Course and Examination Scheme
of NEP 2020 Curriculum

Bachelor of Technology in Electrical Engineering
(Faculty of Science and Technology)

GONDWANA UNIVERSITY, Gadchiroli
MIDC Road Complex, Gadchiroli
PIN-442 605, (M.S.)

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Key Features of Curriculum

1. Multiple exit options 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. Interdisciplinary and multidisciplinary education through minors and open electives.
6. Skill based courses.
7. Provision for learning in online mode through Swayam/NPTEL etc. courses
8. Opportunity for learner to choose courses of their interest in all disciplines.
9. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.
10. Flexibility for all types of learners i.e. Good, Normal and Exit

Credit Distribution for each year and Exit Option

NCrF Level	Year/ Semester	Exit Option	Credits	Additional Credits for exit students	Total Credits
4.5	Semester I & II	One Year U.G. Certificate in Engg. /Tech.	44	04	48
5.0	Semester III & IV	Two Year U.G. Diploma in Engg. /Tech.	86	08	94
5.5	Semester V & VI	Three Years Bachelor's Degree in Vocation (B. Voc.) Or B.Sc. (Engg. /Tech.)	129	08	137
6.0	Semester VII & VIII	B. Tech. Major with Multidisciplinary Minor	171	--	171

Course Category-wise Credit Distribution

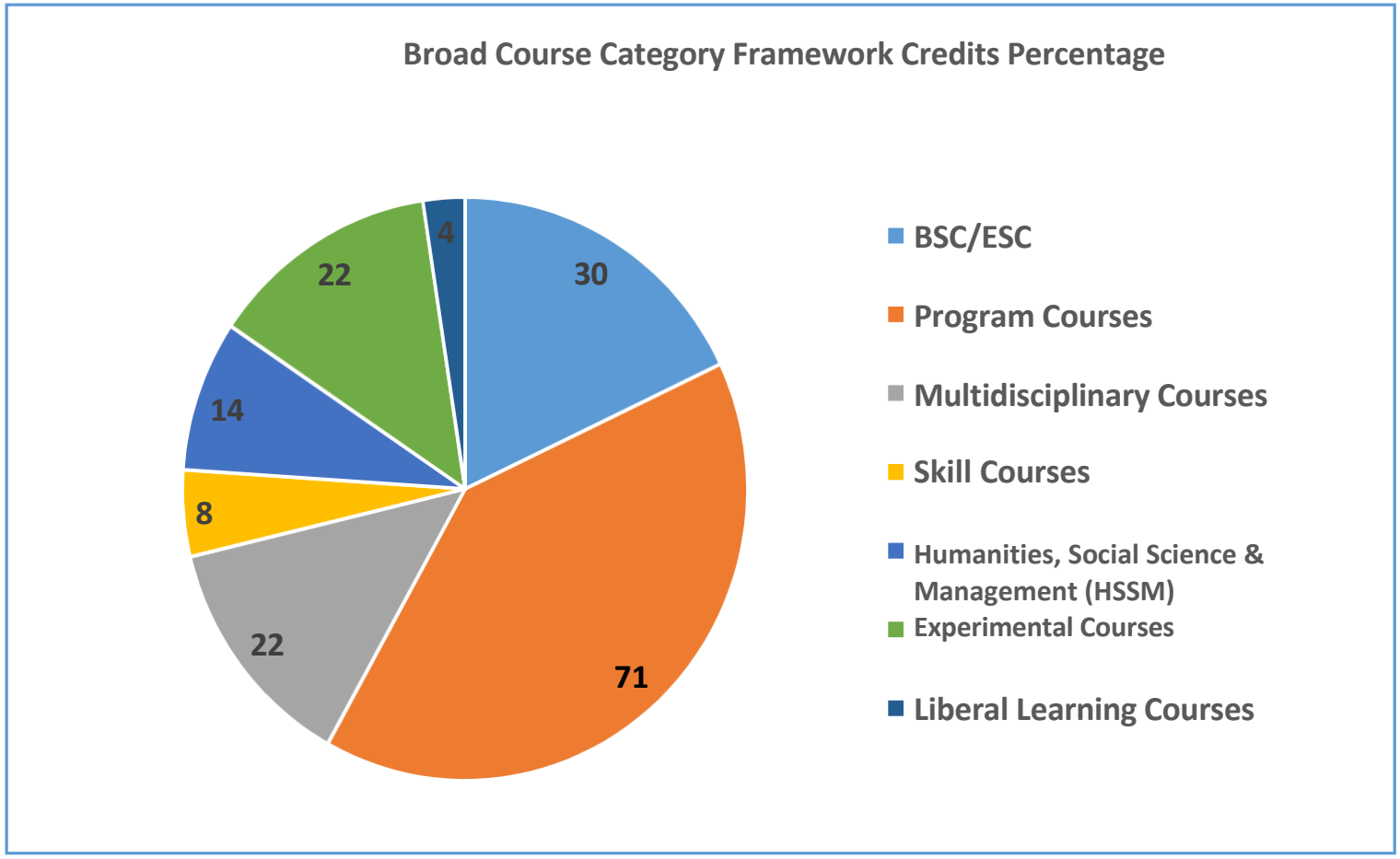
Course Category	As per NEP GR	University Credits	CC	As per NEP GR	University Credits
BSC/ESC	30	30	BSC	14-18	17
			ESC	16-12	13
Program Courses	64 -76	71	PCC	44-56	51
			PEC	20	20
Multidisciplinary Courses	22	22	MDM	14	14
			OE	8	8
Skill Courses	8	8	VSEC	8	8
Humanities, Social Science & Management (HSSM)	14	14	AEC	4	4
			EM	4	4
			IKS	2	2
			VEC	4	4
Experiential Courses	22	22	RM	4	4
			CEP	2	2
			PR	4	4
			IN/OJT	12	12
Liberal Learning Courses	4	4	CC	4	4
Total Credits	**164 - 176**	**171**		**164-176**	**171**

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Semester-wise Credit Distribution:

Sr. No.	SEM	I	II	III	IV	V	VI	VII	VIII	Total Credits	NEP Requirement
1	Basic Science Course (BSC)	8	9							17	14-18
2	Engineering Science Course (ESC)	6	7							13	16-12
3	Program Core Course (PCC)	2		8	10	12	11		8	51	44-56
4	Program Elective Course (PEC)					4	6	6	4	20	20
5	Multidisciplinary Minor Course (MDM)			2	2	3	3	2	2	14	14
6	Open /School Elective Course (OE)			4	2	2				8	8
7	Vocational & Skill Enhancement Course (VSEC)	2	2		2		2			8	8
8	Ability Enhancement Course (AEC)	2			2					4	4
9	Entrepreneurship/ Management Courses (EMC)			2	2					4	4
10	Indian Knowledge System (IKS)		2							2	2
11	Value Education Course (VEC)			2	2					4	4
12	Research Methodology (RM)								4	4	4
13	Community Engagement Activity/Field Project (CEP)			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	**22**	**22**	**20**	**22**	**21**	**22**	**20**	**22**	**171**	**164 - 176**

