understand magnetic forces, materials and inductance.
EE1301.5 To evaluate time varying fields and Maxwell's equations.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE13021.1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
EE1301.2	2	1	-	2	-	-	-	-	-	-	-	-	2	-	-
EE1301.3	3	1	1	1	-	-	-	-	-	-	-	-	2	-	-
EE1301.4	2	2	-	1	-	-	-	-	-	-	-	-	2	-	-
EE1301.5	3	2	1	-	-	-	1	-	-	-	-	-	2	-	-

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Course Code	EE1302	Course category	PC
Course Name	ELECTRICAL CIRCUIT ANALYSIS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2 hrs. 30 min.	--	--	100	03

Course Objectives:

Students will be able to:

1. Analyze electrical network problems.
2. Determine transient and steady state behavior of the electrical networks
3. Estimate the parameters of two port networks.

Course Contents:

Network Theorems

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

Solution of First and Second order networks

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

Sinusoidal steady state analysis

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

Electrical Circuit Analysis Using Laplace Transforms

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

Two Port Network and Network Functions

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Textbooks/ References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. Sudhakar Shyammohan, "Circuit and Network Analysis", Tata McGraw Hill 2005

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

EE1302.1 Apply network theorems for the analysis of electrical circuits.
EE1302.2 Obtain the transient and steady-state response of electrical circuits.
EE1302.3 Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
EE1302.4 Analyze circuits using Laplace transform.
EE1302.5 Analyze two port circuit behavior.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1302.1	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1302.2	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1302.3	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1302.4	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1302.5	2	-	-	-	-	1	2	-	-	-	-	-	1	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1303	Course Category	PC
Course Name	SIGNALS & SYSTEMS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2 hrs 30 min	--	--	100	03

Course Objectives:

After the completion of the course, the students will be able to:

1. Understand about various types of signals, classify them, analyse them and perform various operations on them.
2. Understand about various types of systems, classify them, analyse them and understand their response behaviour.
3. Appreciate use of Fourier transform in analysis of signals and systems.
4. Apply Z- transform in analysis of signals and systems.
5. Learn the sampling and reconstruction of signals.

Course Contents:

Introduction to Signals and Systems:

Signals and systems - everyday life, biomedical, instrumentation domestic and industries. Representations of Signals, Classifications of Signals – Continuous time, Discrete time, comparison among Analog, Digital and Discrete Signals, Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, and the complex exponential. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

Behaviour of Continuous time (CT) & Discrete Time (DT) Linear Time Invariant (LTI) System:

Addition, subtraction, multiplication and division of the signals, parallel and series combinations of the systems, cascading of the systems, impulse response characterization and convolution integral for CT- LTI system, signal responses to CTLTI system, properties of convolution, LTI system response properties from impulse response, Examples. Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system, DT-LTI system properties from Impulse response. System analysis from difference equation model, examples.

Introduction to Fourier Series, Fourier Transform:

Fourier Series Representation of periodic Signals, Fourier series, Waveform Symmetries, Calculation of Fourier Coefficients, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform. Parseval's theorem, Properties of Continuous Time Fourier transform. System Analysis using Fourier Transform. Introduction to DTFT and DFT.

Laplace and Z Transforms:

Review of the Laplace transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The Z-Transform, Convergence of Z-Transform, Properties of Z-Transform, Inverse Z-Transform, LTI System analysis from Linear Constant Coefficient Difference Equations using Z-Transform

Sampling and the Reconstruction:

Representation of the digital signals, The Sampling Theorem, Sampling with a zero order hold, first order hold, Reconstruction of the signal from its samples using interpolation, aliasing and its effects, Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Text Books:

1. Alan V. Oppenheim, Alan S. Wilsky and Nawab, Signals and Systems, Prentice Hall India, 1997
2. B. P. Lathi, Linear Systems and signals, Oxford University press, 2009.
3. P. Ramesh Babu, R. Anandanatarajan, Signals and Systems, fourth Edition, Scitech Publications (INDIA), Pvt. Ltd.

Reference Books:

1. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
2. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
3. Signal and Systems by Anand Kumar, 3rd Edition, PHI
4. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Pearson. 2006.
5. Ashok Ambardar, Analog and Digital Signal Processing, Second Edition, Brooks/Cole Publishing Company

Course Outcomes:

On completion of the course, students will be able to:

EE1303.1 Understand the concepts of Continuous –time and Discrete-time signals.
EE1303.2 Understand the concepts of Continuous –time and Discrete-time systems.
EE1303.3 Examine the response of the systems for various signals.
EE1303.4 Analyse the systems in complex frequency domain.
EE1303.5 Apply sampling theorem and observe its implications.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1303.1	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1303.2	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1303.3	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1303.4	2	-	-	-	-	1	2	-	-	-	-	-	1	-	-
EE1303.5	2	-	-	-	1	1	2	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1304	Course category	VSE
Course Name	ELECTRICAL CIRCUIT ANALYSIS LABORATORY		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
--	--	02	02	--	--	--	--	--	25	25	50	01

Course Objectives:

To make the students aware and understand:

1. Various electrical circuit theorems.
2. Two port network parameters.
3. Steady state response of electrical circuits

Minimum Eight Hands-on experiments related to the course contents of EE1302 Electrical Circuit Analysis to be performed. Representative list is as follows:

1. To find self-inductance of two coils, mutual inductance between the coils and coefficient of coupling.
2. To verify Maximum Power Transfer theorem.
3. To verify Compensation theorem.
4. To verify Tellegen's theorem.
5. To find Z parameters of two, two port networks connected in series.
6. To find Y parameters of two, two port networks connected in parallel.
7. To determine ABCD parameters of given two port network.
8. To find transmission parameters of two, two port networks connected in cascade.
9. To study the response of RL series circuit to sinusoidal input and dc input (using MATLAB).
10. To study the response of RC series circuit to sinusoidal input and dc input (using MATLAB).

Course Outcomes:

After completion of the course, the students will be able to:

EE1304.1 Construct simple electrical circuits using suitable elements
EE1304.2 Perform experiments for verification of various facts and principles
EE1304.3 Derive conclusions on the basis of the readings /observations

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1304.1	3	1	1	--	3	--	--	--	--	--	--	--	3	3	--
EE1304.2	3	2	1	1	3	--	--	--	--	--	--	--	3	3	--
EE1304.3	3	2	1	1	3	--	--	--	--	--	--	--	--	--	--

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Sign
Member Secretary

Sign
BoS Chairperson

Sign
Dean, Academics

Sign
Principal

Course Code	EE1305							Course category			VSE
Course Name	ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS LABORATORY										
Teaching Scheme				Examination Scheme							Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT 1	CT 2	TA	ESE	ESE Duration	ICA	ESE		
01	--	02	03	--	--	--	--	--	25	25	50	02

Course Objectives:

To make the students aware and understand:

1. Necessity and importance of Measurement & Instrumentation.
2. Different bridge circuits used for measurement of electrical parameters such as R, L, C.
3. Operation of signal generators and analyzers, analog and digital instruments and recorders.

Lectures/Demonstrations:

1. Concepts relating to Measurements: True value, Accuracy, Precision, Resolution,
2. Drift, Hysteresis, Dead-band, Sensitivity. Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, C_p, C_{pk}.
3. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.
4. Current and Voltage Measurements. Shunts, Potential Dividers, Instrument Transformers, Hall Sensors.
5. Measurements of R, L and C.
6. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers.
7. Digital Storage Oscilloscope

Experiments:

Minimum Eight Hands-on experiments to be performed. Representative list is as follows.

1. Measurement of a batch of resistors and estimating statistical parameters.
2. Measurement of L using a bridge technique as well as LCR meter.
3. Measurement of C using a bridge technique as well as LCR meter.

4. Measurement of Low Resistance using Kelvin's double bridge.
5. Measurement of capacitance by De-sauty's method.
6. Measurement of inductance by Maxwell inductance Capacitance Bridge.
7. Measurement of High resistance and Insulation resistance using Megger.
8. Usage of DSO for steady state periodic waveforms produced by a function generator. Selection of trigger source and trigger level, selection of time-scale and voltage scale.
9. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.
10. Usage of DSO to capture transients like a step change in R-L-C circuit.
11. Current Measurement using Shunt, CT, and Hall Sensor.

Course Outcomes:

On completion of this course, the students will able to:

EE1305.1 Appreciate various aspects of the art and science of measurement and instrumentation.
EE1305.2 Know about different measurement methods, sensors and transducers.
EE1305.3 Identify and evaluate AC and DC bridges for measurement of R, L and C
EE1305.4 Analyze the dynamic response and the calibration of few instruments. EEU
EE1305.5 Understand statistical data analysis and computerized data acquisition.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge /skills acquired. The performance shall assess experiment wise by using continuous assessment formats, A and B.

ESE - The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1305.1	2	-	-	-	-	2	2	2	--	1	1	1	2	1	2
EE1305.2	2	3	-	-	-	1	2	1	--	1	1	1	2	1	2
EE1305.3	3	2	1	1	-	1	2	1	--	1	1	1	2	1	2
EE1305.4	2	3	-	1	-	1	1	1	-	1	1	1	2	2	2
EE1305.5	3	2	1	-	-	1	3	3	-	1	1	1	1	1	3

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1306							Course category		EM
Course Name	ELECTRICAL WORKSHOP (ICE)									
Teaching Scheme				Examination Scheme						Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	02	02	--	--	--	--	--	50	--	50	01

Course Objectives:

To make the students aware and understand:

1. Symptoms of the failure of domestic appliances.
2. Electrical safety and equipment earthing.
3. Concepts of wiring of various electrical installations.

Minimum Eight experiments should be performed. Representative list of experiments is as follows:

1 Introduction of tools, electrical materials, symbols and abbreviations.

2 Study of the symptoms of the various electrical appliances and their possible causes.

3 Study of the transformer winding and choke winding.

4 To study different types of wiring systems like tube light wiring, staircase wiring godown wiring, etc.

5 One job on preparation of extension board.

6 Study and demonstration of different types of earthing schemes.

7 Familiarization of various types of service mains - wiring installations - accessories and household electrical appliances.

8 Study of various protection elements like fuse, MCB, ELCB etc. in electric circuits.

9 To study electric circuitry and working of UPS.

10 To study electric circuitry and working of home inverter.

11 Any other experiment based on the other program core/VSE courses of the III Semester.

ICA - Internal Continuous Assessment shall be based on the practical record and knowledge/ skills acquired. The performance shall be assessed experiment-wise by using continuous assessment formats, A and B.

Course Outcomes:

After completion of the course, the students will be able to:

EE1306.1 Understand the basics and importance of the electrical tools, earthing and electrical safety.
EE1306.2 Understand and demonstrate the different types of wiring systems.
EE1306.3 Analyse the operation of various home appliances and their failure.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1306.1	3	3	2	-	-	-	1	1	-	-	-	1	3	1	1
EE1306.2	3	3	2	2	2	-	1	2	-	-	-	0	3	1	2
EE1306.3	2	2	1	2	3	-	1	2	-	-	-	1	3	3	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

SEMESTER – IV

Course Code	EE1415	Course category	MM
Course Name	ENERGY RESOURCES, ENVIRONMENT AND ECONOMICS		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. The concept of different energy sources.
2. Present Indian energy scenario and energy policies.
3. Energy efficiency and environment.
4. The energy economics.
5. The future energy sources.

Course Contents:

Basics of energy and its various forms: Overview of Indian energy scenario, various forms of energy, major primary and secondary energy sources, other primary energy sources available, commercial and non-commercial energy sources, renewable and non-renewable energy sources, global primary energy reserves, strategies for better energy security of nation, introduction to energy conservation and its importance, economics reforms in coal, oil, natural gas and electricity, energy pricing in India, energy sector reforms, energy policy, energy regulation, energy forecasting, energy efficiency.