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General Instructions:

1. **Regarding Multi-Disciplinary Minor (MDM) track and subject:**

   i. The MDM subjects included in the NEP curriculum are to encourage students to gain knowledge and skills in areas beyond their core discipline and to promote flexibility, breadth of learning and innovation.

   ii. Minor subject title will be reflected in the student's **degree certificate** (e.g., B.Tech. in Electrical Engineering with Minor in Data Science).

   iii. In the third semester, students must select one track from the MDM basket, that is outside the scope of their parent discipline. For example, a Computer Science and Engineering student should choose an MDM track offered by departments like Instrumentation Engineering, Mechanical Engineering, or Civil Engineering etc., but not permitted to select a track provided by the Computer Science and Engineering department itself.

   iv. Once a track is selected, it cannot be changed throughout the duration of the course.

   v. The offering of any Multi-Disciplinary Minor (MDM) course track shall be subject to a minimum enrollment of fifteen (15) students.

2. **Regarding Open Electives**

   i. Students must choose one subject from open elective basket for the respective Semester.

   ii. Students from any Program/discipline are allowed to opt for any one subject offered in the open elective basket.

   iii. The offering of any Open Elective (OE) course shall be subject to a minimum enrollment of fifteen (15) students.

3. **The courses to be complete through "online" mode, offered through SWAYAM/ NPTEL portal or equivalent platform which provides Evaluation Mechanism with the permission of Departmental Faculty Board (DFB) of their college. In this case –**

   i. Students can register and complete these online courses during semester in which they are offered, 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 examination conducted by the University/institute in respective semester as per curriculum. In this case, the student will have to appear for the examinations of the course, and successfully complete the course.

4. In Seventh semester, the students have to complete mandatory internship of one semester in the company/organization approved by the DFB.

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

6. Exit Options: 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 be awarded from AY 2024-25 for UG Certificate, AY 2025-26 for UG Diploma, AY 2026-27 for B. Voc./B. Sc. Engineering degree. Students opting for exit at any level will have to earn additional four/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. (Engg. /Tech) degree as per eligibility.

7. **Regarding Practical Examination:** To pass the practical course, a student must appear for the university practical examination. Absence from this examination will result in failure, irrespective of the marks obtained in the college assessment.

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Multiple exits: Following options are available for multiple exists:

Option	NCrF Level	Qualification Title	Additional credit requirement	Bridge courses
Exit-1	4.5	One-year UG certificate in Engineering/Technology	4	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at ITI Level from NSQF/ESSC/ANY Other agency which provides certification / Evaluation **OR** Technical Project
Exit-2	5.0	Two-year UG Diploma in Engineering/Technology	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification/Evaluation **OR** Technical Project
Exit-3	5.5	Three-year Bachelor Degree in Vocation (B. Voc) or B.Sc. (Engineering/Technology)	8	Exit offline courses offered by department **OR** 2 Month Internship **OR** Online Two skill courses at Diploma Level from NSQF/ESSC/ANY Other agency which provides certification/Evaluation **OR** Technical Project

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SEMESTER–III																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Electrical Engineering	STMDMELE301	Multi-disciplinary Minor-I	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
OE	Electrical Engineering	STOEELE302	Open Elective- I	4	--	--	4	3	10	10	80	100	40	--	--	--	--	4
HSSM (VEC)	Electrical Engineering	STVECELE303	Introduction to Constitution of India	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE304	Network Analysis	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE305	Measurement & Instrumentation	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
HSSM (EMC)	Electrical Engineering	STEMCELE306	Engineering Economics	2	--	--	2	--	30	20	--	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE307	Network Analysis Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Electrical Engineering	STPCCELE308	Measurement & Instrumentation Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
CEP	Electrical Engineering	STCEPELE309	Community Engineering Project	--	--	4	4	--	--	--	--	--	--	50	--	50	25	2
Total				**16**	**--**	**8**	**24**	**--**	**70**	**60**	**320**	**450**	**--**	**100**	**50**	**150**	**--**	**20**
Marks Grand Total				**600**														

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SEMESTER–III		
LIST OF OPEN ELECTIVES - I COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOESHC302A	Mathematical Transform and Statistical Methods
B	STOESHC302B	Transform Methods in Engineering Mathematics
C	STOESHC302C	Probability and Statistics
D	STOEINS302	Signals and Systems
E	STOECEC302	Building Constructions and Materials
F	STOEELE302	Modelling and Design of EV

Note: An open elective course will be offered if at least 15 students opt for it.

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SEMESTER–IV																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Electrical Engineering	STMDMELE401	Multi-disciplinary Minor-II	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
OE	Electrical Engineering	STOEELE402	Open Elective- II	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE403	Electrical Machine-I	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE404	Renewable Energy Sources	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE405	Electromagnetic Field	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
HSSM (EMC)	Electrical Engineering	STEMCELE406	Organizational Behavior	2	--	--	2	--	30	20	--	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE407	Electrical Machin-I Lab	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Electrical Engineering	STVSECELE408	Workshop-III	--	1	2	3	--	--	--	--	--	--	50	50	100	50	2
HSSM (AEC)	Electrical Engineering	STAECELE409	Modern Indian/ Foreign Language	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
HSSM (VEC)	Electrical Engineering	STVECELE410	Human Values and Ethics	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
Total				**15**	**3**	**8**	**26**	**--**	**70**	**60**	**320**	**450**	**--**	**175**	**75**	**250**	**--**	**22**
Marks Grand Total				**700**														

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SEMESTER–IV		
LIST OF OPEN ELECTIVES - II COURSE		
Sr.	**Course Code**	**Name of the course**
A	STOEELE402	Industrial Management
B	STOEETC402	Digital System Design
C	STOECSE402	Design Thinking
D	STOEINS402	Chemical and Analytical Instrumentation
E	STOECEC402	Building Automation
F	STOEELE402	EV Design Analysis and Control

Note: An open elective course will be offered if at least 15 students opt for it.

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EXIT CRITERIA FOR U. G. DIPLOMA (AFTER SECOND YEAR)																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
PCC	Electrical Engineering	STEXELE421	Repairing & Maintenance of Electrical Appliances	--	--	16	16	--	--	--	--	--	--	100	100	200	100	8
OR																		
PCC	Electrical Engineering	STEXELE422	Industrial Electrical Systems Installation & Maintenance	--	--	16	16	--	--	--	--	--	--	100	100	200	100	8
OR																		
EX2	Electrical Engineering	STEXELE431	Internship / Technical Project											100[@]	100	200	100	8
Total				**--**	**--**	**16**	**16**	--	--	--	--	--	--	**100**	**100**	**200**	**--**	**8**
Marks Grand Total				**200**														

@ Evaluation based on seminar, technical project report, skill courses certification.

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SEMESTER– V																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Electrical Engineering	STMDMELE501	Multi-disciplinary Minor-III	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
OE	Electrical Engineering	STOEELE502	Open Elective- III	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE503	Electrical Machine-II	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE504	Power System-I	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE505	Electrical Machine Design	3	1	--	4	3	10	10	80	100	40	--	--	--	--	4
PEC	Electrical Engineering	STPECELE506A/B	Program Elective - I	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE507	Electrical Machine-II Lab. - I	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Electrical Engineering	STPCCELE508	Power System-I Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PEC	Electrical Engineering	STPECELE509A/B	Program Elective – I Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
Total				**17**	**1**	**6**	**24**	**--**	**55**	**55**	**440**	**550**	**--**	**75**	**75**	**150**	**--**	**21**
Marks Grand Total				**700**														

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SEMESTER–V						
LIST OF OPEN ELECTIVES - III COURSE			**LIST OF PROGRAM ELECTIVES - I**		**LIST OF PROGRAM ELECTIVES – I LAB**	
Sr.	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**	**Course Code**	**Name of the course**
A	STOEMEC502	Operations Research Techniques	**STPECELE506A**	High Voltage Engineering	**STPECELE508A**	High Voltage Engineering Lab
B	STOEETC502	Automotive Electronics	**STPECELE506B**	Digital Electronics Circuits	**STPECELE508B**	Digital Electronics Circuits Lab
C	STOECSE502	Software Project Management				
D	STOEINS502	Power Plant Instrumentation				
E	STOECEC502	Remote Sensing and GIS				
F	STOEELE502	Introduction to Smart Grid				

Note:

1. Note: The offering of any open elective or Program elective course shall be subject to a minimum enrollment of fifteen (15) students.
2. If a student opts for Program Elective – I (Serial No. A), they will be eligible only for the corresponding Program Elective – I Lab (Serial No. A); the same applies for serial no. B

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SEMESTER– VI																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Electrical Engineering	STMDMELE601	Multi-disciplinary Minor-IV	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE602	Control System	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE603	Power Electronics	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE604	Power System-II	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Electrical Engineering	STPECELE605A/B	Program Elective - II	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PEC	Electrical Engineering	STPECELE606A/B	Program Elective – III	3	--	--	3	3	10	10	80	100	40	--	--	--	--	3
PCC	Electrical Engineering	STPCCELE607	Power Electronics Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Electrical Engineering	STPCCELE608	Power System– II Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
PCC	Electrical Engineering	STPCCELE609	Control System Lab.	--	--	2	2	--	--	--	--	--	--	25	25	50	25	1
VSEC	Electrical Engineering	STVSECELE610	Soft Skills	--	1	2	3	--	--	--	--	--	--	50	--	50	25	2
Total				**17**	**1**	**8**	**26**	**--**	**55**	**55**	**440**	**550**	**--**	**125**	**75**	**200**	**--**	**22**
Marks Grand Total				**750**														

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LIST OF PROGRAM ELECTIVES - II	
Course Code	**Name of the course**
STPECELE605A	Electrical Drives
STPECELE605B	Power System Operation & Control

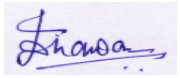
LIST OF PROGRAM ELECTIVES - III	
Course Code	**Name of the course**
STPECELE606A	Advanced Microprocessor Systems and Microcontroller
STPECELE606B	Programming Techniques & Simulation

Note:

1. Note: The offering of any Program elective course shall be subject to a minimum enrollment of fifteen (15) students.


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EXIT CRITERIA FOR BACHELOR DEGREE IN VOCATION (AFTER THIRD YEAR)																		
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**										**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**				
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
EX3	Electrical Engineering	STEXELE621	Installation of Transformer	--	--	16	16	--	--	--	--	--	--	100	100	200	100	8
OR																		
EX3	Electrical Engineering	STEXELE622	Autonomous, Connected, Electric Vehicles (ACE)	--	--	16	16	--	--	--	--	--	--	100	100	200	100	8
OR																		
EX3	Electrical Engineering	STEXELE631	Internship / Technical Project											100@	100	200	100	8
Total				**--**	**--**	**16**	**16**	--	--	--	--	--	--	**100**	**100**	**200**	**--**	**8**
Marks Grand Total				**200**														

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SEMESTER– VII																		
Course Category	Board of Studies	Course Code	Name of the Course	Teaching Scheme				Examination Scheme										Credit
				Hours per week				Theory Marks						Practical Marks				
				L	T	P	T	Duration in hrs.	MSE (CA)	IE (CA)	ESE (UA)	Total	Min (CA+UA)	CA	UA	Total	Min (CA+UA)	
MDM	Electrical Engineering	STMDMELE701	Multi-disciplinary Minor-V	*2	--	--	2	--	--	50	--	50	20	--	--	--	--	2
PEC	Electrical Engineering	STPECELE702	Program Elective - IV	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
PEC	Electrical Engineering	STPECELE703	Program Elective - V	*3	--	--	3	--	--	100	--	100	40	--	--	--	--	3
IN	Electrical Engineering	STINELE704	Internship / OJT	--	--	24	24	--	--	--	--	--	--	100	200	300	150	12
Total				**8**	**--**	**24**	**32**	**--**	**--**	**250**	**--**	**250**	**--**	**100**	**200**	**300**	**--**	**20**
Marks Grand Total				**550**														

Note: Program Elective-IV and V is 12-week online certificate courses conducted by NPTEL / SWAYAM / MOOC / OTHERS in the area approved by DFB