Energy and Environment: Air pollution, So_x, No_x, Co, CFC, water pollution, acid rain, green-house effect, carbon cycle, environmental consequences of fossil fuel use.

Global environmental concerns: Ozone layer depletion, its effects, global warming, implications of global warming (climate change), Co_2 emissions, impacts, mitigation, sustainability, clean development mechanism (CDM), prototype carbon fund (PCF).

Energy Economics: Cost factors, budgeting, standard costing, sources of capital, cash flow diagram, activity chart, simple payback period analysis, time value of money, net present value method, internal rate of return method, profitability index for benefit cost ratio. Simple illustrative numerical.

Future Energy Systems: Introduction to hydrogen, properties of hydrogen, sources of hydrogen, production of hydrogen, storage of hydrogen, Introduction to fuel cell.

Text Books:

1. Fowler, J. M., Energy and Environment, McGraw Hill, New York 1984.
2. Energy Management: W. R. Murphy, G. Mckay, Butteworths Heinemann. An imprint of Elsevier.
3. Guide book for National certification examination for energy managers and energy auditors. Bureau of energy efficiency.
4. Non-conventional energy sources: G. D. Rai, Khanna Publishers, Darya Gani, New Delhi.

Course Outcomes:

On completion of the course, students will be able to:

EE1415.1 Understand different sources of energy
EE1415.2 Understand energy pricing/marketing
EE1415.3 Understand the role of energy in the economy
EE1415.4 Understand energy economics and how to maintaining a balance between economic development and environmental quality
EE1415.5 Understand the importance of future energy sources.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1415.1	2	-	-	-	-	2	3	1	-	--	-	-	2	-	-
EE1415.2	2	2	1	2	2	2	2	1	-	2	3	-	2	-	1
EE1415.3	2	2	1	2	2	2	2	1	-	2	3	-	2	-	1
EE1415.4	2	2	1	2	2	2	3	1	-	2	3	-	2	-	1
EE1415.5	2	-	-	2	2	2	2	1	-	2	3	2	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1416	Course category	MM
Course Name	SPECIAL ELECTRICAL MACHINES		

Teaching Scheme				Examination Scheme								
				Theory					Practical		Total	Credits
Th	Tu	Pr	Total	CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. Construction, principle of operation, control and performance of stepping motors.
2. Construction, principle of operation, control and performance of switched reluctance motors.
3. Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.The energy economics.
4. Construction, principle of operation and performance of permanent magnet synchronous motors
5. Construction, principle of operation and performance of other special Machines.

Course Contents:

Stepper Motors: Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits – Closed loop control – Concept of lead angle - Applications.

Switched Reluctance Motors (SRM): Constructional features –Principle of operation- Torque prediction–Characteristics Steady state performance prediction – Analytical Method – Power controllers – Control of SRM drive - Sensor less operation of SRM – Applications.

Permanent Magnet Brushless D.C. motors: Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

Permanent Magnet Synchronous Motors (PMSM): Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers – performance characteristics -Digital controllers – Applications.

Other Special Machines: Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor- Applications.

Text Books:

1. K. Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
3. E. G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

References:

1. R. Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
3. T. J. E. Miller, 'Brushless Permanent-Magnet and Reluctance Motor Drives', Oxford University Press, 1989.
4. R. Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.

Course Outcomes:

On completion of the course, students will be able to:

EE1416.1 Explore the knowledge of construction and operation of stepper motor in practical applications.
EE1416.2 Utilize the knowledge of construction, operation, and applications of stepper switched reluctance motors.
EE1416.3 Correlate the theory of the construction and operation of permanent magnet brushless D.C. motors in practice.
EE1416.4 Acquire the knowledge of construction and operation of permanent magnet synchronous motors
EE1416.5 Select a special machine for a particular application.

CO – PO – PSO Mapping:

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1416.1	3	3	3	3	-	-	1	1	-	2	-	3	3	3	3
EE1416.2	3	1	1	1	-	-	1	1	-	1	-	2	3	3	3
EE1416.3	3	3	3	3	-	-	1	1	-	2	-	3	3	3	3
EE1416.4	3	3	3	3	-	-	1	1	-	2	-	2	3	3	3
EE1416.5	3	3	3	3	3	-	2	1	-	3	-	3	3	3	3

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Sign
Member Secretary

Sign
BoS Chairperson

Sign
Dean, Academics

Sign
Principal

Course Code	EE1401	Course category	PC
Course Name	ELECTRICAL MACHINES -I		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

To make the students aware and understand:

1. Basic concept of Electromagnetic force and torque in rotating machines
2. Construction, Operation and testing of dc machines
3. Operation and testing of transformers (single-phase and three-phase)

Course Contents:

DC Machines

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

DC Machine - Motoring and Generation

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

Transformers

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion.

Text Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

References Books:

1. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers,2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

EE1401.1 Know the concepts of Electromagnetic force and torque.
EE1401.2 Understand the operation of dc machines.
EE1401.3 Evaluate the differences in operation of different dc machine configurations.
EE1401.4 Investigate the performance of dc machines and transformer by testing
EE1401.5 Analyse single phase and three phase transformers circuits and connections

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1401.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
EE1401.2	2	3	1	2	--	-	-	-	-	-	-	-	3	-	-
EE1401.3	3	2	1	2	--	-	-	-	-	-	-	-	2	-	-
EE1401.4	3	2	1	-	-	-	1	-	-	-	-	-	3	-	-
EE1401.5	2	1	1	-	-	-	-	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1402	Course category	PC
Course Name	MICROPROCESSORS AND MICROCONTROLLERS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

Students will be able to:

1. Explain the basic fundamentals and hardware of the microprocessor and microcontrollers.
2. Impart the knowledge of the programming/software used to develop programs.
3. Interface a variety of external devices with microcontrollers.

Course Contents:

Fundamentals of Microprocessors: Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

The 8051 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Instruction Set and Programming: Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Memory and I/O Interfacing: Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, and memory devices.

External Communication Interface and applications: Synchronous and Asynchronous Communication. RS232, SPI, I2C. LED, LCD and keyboard interfacing.

Text Books/ Reference Books:

1. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
2. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.
3. R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996.
4. R. Kamal, "Embedded System", McGraw Hill Education, 2009.
5. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
6. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.

Web Resources:

1. NPTEL Web course on Microprocessor by Dr.PramodAgarwal, IIT Roorkee. https://nptel.ac.in/courses/108/107/108107029/
2. NPTEL Web course on Microcontrollers and Applications by Dr. S. P. Das, IIT Kanpur. https://nptel.ac.in/courses/117/104/117104072/

Course Outcomes:

On completion of the course, students will be able to:

EE1402.1 Explore the basics of microprocessor and microcontroller.

EE1402.2 Understand the internal design of 8051 microcontroller along with its features and programming.

EE1402.3 Demonstrate the limitations and strengths of microprocessor and microcontrollers, and their comparison.

EE1402.4 Apply the knowledge to design different interfacing applications using microcontrollers and peripherals.

EE1402.5 Explore the use of microcontroller in real time applications.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1402.1	2	1	-	-	-	-	-	-	-	-	-	-	1	2	1
EE1402.2	2	1	2	2	1	-	-	-	-	-	-	-	1	2	1
EE1402.3	1	1	1	2	2	-	-	-	-	-	-	1	1	1	1
EE1402.4	1	1	-	-	-	-	-	-	-	-	-	-	1	-	1
EE1402.5	1	-	-	2	2	-	-	-	-	-	-	1	2	1	2

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Sign Member Secretary | Sign BoS Chairperson | Sign Dean, Academics | Sign Principal

Course Code	EE1403	Course Category	PC
Course Name	POWER ELECTRONICS		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
03	--	--	03	15	15	10	60	2hrs. 30min.	--	--	100	03

Course Objectives:

The students will be able to:

1. Understand the role of Power Electronics in control and conversion of Electrical power
2. Analyse all power converters
3. Use PWM converters, Switched mode converters and UPS system in appropriate circuits

Course Contents:

Thyristor family devices:
Structure, Characteristics, Switching actions, Trigger requirements, Ratings, Protections and applications of SCR, TRIAC and DIAC.

Modern power devices:
Structure, Characteristics, Switching actions, Trigger requirements, Protections and Applications of GTO, IGBT, Power MOSFET and MCT. Introduction to Power Integrated Circuits and Silicon Carbide (SiC) Power Devices.

AC-DC and AC/DC Converters (Controlled Rectifiers):
Single phase half controlled (semi-converter) and fully controlled converters - Quadrants of operation, circuit configurations, working, performance parameters and input-output wave forms for R and R-L loads, continuous and discontinuous current conduction, effect of free-wheeling diode. Single phase dual converter in circulating and non-circulating current modes.

DC-DC Converters (DC Choppers):
Step-up and step-down configurations, CLC and TRC techniques, PWM and FM techniques. Thyristorized and transistorized chopper circuits - working, control, commutation, waveforms, continuous and discontinuous current conduction.

DC-AC Converters (Inverters):
VSI and CSI. PWM techniques-Single, Multiple and Sinusoidal PWM. Transistorized (PWM) Inverters-Principle of operation, performance parameters and working of single phase and three-phase circuits.

PWM Converters:

Principle of operation, circuit configuration s and applications of Switched Mode Converters (buck, boost and buck-boost) and Switched Mode Rectifiers. Principle of cycloconverter, single phase to single phase cycloconverter circuit. Single phase AC regulators with R and R-L loads, Power factor corrector circuits, Introduction to UPS systems.

Text Books:

1. Power Electronics-Circuits Devices and Application, M. H. Rashid 2nd Ed., Prentice Hall of India (PHI) Pvt. Ltd., New Delhi, 2003.
2. Power Electronics – Converters, Applications and Design, Mohan, Undemand, Robbins, 3rd Ed., John Willey & Sons, 2004

Reference Books:

1. SCR Manual, General Electric, 6th Ed,1990.
2. Modern Power Devices, B. J. Baliga, John Willey, 1992.
3. Power Electronics Principles and Applications, Joseph Vithyathil, Tata MC-Graw-Hill Edition, 2010
4. Power Electronics–Devices, Drivers and Applications, B. W. Williams, John Wiley, 2005
5. Power Electronics, K. Thorborg, PHI Int. Ltd., 1988.

Web Resources:

1. http://www.nptel.iitm.ac.in
2. www.ocw.mit.edu

Course Outcomes:

On completion of the course, students will be able to:

EE1403.1 Classify different types of Power Semiconductor Switches.

EE1403.2 Evaluate V-I characteristics, turn-on and turn-off methods for different power semiconductor devices.

EE1403.3 Compare different types of Power Converters with their operational and analytical details.

EE1403.4 Analyse waveforms at the input and output ports of the converters.

EE1403.5 Understand construction and working of PWM converters, UPS, Power factor corrector circuit etc.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE14031	2	0	0	0	0	0	0	0	0	0	0	0	2	1	0
EE14032	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0
EE14033	3	3	2	2	2	0	0	0	0	0	0	0	2	2	0
EE14034	2	3	0	1	2	0	0	0	0	0	0	0	2	2	0
EE14035	2	1	0	0	0	0	0	0	0	0	0	0	1	1	0

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	SH1401A	Course Category	OE
Course Name	APPRECIATING INDIAN MUSIC		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	Ct-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2 hrs. 30 min.	-	-	100	03

Course Objectives:

1. To familiarize students with the historical and cultural context of Indian Classical Music.
2. To introduce students to the fundamental concepts of raga, tala, and improvisation.
3. To develop students' listening skills through analysis and appreciation of classical music recordings.
4. To provide students with practical training in basic vocal or instrumental techniques.
5. To encourage critical thinking and reflection on the aesthetic and philosophical aspects of Indian Classical Music.

Course Contents:

Introduction to Indian Music:
Historical overview: origins, evolution, and major developments, definitions (sangeet, swar and its types, saptak and its types, aroha, aavaroha, pakad, alankar, wadiswar, sanvadiswar, varjitswar, sthayi and antara) Regional variations and prominent classical music traditions (Hindustani and Carnatic). Influence of spirituality, mythology, and philosophy on Indian Classical Music.