***Courses to be mentored and assessed by faculty members**

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SEMESTER– VIII																	
Course Category	**Board of Studies**	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Examination Scheme**									**Credit**
				Hours per week				**Theory Marks**						**Practical Marks**			
				L	**T**	**P**	**T**	**Duration in hrs.**	**MSE (CA)**	**IE (CA)**	**ESE (UA)**	**Total**	**Min (CA+UA)**	**CA**	**UA**	**Total**	**Min (CA+UA)**	
MDM	Electrical Engineering	STMDMELE801	Multi-disciplinary Minor-VI	2	--	--	2	2	5	5	40	50	20	--	--	--	--	2
PCC	Electrical Engineering	STPCCELE802	Power System Protection	3	--	--	3	3	10	10	80	100	40	---	---	---	---	3
PCC	Electrical Engineering	STPCCELE803	Computer Applications in Power Systems	3	--	--	3	3	10	10	80	100	40	---	---	---	---	3
PEC	Electrical Engineering	STPECELE804A/B	Program Elective - VI	3	--	--	3	3	10	10	80	100	40	---	---	---	---	3
RM	Electrical Engineering	STRMELE805	Research Methodology and IPR	3	1	---	4	3	10	10	80	100	40	---	---	---	---	4
PCC	Electrical Engineering	STPCCELE806	Power System Protection Lab.	---	---	2	2	---	---	---	---	---	---	25	25	50	25	1
PCC	Electrical Engineering	STPCCELE807	Computer Applications in Power Systems Lab	---	---	2	2	---	---	---	---	---	---	25	25	50	25	1
PEC	Electrical Engineering	STPECELE808A/B	Program Elective – VI Lab.	---	---	2	2	---	---	---	---	---	---	25	25	50	25	1
PR	Electrical Engineering	STPRELE809	Major Project	---	---	8	8	---	---	---	---	---	---	75	75	150	75	4
Total				**14**	**1**	**14**	**29**	**--**	**45**	**45**	**360**	**450**	**--**	**150**	**150**	**300**	**--**	**22**
Marks Grand Total				**750**														

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Semester - VIII			
LIST OF PROGRAM ELECTIVES - VI		**LIST OF PROGRAM ELECTIVES – VI Lab.**	
Course Code	**Name of the course**		
STPECELE804A	Power Quality and Harmonics	**STPECELE808A**	Power Quality and Harmonics Lab
STPECELE804B	Reactive Power Control and FACTS Devices	**STPECELE808B**	Reactive Power Control and FACTS Devices Lab

Note:

1. Note: The offering of any Program elective course shall be subject to a minimum enrollment of fifteen (15) students.
2. If a student opts for Program Elective – VI (Serial No. A), they will be eligible only for the corresponding Program Elective – VI Lab (Serial No. A); the same applies for serial no. B

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LIST OF OPEN ELECTIVE COURSE (BASKET OF OPEN ELECTIVE)			
	OPEN ELECTIVE-I	**OPEN ELECTIVE -II**	**OPEN ELECTIVE -III**
A	STOESHC302A Mathematical Transform and Statistical Methods	STOEMEC402 Industrial Management	STOEMEC502 Operations Research Techniques
B	STOESHC302B Transform Methods in Engineering Mathematics	STOEETC402 Digital System Design	STOEETC502 Automotive Electronics
C	STOESHC302C Probability and Statistics	STOECSE402 Design Thinking	STOECSE502 Software Project Management
D	STOEINS302 Signals and Systems	STOEINS402 Chemical and Analytical Instrumentation	STOEINS502 Power Plant Instrumentation
E	STOECEC302 Building Constructions and Materials	STOECEC402 Building Automation	STOECEC502 Remote Sensing and GIS
F	STOEELE302 Modelling and Design of EV	STOEELE402 EV Design Analysis and Control	STOEELE502 Introduction to Smart Grid

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LIST OF PROGRAM ELECTIVES						
Name of course	**Program Elective - I**	**Program Elective - II**	**Program Elective - III**	**Program Elective - IV**	**Program Elective - V**	**Program Elective - VI**
Code	**STPECELE506**	**STPECELE605**	**STPECELE606**	**STPECELE702**	**STPECELE703**	**STPECELE804**
A	High Voltage Engineering	Electrical Drives	Advanced Microprocessor Systems and Microcontroller	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Power Quality and Harmonics
B	Digital Electronics Circuits	Power System Operation & Control	Programming Techniques & Simulation	NPTEL / SWAYAM / MOOC / OTHERS	NPTEL / SWAYAM / MOOC / OTHERS	Reactive Power Control and FACTS Devices

SWAYAM/NPTEL etc. portal Courses should be approved by DFB and **at least of 12 weeks** including tutorials.

LIST OF PROGRAM ELECTIVES LABS		
Name of course	**Program Elective – I Lab**	**Program Elective – VI Lab**
Code	**STPECELE508**	**STPECELE808**
A	High Voltage Engineering Lab	Power Quality and Harmonics Lab
B	Digital Electronics Circuits Lab	Reactive Power Control and FACTS Devices Lab

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LIST OF MULTI DICIPLINARY MINOR COURSE TRACK (MDM BASKET)

Sr. No.	Offering Department	Name of Minor Course (Track)	Students from Department Who can register
1	Mechanical Engineering (MEC)	Industrial IoT and Smart Manufacturing	All branches except Mechanical Engineering
2	Instrumentation Engineering (INS)	Industrial Automation	All branches except Instrumentation Engineering
3	Electronics and Telecommunication Engg. (ETC)	IoT and Drone Technology	All branches except Electronics and Telecommunication Engineering
4	Electrical Engineering (ELE)	Power System Engineering	All branches except Electrical Engineering
5	Computer Science & Engineering (CSE)	Data Science	All branches except Computer Science & Engineering
6	Civil Engineering (CEC)	Environmental Engineering	All branches except Civil Engineering

LIST OF MULTI DICIPLINARY MINOR COURSES (MDM BASKET)