Fundamentals of Raga:
Understanding the concept of raga (melodic framework) and its elements, Notation systems and the role of improvisation within the framework of raga (Paluskar and Bhatkhandelipi), Different THAATs and their brief information, Definition of Raga, Sargamgeet, the concept of Khyal ,aalap and tana, Raga and Time Association, Basic ragas (Bhupali, Yaman, Bhimpalasi and Kedar) along with Aaroha, avaroha, pakad and sargamgeet and khyal.

Introduction to Taala:
Understanding the components of a tala cycle (Defining- Taal, Lay and its types, matras, theaka, sum, tali, kaal, avartan).
Study of common talas (Teental, Rupak, Kehrarva, Dadra and Bhajni Theaka)
Practical exercises in clapping and counting rhythms to internalize talas.

Introduction to Musical Instruments:
Classification of Indian Musical Instruments (String, wind, percussion and Solid Instruments), components parts of Indian classical instruments along with neat sketch
Biography- Ustad Zakir Husen (Tabla), Pandit Appa Jalgaokar (Harmonium) Pandit Ravi Shankar (Sitar), Pandit Hari Prasad Chaurasiya (Flute), Dr. N Rajam (Violin)

Textbooks:
1. Indian Classical Music by Ravi S. Prasanna
2. Appreciating Indian Music by Emmons E. White
3. Fundamental of Indian Music by S. Sharma.

References:
1. Indian Music by Dr. Thakur J. Sing
2. Finding the Raga by Amit Choudhari.
3. History of Indian Music by B. A. Pingle
4. Raga Harmony by L. Subramaniam

Course Outcomes:
After successful completion of this course student will be able to

SH1401A.1: Students will demonstrate an understanding of the historical development and cultural significance of various genres and styles of Indian music.
SH1401A.2: Students will understand classical, folk, and contemporary forms, by discussing key historical milestones and movements.
SH1401A.3: Students will be able to applying knowledge of musical elements such as raga, tala, swara, and laya to identify stylistic features, structural patterns, and aesthetic qualities.
SH1401A.4: Students will develop skills and competencies relevant to careers in music education.
SH1401A.5: Students will develop skills and competencies relevant to research, arts administration, cultural advocacy, or related fields, preparing them for further academic pursuits or professional endeavours in the music industry.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401A.1	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.2	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.3	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.4	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2
SH1401A.5	1	0	0	0	0	1	2	2	3	0	0	0	1	0	2

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Sign Member Secretary | Sign BoS Chairperson | Sign Dean, Academics | Sign Principal

Course Code	SH1401B	Course Category	OE
Course Name	INTRODUCTION TO HUMAN PSYCHOLOGY		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	CT-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2hrs. 30min.	-	-	100	03

Course Objectives:

To make the students will be able to:

1. Understand the human behaviour.
2. Helps humans in exerting more control over situations
3. Basic cognitive processes that guide human behaviours.
4. Tackling everyday problems and attaining optimal solutions
5. Knowledge about human cognitive systems in designing sophisticated Artificial Intelligence (AI) systems.

Course Contents:

Introduction to Cognitive Psychology:

- History
- Theory
- Research in Human Cognition

Basic Cognitive Processes:

- Object Perception and Recognition
- Attentional Processes and cognition
- Memory Introduction
- Long Term Memory

Organizational Knowledge:

- Memory of general knowledge.
- Concept Formation
- Visual and Spatial Memory

The Use of Knowledge:

- Human language skills.
- Thought process and Problem Solving
- Reasoning
- Decision Making

Textbooks:

1. Kathleen Galotti, Cognitive Psychology, Cengage Learning.
2. Robert Stenberg, Applied Cognitive Psychology, Cengage Learning.

References:

1. Bridger Riegler, Cognitive Psychology, Pearson Press
2. Stephen Kosslyn, Cognitive Psychology, PHI Press

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

SH1401B.1: To learn history of Human Psychology.
SH1401B.2: To understand, theory and research in Human Psychology.
SH1401B.3: To learn the Basic Cognitive Processes.
SH1401B.4: To understand about Organizational Knowledge.
SH1401B.5: Apply the knowledge of human Psychology to developed process of problem solving, reasoning, decision making.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401B.1	2	3	0	0	0	0	0	1	2	0	0	0	3	1	2
SH1401B.2	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.3	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.4	2	0	0	0	0	0	0	1	2	0	0	0	2	1	1
SH1401B.5	2	2	0	0	0	0	0	1	2	0	0	0	2	1	1

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Sign
Member Secretary

Sign
BoS Chairperson

Sign
Dean, Academics

Sign
Principal

Course Code	SH1401C	Course Category	OE
Course Name	NANOTECHNOLOGY, SCIENCE AND APPLICATION		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-1	CT-2	TA	ESE	ESE Duration	ICA	ESE		
03	-	-	03	15	15	10	60	2hrs. 30min.	-	-	100	03

Course Objectives:

Students will be able to:

1. To understand the history, background and nature of Nano science and nanotechnology as well as the quantum and Nano sized scale effect on materials.
2. To acquire theoretical understanding of different types of nanostructure
3. To understand the synthesis technique and its types.
4. To learn the different methods of characterization.
5. To approach towards advance research and application of nanoparticals.

Course Contents:

Basics of Nanoscience:

Introduction, Effect of reduction of dimensions on physical properties, History of Nanotechnology, Quantum size effect.

Different classes of Nanomaterials:

Classification based on dimensionality-Quantum Dots, Wells and Wires, preparation of quantum nanostructures, conduction electrons and dimensionality, Fermi gas and density of states, potential wells, partial confinement, properties dependent on density of states, exitons, single electron tunnelling.

Material Synthesis Method:

Nanostructures of one dimension: Crystalline growth, Template based synthesis. Nanostructures of two dimensions: Fundamentals of thin film growth, physical vapour deposition, chemical vapour deposition, atomic layer deposition, self-assembly, Sol-Gel films, and electrochemical deposition.

Material Characterization Methods:

UV visible microscopy, Scanning electron microscopy (SEM), Transmission electron microscope (TEM), X-ray diffraction (XRD). Atomic Force Microscope (AFM)

Application of Nanomaterial's:

Agriculture field, Medical field, Space Technology, Food Technology, Water Treatment, Energy Sector, Automobile, Electronics Field, Textile Field, Cosmetic.

Textbooks:

1. Introduction to Nanotechnology by C.P. Poole Jr. and F.J. Owens, Wiley Interscience.
2. Nano-Technology by Gregory Timp (Editior), AIP Press, Springer.
3. Pradeep T., "A Textbook of Nanoscience and Nanotechnology", Tata Mc-Graw Hill Education Pvt. Ltd.

Reference Books and Website links:

1. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press
2. Graphene: Synthesis and applications, edited by Wonbong Choi and Jo-won Lee.
3. Semiconductor Nanostructures and Nanodevices, Vol 1-5-A. A. Balandin, K. L. Wang.
4. Springer Handbook of Nanotechnology: Bharat Bhushan
5. Nanofabrication towards biomedical application: Techniques, tools, Application and impact: Ed. Challa S., S. R. Kumar, J. H. Carola
6. A. S. Edelstein and R. C. Cammarata, "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Pub., 1998.
7. G. Cao, Nanostructures & Nanomaterials: Synthesis, Properties & Applications, Imperial College Press, 2004.
8. G. A. Ozin and A.C. Arsenault, "Nano chemistry: A chemical approach to nanomaterials", Royal Society of Chemistry, 2005.
9. Joel I. Gersten, "The Physics and Chemistry of Materials", Wiley, 2001.

10. K.W. Kolasinski, "Surface Science: Foundations of Catalysis and Nanoscience", Wiley, 2002.
11. Physical Chemistry – Atkins Peter, Paula Julio.
12. Nanotechnology in Biology and Medicine: Methods, Devices, and Applications.

Course Outcomes:

On completion of the course, students will be able to:

SH1401C.1: Learn basic of Nano science with special, emphasize on nanomaterials.
SH1401C.2: Correlate physical behavior of materials at the Nano scale.
SH1401C.3: Understand the physical, chemical and other important methods for synthesis of nanoparticles.
SH1401C.4: Understand the various characterization techniques of Nano materials.
SH1401C.5: Apply the knowledge gained to suggest different applications of Nano science and technology.

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SH1401C.1	2	0	2	0	0	0	0	0	1	2	2	3	2	2	1
SH1401C.2	3	2	3	0	2	0	2	0	0	3	2	3	2	2	1
SH1401C.3	3	2	3	2	0	0	3	3	1	3	3	3	2	2	1
SH1401C.4	3	2	3	2	2	0	2	0	0	3	3	3	2	2	1
SH1401C.5	3	2	3	2	2	0	3	1	0	3	3	3	2	2	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1404	Course Category	PC
Course Name	ELECTRICAL MACHINES-I LABORATORY		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT-I	CT-II	TA	ESE	ESE Duration	ICA	ESE		
--	--	02	02	--	--	--	--	--	25	25	50	01

Course Objectives:

To make the students aware and understand:

1. Various parts of d.c. machine and transformer
2. Operation and performance of dc motors
3. Testing of dc machines and transformers

Minimum Eight hands-onexperimentsrelatedtothecoursecontentsofEE1401 Electrical Machines- I to be performed. Representative list is as follows:

1. To identify and understand the functions of various parts of d.c. machines
2. To plot the OCC of d.c. generator
3. To find the critical speed of the d.c. generator
4. To perform and verify the speed control method of d.c. shunt motor
5. To perform the Swinburne test on d.c. machine
6. To perform the load test on d.c. series generator
7. To perform the load test on d.c. series motor
8. To perform the load test on d.c. shunt generator
9. To perform the load test on d.c. shunt motor
10. To perform the load test on d.c. compound generator
11. To perform the load test on d.c. compound motor
12. To perform the test/tests on d.c. machine to separate the losses at constant speed
13. To perform the Hopkinson's Test on d.c. machines
14. To perform the Field test on the d.c. machines
15. To perform the Sumpner's Test on single phase transformer
16. To identify and understand the functions of various parts of the three-phase transformer
17. To perform the OC and SC test on three phase transformer

18. To perform the direct loading test on three phase transformer
19. To perform the various connections of three phase transformer
20. To study the Scott connection of transformer
21. To perform OC and SC test on single phase transformer

Course Outcomes:

After completion of the course, the students will be able to –

EE 1404.1 Identify and understand the functions of various parts of d.c. machines

EE 1404.2 Plot various characteristics of dc machines

EE 1404.3 Test dc machines and transformers

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1404.1	2	-	-	-	-	-	-	1	2	-	-	-	2	1	1
EE1404.2	2	-	-	-	-	-	-	1	2	-	-	-	2	1	1
EE1404.3	2	2	-	-	-	-	-	1	2	-	-	-	2	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

Course Code	EE1405	Course category	PC
Course Name	MICROPROCESSOR AND MICROCONTROLLER LABORATORY		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	02	02	--	--	--	--	--	25	25	50	01

Course Objectives:

Students will be able to:

1. Understand the functional hardware components of a microprocessor and microcontroller.
2. Explore the programming skills for microcontroller-based system.
3. Interface various external devices with microcontroller.

Minimum Eight Experiments to be performed covering the entire Syllabus of EE1402 Microprocessors and Microcontrollers. Representative list is as follows:

1. Write a program to store data into given RAM memory locations using direct and indirect addressing modes.
2. N 8 bit numbers stored in internal data memory write a program to arrange the numbers in descending order and ascending order.
3. Write a program to create a delay of 1000 ms. Assume that the oscillator frequency is 12 MHz.
4. Write a program to toggle alternate bits at port 1.
5. Write a program to receive 8 bits data from port0 and port1. Perform AND operation of the received data and send the results to port2.
6. Write a program for Hexadecimal up counter.
7. Interface DAC and write program to generate square wave.
8. Write a program to start A/D converter and store the results in accumulator.
9. Write a program to interface LCD.
10. Write a program to interface LED.