Name of Minor Course	Mechanical Engineering	Instrumentation Engineering	Electronics & Telecommunication Engineering	Electrical Engineering	Computer Science and Engineering	Civil Engineering
	TRACK-I Industrial IoT and Smart Manufacturing	**TRACK-I Industrial Automation**	**TRACK-I IoT and Drone Technology**	**TRACK-I Power System Engineering**	**TRACK-I Data Science**	**TRACK-I Environmental Engineering**
Multi-disciplinary Minor -I	STMDMMEC301 Additive Manufacturing	STMDMINS301 Industrial Measurements	STMDMETC301 IoT Sensors and Actuators	STMDMELE301 DC Machines and Transformer	STMDMCSE301 Introduction to Data Science	STMDMCEC301 Basics of Environmental Engineering
Multi-disciplinary Minor -II	STMDMMEC401 Mechatronics Systems	STMDMINS401 Control System Components	STMDMETC401 Basics of Drone Technology	STMDMELE401 AC Machines	STMDMCSE401 Tools for Data Science	STMDMCEC401 Drinking Water Quality and Water Pollution
Multi-disciplinary Minor -III	STMDMMEC501 PLC and Automation	STMDMINS501 Control System Engineering	STMDMETC501 IoT Architecture and Protocol	STMDMELE501 Electrical Drives	STMDMCSE501 Data Visualization and Data Analytics	STMDMCEC501 Air Pollution
Multi-disciplinary Minor -IV	STMDMMEC601 Industrial Robotics	STMDMINS601 Process Automation	STMDMETC601 Interfacing Programming of IoT and Drone	STMDMELE601 Power System Protection	STMDMCSE601 Machine Learning	STMDMCEC601 Soil, Sound and Solid Waste Pollution
Multi-disciplinary Minor -V	STMDMMEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMINS701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMETC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMELE701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDCSEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track	STMDMCEC701 NPTEL / SWAYAM / MOOC 8 Week online course related to track
Multi-disciplinary Minor -VI	STMDMMEC801 IoT in Automotive Engineering	STMDMINS801 Process Control	STMDMETC801 IoT and Drones Application	STMDMELE801 Digital Signal Processing	STMDMCSE801 Data Science in Practice	STMDMCEC801 Advance Air Pollution and Solid waste Management

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STMDMELE301
Title of Course: Multi-Disciplinary Minor - I (MDM)

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Multidisciplinary Minor (MDM) course is provided separately under Multi-disciplinary Minors (MDM) Basket.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STOEELE302
Title of Course: Open Elective - I

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
4	--	--	4	4	3	10	10	80	100

The Detail Syllabus for the Open Elective - I course (OE) is provided separately under "Open Electives" Basket.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STVECELE303
Title of the Course: Introduction to Constitution of India

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
2	-	-	2	2	2	05	05	40	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Explain the value of the fundamental rights and duties for becoming a responsible citizen of India.

CO2 Analyze the functioning of the three wings of the government i.e., legislative, executive and judiciary.

CO3 Discuss the decentralization of power between the central, state and local self-government.

CO4 Describe the functioning of urban and rural administration in India.

Unit	Content	Hours
I	**Constitution: Meaning and Importance** Introduction to the Constitution of India, history, social, political, economic, and spiritual influences in the development of the constitution, Nature and special features: Equality and social justice- various kinds of freedoms-social control, Citizenship, Preamble, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy (Article 41 to 47)	8
II	**The Central Government of India** The levels of government, Indian Federation, Center-state relationship: Legislative, Administrative and Financial, Roles and positions of President, PM, Council of union ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.	8
III	**The State Government** Roles and positions of Governor, CM, and Council of ministers of states: Legislative, and Executive Control, Secretariat and Directorates: organization, structure, and functions, District Administration and the role of District Collector: Legislative, and Executive Control. The Supreme Court and High Court: Powers and Functions.	7
IV	**Urban and Rural Administration** Role and importance of District's administrative head, the role of Mayor and elected representative, Role and functioning of the Municipal Corporation and Municipalities, Zila Panchayat, Gram Panchayat, Block level governance, democracy at the grass root level, The Election Commission of India: Introduction to the role and functioning of the Election Commission of India, Overview of the electoral procedure.	7

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Reference Books:

1. Introduction to the Constitution of India by Durga Das Basu, Prentice Hall of India Pvt. Ltd., New Delhi
2. Indian Constitution by Subash Kashyap, National Book Trust
3. Constitution of India by Dr. P. K. Agrawal and Dr. K. N. Chaturvedi, Prabhat Prakashan 2017
4. Constitution of India by V. N. Shukla, Eastern Book Company

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE304
Title of the Course: Network Analysis

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
3	-	-	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Make use of mesh and nodal analysis and apply network theorems for the analysis of electrical circuits

CO2 Obtain the transient and steady-state response of electrical circuits

CO3 Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).

CO4 Examine behavior of the network using Laplace transformation.

CO5 Determine different parameters of two port networks and their relationship

Unit	Content	Hours
I	**Circuit Analysis Techniques** Basic Nodal and Mesh Analysis, Network Theorems, Linearity and Superposition Theorem, Thevenin Theorem, Norton Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Compensation Theorem, Millman's Theorem, Concept of Duality and Dual Networks, Source Transformation	8
II	**DC Transient Circuits** The Source free RL, RC & RLC Circuits. Natural & Forced Response of RL, RC & RLC Circuits. RC & RL Circuit responses to Pulse and Exponential signals	8
III	**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.	8
IV	**Networks and Laplace Transform** 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	8
V	**Two Port Networks & Filters** Relationship of Two Port Variables, Short Circuit Admittance Parameters, Open Circuit Impedance Parameters, Transmission Parameters, Hybrid Parameters, Relationship Between Parameter Sets, Interconnections of Two Port Networks. **Filters:** Behavior of Characteristic Impedance, The Constant - k Low Pass Filter, The Constant – k High Pass Filter, Band Pass Filters, Band Reject Filters - Illustrated Problems.	8

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Text / 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.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE305
Title of the Course: Measurement & Instrumentation

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
3	-	-	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 *Classify* different types of measuring instruments on the basis of principle of operation.
CO2 *Measure* various electrical and physical quantities using transducers.
CO3 *Apply* different methods to measure power and energy.
CO4 *Compute* resistances, inductance and capacitance using different methods.
CO5 *Understand* and *apply* various temperature and pressure measurement techniques

Unit	Content	Hours
I	**Measuring Instruments** Classification, deflecting, controlling, damping torques, Basic principles of operation of Ammeter & Voltmeter, PMMC, Moving Iron, and Electrodynamometer type instruments, Principle of operation, Torque Equation, Errors, merits & demerits of each type, Analog & Digital instruments, Advantages of digital instruments, Absolute & secondary Instruments, Indicating & Recording type instruments, Shunt & Multiplier	8
II	**Generalized Instrumentation System** General block diagram of instrumentation system, Active and passive transducers, Strain Gauges, Resistive, Inductive & Capacitive Transducers, Transducers for measurement of Displacement, Velocity, Force, & Torque, Static and dynamic characteristics and performances of instruments, Statistical treatment of measurement errors, Gaussian error distribution, probability tables, combination of errors	8
III	**Measurement of Power & Energy** Measurement of active & reactive power in single & three phase circuits, using dynamometer type instruments, Errors in Power Measurement, Measurement of Energy in single & three phase circuits using indication type instruments, Errors in energy measurements, Maximum Demand Indicator.	8
IV	**Measurement of Circuit Parameters** Measurement of low resistance by Kelvin's Double Bridge, Measurement of Medium Resistance by Wheatstone bridge, Measurement of high resistance by loss of charge method, Earth Resistance Tester, Measurement of Inductance & Capacitance: General theory of AC bridges, study of Maxwell, De-sauty's & Schering Bridges, detectors of AC bridges.	8
V	**Miscellaneous Measurement** Temperature Measurement: Laws of Thermo-electric circuits, Thermocouples, Thermistors, Optical Pyrometers, Temperature compensation of Temperature Sensors. Pressure Measurement: Manometer, Bellows, Bourdon Tube, Diaphragms, Power factor & Frequency Measurement, General Theory of Instrument Transformer, extension of range using CT & PT and its applications	8