ICA: Internal Continuous Assessment shall be based on the practical record and knowledge/ skills acquired. The performance shall be assessed experiment-wise by using continuous assessment formats, A and B.

ESE: The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

Course Outcomes:

After completion of the course, the students will be able to:

EE1405.1 Design the microcontroller-based systems.
ET1405.2 Develop the programs in assembly/C language for a microcontroller-based system.
ET1405.3 Demonstrate the skills to interface the external devices with microcontrollers.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1405.1	3	1	1	3	0	0	0	0	0	0	0	0	1	3	0
EE1405.2	3	3	3	2	2	0	0	0	0	0	0	0	2	3	0
EE1405.3	3	3	3	2	3	0	0	0	0	0	0	0	2	3	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Course Code	EE1406	Course Category	VSE
Course Name	POWER ELECTRONICS LABORATORY		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT2	TA	ESE	ESE Duration	ICA	ESE		
--	--	02	02	--	--	--	--	--	25	25	50	01

Course Objectives:

The students will be able to:

1. Plot characteristics of various power semiconductor devices
2. Know functioning of various power converters
3. Perform simulation of power converters to get desired output

Minimum Eight Experiments should be performed covering the entire syllabus of EE1403, Power Electronics course. Representative list is given as follows:

Any THREE from 1 to 5

1. SCR/ GTO Characteristics.
2. SCR Turn-on methods.
3. SCR Commutation methods.
4. IGBT / MOSFET Characteristics, Drivers.
5. TRIAC – Triggering modes and Phase control.

AnyTHREE from 6 to 10

6. Single-phase Half / Full Controlled Converter.
7. Single-phase Dual Converter.
8. Thyristorised / Transistorized D.C. Chopper.
9. Single phase Thyristorised / Transistorised Inverter.
10. Single phase Cycloconverter / A.C. Regulator.

Any TWO from 11 to 15

11. Simulation of Converter/ Chopper.

12. Simulation of Inverter / Cycloconverter.

13. Simulation of Triggering Scheme / PWM Technique.

14. Switched mode Converter/ Rectifier.

15. Uninterruptible Power Supply.

ICA: Internal Continuous Assessment shall be based on the practical record and knowledge / skills acquired. The performance shall assess experiment-wise by using continuous assessment formats, A and B.

ESE: The End Semester Exam for practical shall be based on performance in one of experiments and may be followed by sample questions.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

EE1406.1 Select appropriate semiconductor device for building a power converter

EE1406.2 Develop the power converter required for given application.

EE1406.3 Simulate the power converter before its prototype.

CO-PO-PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1406.1	2	1	0	0	0	0	0	0	0	0	0	0	1	2	1
EE1406.2	1	1	2	2	1	0	0	0	0	0	0	0	1	2	1
EE1406.3	0	1	1	2	2	0	0	0	0	0	0	1	1	1	1

0 - Not correlated 1 - Weakly Correlated 2 - Moderately Correlated 3 - Strongly Correlated

EXIT COURSES (After B. Tech. II Year)

Course Code	EE1411	Course category	EX
Course Name	INDUSTRIAL AUTOMATION		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT1	TA	ESE	ESE Duration	ICA	ESE		
--	--	--	--	--	--	--	--	--	50	--	50	04

Course Objectives:

To make the students aware and understand:

1. Need & Requirement of automation.
2. Concept of control system.
3. Concept of Programmable logic controller.

Course Contents:

Automation

Need of automation, Advantages of automation, Requirements of automation.

Control System

Concept of control system, Basic block diagram of control system, Transfer function, Different terms in control system, Types of control system, Applications of control system, Development of block diagram for simple applications like level, temperature, flow control.

Control System Components

Contacts-types, current capacity & load utilization categories, Solenoids-dc, ac , I/P devices- switches-push buttons, foot switch, selector switch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing, Relays- electromechanical, reed O/P devices- contactors, valves, pilot lamps, Symbols in power & control circuits, Developing control circuit-basic & thumb rule. Power & control circuit for different applications like hoist, crane, conveyer belt, induction motors.

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Electrical Actuators

Potentiometers-working & use as error detector, Servomotors-ac & dc –working principle, Synchros - transmitter, control transformer, use of as error detector, Stepper motor-PM & variable reluctance- working principle Tacho – generator, Applications of above components as AC/DC control system.

Controllers

Hydraulic-advantages & disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic & hydraulic systems, Electrical & electronic controller-brief overview of op-amps, inverting, non-inverting, lead-lag networks, Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller.

Control actions

On-Off, P, I, P+I, P+D,P+I+D, actions, P+I+D action using hydraulic, pneumatic electronic controller Tuning of P+I+D controller.

Programmable Logic Controller

Introduction, Advantages & disadvantages, PLC vs PC, Block diagram of PLC, Basic blocks like CPU, I/O modules, bus system, power supplies & remote I/Os, Different PLCs available in market.

Programming of PLC

Development of Ladder logic, some simple programs such as I/O connections, starting of IM, stepper motor control.

Introduction to special control systems

Distributed Control System (DCS) - brief introduction to hardware & software used, SCADA- brief introduction to hardware & software used.