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Text / References:

1. Electrical Measurement & Measuring Instruments by Golding.
2. Instrumentation Devices and Systems by Rangan.
3. Electronic Instrumentation & Measurement Technique by W.D. Cooper.
4. Electrical and Electronics Measurement & Instrumentation by A.K. Sawhney

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STEMCELE306
Title of the Course: Engineering Economics

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
2	-	-	2	2	-	30	20	-	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Identify the challenges of the economy as entrepreneur/manufacturer as well as consumer

CO2 Describe the economic system at the micro and macro level

CO3 Apply principles of economics and accountancy in the professional, personal and societal life

CO4 Assess the role of engineering economics and accounting in attaining economic efficiency

Unit	Content	Hours
I	**Introduction to Engineering Economics** Definitions, Nature, Scope and application; Difference between Micro Economics and Macro Economics; Theory of Demand & Supply: Meaning, Determinants, Law of Demand, Elasticity of demand, Demand Forecasting, Law of Supply, Equilibrium between Demand & Supply	7
II	**Production and Cost** Production functions, isoquant, Least Cost combination, Laws of Returns to Scale. Economics and Diseconomies of Scale of production, Cost and Cost curves, Revenue and Revenue curve, Break even analysis.	7
III	**Money** Meaning, Functions, Types; Monetary Policy- Meaning, Objectives, Tools; Fiscal Policy: -Meaning, Objectives, Tools. Banking: Meaning, Types, Functions, Central Bank: its Functions, concepts CRR, Bank Rate, Repo Rate, Reverse Repo Rate, SLR	8
IV	**Depreciation** Meaning of depreciation, causes, object of providing depreciation, factors affecting depreciation, Methods of Depreciation: Straight line method, diminishing balance method, Annuity method and Sinking Fund method	8

Text / References:

1. Principles of Micro Economics by Mceachern & Kaur, Cengage Publication.
2. Managerial Economics by Craig Peterson & W Cris Lewis, PHI Publication
3. Modern Microeconomics by A. Koutsoyiannis, Macmillan.
4. Managerial Economics Theory and Applications by D. M.Mithani. Himalaya Publication House. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006
5. Principles of Micro Economics by Mceachern & Kaur, Cengage Publication.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE307
Title of Course: Network Analysis Lab

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Outline the Schematic Diagram for Various Experiments.
CO2 Select Appropriate Instruments/Apparatus Required for the Experiments.
CO3 Identify the Terminals/Ports for Measurement of Parameter Across or Through the Elements.
CO4 Compare Theoretical Calculations and Experimental Results of Various Theorems.
CO5 Understand DC Analysis, Transient Analysis and Frequency Analysis of a Given Circuit Depending on Types of Elements

Lab Activities: A minimum of eight practical's should be performed from the topics listed below.

List of practical:

1. Verification of Principle of Superposition in A.C/DC Circuits.
2. Verification of Thevenin Theorem in A.C/DC Circuits
3. Verification of Norton's Theorem in A.C/DC Circuits
4. Verification of Reciprocity Theorem in A.C/DC Circuits.
5. Verification of Millman's Theorem.
6. Verification of Maximum Power Transfer Theorem in A.C/DC Circuits
7. Verification Of Telligent's Theorem
8. Determination of Time Response of R-C Circuit to a Step D.C. Voltage Input. (Charging and Discharging of a Capacitor Through a Resistor)
9. Determination of Time Response of R-L Circuit to a Step D.C. Voltage Input. (Rise and Decay of Current in an Inductive Circuit)
10. Determination of Time Response of R-L-C Series Circuit to a Step D.C. Voltage Input
11. Determination of Parameter of Two Port Network.
12. Determination of Bandwidth and Q Factor of R-L-C Parallel Circuit under Resonance Condition.
13. Determination of Bandwidth and Q Factor of R-L-C Series Circuit under Resonance Condition.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE308
Title of Course: Electrical Measurements & Instrumentation Laboratory

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1 *Acquire* hand on experience about different measurement devices and its working principles.

CO2 *Acquire* knowledge of principle of calibration of a measuring instrument and plotting of calibration curves.

CO3 *Acquire* hand on experience and knowledge on working of Kelvin's double bridge and wheat stone's bridge, AC bridges, CT/PT

CO4 *Analyze* features of oscilloscope and different types of oscilloscopes

CO5 *Analyze* the performance characteristics of temperature transducer like Thermocouple, Thermistor and RTD

Lab Activities: A minimum of eight practical's should be performed from the topics listed below.

List of practical:

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 High resistance and Insulation resistance using Magar.
6. 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. Bandwidth of measurement and sampling rate
7. Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program
8. Usage of DSO to capture transients like a step change in R-L-C circuit.
9. Current Measurement using Shunt, CT, and Hall Sensor.
10. To study differential pressure transducer & signal conditioning of output signal.

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III Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STCEPELEC309
Title of Course: Community Engineering Project

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	4	4	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 In the context of their discipline, exhibit an applied understanding of critical and active citizenship, including social and ethical responsibility.
CO2 In the context of a community partnership, demonstrate your understanding of the concepts of respect, mutuality, reciprocity, and teamwork.
CO3 Exhibit the ability to critically reflect on their experiences through thoughtful writing.
CO4 Exhibit knowledge of the variety of participatory techniques suitable for cooperative partnership projects

Content: -

The Community Engineering Project shall be carried out in-house i.e. in the department's laboratories/centers by a Group 5 – 6 students. The project outline on the selected topic should be submitted to the course coordinator for approval within one week from the commencement of the term. it may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis. Each student is required to maintain separate log book for documenting various activities carried under it.

Before the end of semester, student shall deliver a presentation and submit the project report (paper bound copy) in prescribed format.