Text Books:

1. Nagrath & Gopal , Control System Engineering, Wiley Eastern
2. K. Ogata, Modern Control System, Prentice Hall
3. Andrew Parr, Hydraulics & Pneumatics, Jaico Publication

Reference books:

1. Webb & Reis, Programmable Logic Controller: Principle applications, Wiley Eastern
2. S.K. Bhattachrya & Brijinder Singh, Control of Electrical Machines Control of Electrical Machines, New Age International Publishers
3. Jacob, Industrial Control Engineering, Prentice Hall

Course Outcomes:

At the end of this course, students will demonstrate the ability to

EE1411.1	Explain applications of control system/Automation
EE1411.2	Read and design data for control system
EE1411.3	Explain the hydraulic/ pneumatic systems
EE1411.4	Describe & program PLC using Ladder logic
EE1411.5	Draw power & control circuit

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1411.1	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1411.2	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1411.3	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1411.4	2	-	-	-	-	1	2	-	-	-	-	-	2	-	-
EE1411.5	2	-	-	-	1	1	2	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

Sign
Member Secretary

Sign
BoS Chairperson

Sign
Dean, Academics

Sign
Principal

Course Code	EE1412	Course Category	EX
Course Name	ELECTRICAL ESTIMATING AND COSTING		

Teaching Scheme				Examination Scheme								Credits
Th	Tu	Pr	Total	Theory					Practical		Total	
				CT1	CT1	TA	ESE	ESE Duration	ICA	ESE		
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Course Objectives:

To make the students aware and understand:

1. The importance of estimation, specification and earthing
2. The schedule of materials with specifications and estimates for service mains.
3. The students to prepare the schedule of materials with specifications and estimates for different types of electrical installations.

Course Contents:

Introduction

Meaning of estimation, purpose of estimating and the factors to be considered while preparing estimations, qualities of a good estimator, Meaning of specification, importance of specification and the factors to be considered. Meaning of standardization and its advantages. Meaning of overhead charges, stock incidental charges, contingencies, supervision charges, labour charges, Inspection/Inspectorate charges, transportation charges and miscellaneous charges. Meaning of tender/tender notice, quotation, comparative statement, purchase order and work order. Importance/ purpose of IE Act and IE Rules.

Meaning of earthing, touch potential and step potential, necessity of earthing, Points to be earthed, factors influencing earth resistance, methods of reducing earth resistance, standard values of earth resistance for various installations, method of selecting the size of earth conductor, types /methods of earthing, Pipe earthing-diagram, specifications of pipe earthing, Plate earthing-diagram and specifications of plate earthing.

Service Mains

Meaning of service mains, code of Practice for service mains, types of service mains- Over Head Service Mains -materials and specifications, UG Service Mains -materials and specifications, Standard wire size table, current ratings for Aluminum, copper conductors and selection of size of conduit pipe as per the size and number of wires.

Load calculation, selection of size and type of conductor/UG cable, discrimination of size of protective devices, Quantity calculation, schedules of materials and estimates for single phase OH service connection, three phase OH service connection, single phase UG service connection and three phase UG service connection.

Lighting Installations

Interior Wiring types and their applications, factors to be considered while selecting the type of wiring system, materials required for Interior wiring and their specifications, Code of Practice for Lighting Installations, method of deciding the number of sub-circuits, calculating the quantity of wiring materials and accessories for the Interior Wiring, load calculations for a residential buildings, size of conductors, main switch, sub switches and protective devices. Draw wiring plan for AEH Installation, concept of horizontal run, vertical rise and vertical drop. Prepare the schedule of materials for providing lighting and heating circuits and their estimates. Procedure for converting lighting to AEH installation

Power Installations

Code of Practice for Power Installations, materials required for power circuit wiring and their specifications, Prepare the layout diagram of machines showing clearances as per IS standards, draw wiring plan of the Power circuit for workshops, Decide the type of wiring.

System, load calculations, determine the size of conductors, main switch, Isolators, sub switches and protective devices, Draw the SLD of Power Distribution Scheme showing grading/discrimination of ratings of protective devices, Prepare the schedule of materials with specifications for workshops and their estimates, Determine the rating of motor for IP set and the concept (only)of pump house wiring.

Distribution Lines and Transformer Substations Code of practice for Distribution Lines and Transformer centre, types of transformer centres - Pole mounted, plinth mounted, indoor and outdoor types. Determining the rating of distribution Transformer. Write Specifications of the Distribution Transformer. Draw the SLD of a Transformer centre indicating the size of protective devices, Prepare the schedule of equipments /Materials with specifications for a 11KV/415V,100 KVA transformer centre and their estimates, 415 V LT line materials and specifications , method of calculating various LT line materials (only). Prepare the schedule of materials (only) for 3 phase 4 wire LT line, 11 KV HT Line-materials and their specifications, method of calculating various HT line materials and tapping structure, TOPO sheet and its use, Concept of combined estimates. Prepare the schedule of materials (only) for 11 KV single circuits. HT line for Rural Electrification.

Transmission Lines and Substations

Code of practice for Transmission lines and substations, transmission line materials and their specifications, types of Towers, ACSR conductors and Number of Disc insulators in suspension string, strain string, span and height of towers for 66 KV, 110 KV, 220 KV transmission lines, concept of single circuit and double circuit transmission lines, method of calculating the Quantity of transmission line materials, Prepare the schedule of materials (only) for 66 KV,110 KV and 220 KV single circuit transmission lines. 66KV/11KV, 5 MVA Substations- Single Line diagram, list of Electrical equipment/ materials (only) and their specifications.

Text Books:

1. Electrical Design Estimating and Costing, Raina. K. B. & Bhattacharya. S. K., New Age International.

Reference Books:

1. A Course in Electrical Installation, Estimating & Costing, J. B. Gupta, S. K. Kataria & Sons.
2. Electrical estimating and costing, Surjith Singh, Dhanpat Rai & Co.

Course Outcomes:

On completion of the course, students will be able to:

EE1412.1	Understand various types of materials required for wiring.
EE1412.2	Comprehend the estimation of a domestic installation.
EE1412.3	Know different systems of earthing.
EE1412.4	Comprehend the estimation of industrial installations.
EE1412.5	Comprehend the estimation of substations

CO – PO – PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
EE1412.1	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1412.2	2	-	-	-	1	1	1	-	-	-	-	-	2	-	-
EE1412.3	2	-	-	-	1	1	1	-	-	-	-	-	1	-	-
EE1412.4	2	-	-	-	-	1	2	-	-	-	-	-	2	-	-
EE1412.5	2	-	-	-	1	1	2	-	-	-	-	-	2	-	-

0 - Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

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Dean, Academics

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