- Student should preferably refer minimum five reference books/magazines/standard research papers

Format of report

1. Introduction
2. Literature survey
3. Theory (Implementation, Methodology, Applications, Advantages, Disadvantages, etc)
4. Conclusion

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Assessment of Community Engineering Project
Name of the Project:
Name of the Guide:
Assessment Table: -

Sr. No	Exam Seat No	Name of Student	Community Project Selection & documentation	Presentation	Result	Total	Remark

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STMDMELE401
Title of Course: Multi-Disciplinary Minor - II (MDM)

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Multi-disciplinary Minor (MDM) course is provided separately under Multi-disciplinary Minors (MDM) Basket.

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STOEELE402
Title of Course: Open Elective - II

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	2	5	5	40	50

The Detail Syllabus for the Open Elective - I course (OE) is provided separately under "Open Electives" Basket.

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE403
Title of the Course: Electrical Machine-I

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
3	-	-	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Understand the concept of magnetic circuits.
CO2 Understand the basic operation of DC Generator.
CO3 Understand the basic operation of DC Motor.
CO4 Analyze the single-phase transformer circuit.
CO5 Analyze the three-phase transformer circuit.

Unit	Content	Hours
I	**Magnetic fields and magnetic circuits** Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot-Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines. B-H curve of magnetic materials; flux- linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits. Hysteresis and Eddy Current Losses: Understanding and minimizing these losses. Faraday's Law: Electromagnetic induction and induced EMF. Force on Current Carrying Conductor: Understanding the force exerted on a current carrying conductor in a magnetic field.	8
II	**DC Generator** Parts of generator, Armature Winding, coil pitch, back pitch, front pitch, Resultant pitch, commutator pitch, single layer winding, two layer winding, Multiplex winding, lap & wave winding, dummy coils, Types of generators, Equalizer connections, EMF & Torque Equation, total losses and efficiency, Armature reaction, Demagnetizing and Cross Magnetizing Effects, Compensating winding Commutation, Methods for Improving Commutation, Interpoles, Performance Characteristics of DC generators, Critical speed, Parallel operation,	8
III	**DC Motor** 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. Principle of Motor, comparison of generator and motor action, Back Emf, Power	8

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	& torque, Shaft torque, Performance characteristics of DC Motors, Losses & efficiency, power stages, speed control of DC motors, Electric Braking, Necessity of a starter, Three point & four-point starters, Starting of DC motors.	
IV	**Single phase Transformer** Construction and principle, Types & Classification, operation at no load and on load, vector diagrams, equivalent circuit, losses, efficiency and regulation, determination of regulation and efficiency by direct load test and indirect test methods, Sumpner's test, parallel operation, auto transformer, condition for maximum efficiency, all day efficiency.	8
V	**Three phase Transformers** Star/star, Star/delta, Delta/delta, Delta/Star, delta/zigzag, terminal marking, Nomenclature, Vector diagram, Phase groups, Parallel operation of 3-phase Transformer, Scott connection, V-V connections, tertiary winding, Testing of transformers, Transients in transformers - voltage regulation - off load and on load tap changers, Introduction of harmonics in Transformer.	8

Text / References:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE404
Title of the Course: Renewable Energy Sources

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
3	-	-	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Understand the need importance and scope of Non- Conventional Energy Resources
CO2 Demonstrate new type of Renewable Energy Sources & Demonstrate wind Energy Sources
CO3 Develop and Deploy Energy Sources on much larger scale
CO4 Implement improved techniques for harnessing fossil fuels
CO5 Understand the need importance and scope of Non- Conventional Energy Resources

Unit	Content	Hours
I	**Introduction to Sustainable Energy System** Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.	8
II	**Solar PV and thermal systems** Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds - Thermal Energy storage system with PCM- Solar Photovoltaic systems: Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.	8
III	**Wind Energy** Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, wind speed & velocity, towers, Applications of wind energy. Sinusoidal steady state analysis	8
IV	**Geothermal Energy** Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. Networks and Laplace Transform	8
V	**Other Energy Sources** Tidal Energy: Energy from the tides, Barrage and Non-Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC) - Hydrogen Production and Storage- Fuel cell: Principle of working- various types -	8

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	construction and applications. Energy Storage System- Hybrid Energy Systems. Two Port Networks & Filters	

Text / References:

1. Chetan Singh Solanki, “Solar Photovoltaics: fundamentals, Technologies and Applications”, Prentice Hall of India
2. D.P.Kothari, K.C Singal, RakeshRanjan “Renewable Energy Sources and Emerging Technologies”, PHI Learning Pvt.Ltd, New Delhi, 2013
3. Ali Keyhani, “Design of Smart Power Grid Renewable Energy Systems”, Wiley-IEEE Press.
4. B. H. Khan, “Non-Conventional Energy Resources”, , The McGraw Hill
5. G.D. Rai, “Non-conventional Energy sources”, Khanna Publishers.

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE405
Title of the Course: Electromagnetic Field

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper (Hrs.)	MSE	IE	ESE	Total
3	-	-	3	3	3	10	10	80	100

Course outcomes:

After completing the course, the students will be able to;

CO1 Derive the relationship between different types of coordinate systems
CO2 Apply Coulomb's law and Gauss' Law to different kinds of charge distribution in space
CO3 Solve electrostatic boundary-value problems by Poisson's and Laplace's equations.
CO4 Understand Boisvert's Law and Ampere's Law in magnetic field
CO5 Analyze time-varying electromagnetic field governed by Maxwell's equations and propagation of EM wave through various media.

Unit	Content	Hours
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.	8
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.	8
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	8
IV	**Magnetic Forces, Materials and Inductance & Static Magnetic Fields** 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. Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors	8

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V	**Time Varying Fields, Maxwell's Equations and Electromagnetic Waves** 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. Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem	8

Text / References:

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. 8.B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STEMCELE406

Title of Course: Organizational Behavior

Teaching Scheme					Examination Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	MSE	IE	ESE	Total
2	--	--	2	2	--	30	20	--	50

After completing the course, the students will be able to;

CO1 Identify the challenges of the present organization

CO2 Describe the organizational system

CO3 Apply the principles of organizational behavior to inculcate the habit of team work and which is essential for the organization

CO4 Assess the role of psychological and social principal in improvement of efficiency as well as quality of employee life

Unit	Content	Hours
I	**Organizational Behavior (OB)** Concept, nature, characteristics, conceptual foundations, determinants and importance, management functions, role & skills, disciplines that contribute to the field of OB, Challenges & Opportunities for OB, diversity in Organizations, attitudes & Job satisfaction.	8
II	**Group and Interpersonal Relationship** Analysis of Interpersonal Relationship, developing interpersonal relationship, Group Dynamic: Definition of Group, stages of Group Development, Punctuated Equilibrium Model, Group Structure, Group Decision Making, understanding work teams.	8
III	**Organizational Power and Politics** Concept of power, structure of power, classification of power, contrasting leadership & power, dependence a key to power, causes & consequences of political behavior. Organizational conflict: view of conflict, conflict process, negotiation & bargaining strategies.	7
IV	**Conflict and Negotiation** Conflict definition in conflict thought: Traditional view, the Human relation view, interactionist view. Functional versus dysfunctional conflict, conflict process. Negotiation Bargaining strategies, the negotiation process and issues in negotiation.	7

Text Books:

1. Organizational Behavior by Robbins, S.P., Prentice Hall of India
2. Organizational Behavior by Luthans F., McGraw-Hill..
3. Human Behavior at Work: Organizational Behavior by Davis K., Tata McGraw-Hill Human Resource Management, Seema Sanghi, Vikas Publishing

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STPCCELE407
Title of Course: **Electrical Machine-I Laboratory**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	--	2	2	1	--	25	25	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Demonstrate the working principle of D.C. machines
CO2 Demonstrate the working principle three phase transformers.
CO3 Apply various speed control methods to D.C. machines.
CO4 Investigate the performance of D.C.
CO5 Estimate the performance parameters of transformer

Lab Activities: A minimum of eight practical's should be performed from the topics listed below.

List of practical:

1. Open Circuit and Short Circuit Test on 1 phase Transformers
2. Parallel operation of single-phase transformers
3. Load test on single phase transformer
4. Open Circuit and Short Circuit Test on 3 phase Transformers
5. Scott Connection of Transformer
6. Magnetization Characteristics of separately excited DC Generator
7. Load Test on DC Shunt Generator
8. Load Test on DC Compound Generator
9. Starting of DC Shunt Motor
10. Load Test on DC Shunt Motor

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STVSECELE408
Title of Course: Workshop Practice - III

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	50	100

Course outcomes:

After completing the course, the students will be able to;

CO1 *Perform* wiring tasks such as making married joints, tee joints, and controlling lamps using different switches in house wiring circuits

CO2 *Demonstrate* an understanding of electrical safety features, including the role of fuses, MCBs, and earthing in electrical circuits.

CO3 *Evaluate* the effectiveness of electrical control circuits, such as the impact of series and parallel connections on lamp performance.

CO4 *Explain* the working principles and construction of various electrical devices, such as fluorescent lamps, UPS, home inverters, and battery chargers

CO5 *Develop* a fault-finding procedure for electrical appliances, such as ceiling fans, and suggest possible repairs or improvements.

Lab Activities: A minimum of eight practical's should be Performed from the topics listed below.

List of Practical:

1. Introduction of tools, electrical materials, symbols and devices etc.
2. To study & Identification of single core (ST), Twin core (TC), three core(3C), four core(4C), copper and aluminum PVC, VIR & weather proof (WP) wire.
3. To make a married joint of 7/22 P.V.C wire.
4. To make a Tee (T) joint of 7/22 P.V.C wire.
5. To study circuit of a Simple power supply with regulation & filters.
6. To study circuit of a SMPS
7. To study circuit & working of a U.P.S.
8. To study circuit and working of a Home Inverter
9. To study fuses, MCB and important of earthing
10. Fault Finding and repairing of ceiling Fan and observation of different parts
11. To study the working principles and control of two lamps when connected in series and in parallel configurations
12. Study battery charger and make charging of lead acid battery.

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STAECELE409

Title of Course: **Modern Indian / Foreign Language**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Recognize and pronounce the German alphabet, basic greetings, and introductions, demonstrating an understanding of fundamental language structures

CO2 Form basic sentences using present tense verb conjugations, applying correct sentence structure and grammar rule

CO3 Identify and use German nouns with their corresponding articles and cases, demonstrating an understanding of grammatical concepts

CO4 Engage in basic conversations, ask and respond to questions, and demonstrate an understanding of question words and sentence formation, phrases related to everyday situations

Unit	Content
I	**Introduction to German Language and Alphabet** German alphabet and pronunciation Basic greetings and introductions (e.g., Hallo, Guten Tag, Ich heiße...) Basic phrases (e.g., Wie geht es dir?, Danke, Bitte) Numbers 1-10
II	**Basic Sentence Structure and Verb Conjugation** Basic sentence structure (e.g., Ich bin, Ich habe) Verb conjugation in present tense (e.g., sein, haben, gehen) Common verbs and their conjugations (e.g., essen, trinken, sprechen) Basic sentence formation (e.g., Ich esse ein Sandwich)
III	**Nouns, Articles, and Cases** German nouns and their genders (masculine, feminine, neuter) Definite and indefinite articles (e.g., der, die, das, ein, eine) Nominative and accusative cases Basic sentence formation with articles and cases
IV	Basic conversations (e.g., asking for directions, ordering food) Question words (e.g., Wer?, Was?, Wo?, Wann?) Basic question formation (e.g., Wie heißt du?, Woher kommst du?)

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	Responding to basic questions Vocabulary related to everyday situations (e.g., family, food, transportation) Basic phrases for shopping, eating out, and traveling Using phrases like "Ich möchte..." and "Ich brauche..." Basic writing and reading comprehension exercises

Lab activities;
sed on the above, students are required to appear for internal written examinations or quizzes, oral examinations or role plays. Additionally, they must submit at least one assignment for each unit. The assessment and evaluation will be carried out as follows.

Written exams or quizzes (20 marks)
Oral exams or role-plays (20 marks)
Assignments or projects (10 marks)

Reference Books:

1. RAPIDEX Hindi-German language Course, Publisher: Pustak Mahal,
2. Get Ready Practice Book German Class X (part-2), Dr. Shruti Jain Parul Sharma
3. Goyal Basic German Vocabulary, Goyal Publishers
4. Goyal Collins Easy Learning German Grammar, Goyal Publishers
5. Netzwerk Neu A1: Textbook + Workbook + Glossar + Lösungen (Set Of 4 Books), Stefanie Dengler

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IV Semester B. Tech. Electrical Engineering (NEP 2020)

Course Code: STVECELE410
Title of Course: Human Values and Ethics

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	1	2	3	2	--	50	--	50

Course outcomes:

After completing the course, the students will be able to;

CO1 Demonstrate an understanding of basic human values and their role in shaping ethical behavior and personal well-being.

CO2 Demonstrate the ability to apply ethical principles and interpersonal skills such as empathy, trust, and respect to analyze and resolve real-life dilemmas in personal and social contexts through case studies and role plays.

CO3 Demonstrate the ability to evaluate and address real-life professional dilemmas using ethical frameworks through the analysis of case studies and participation in role plays.

CO4 Exhibit a sense of environmental responsibility and understand the importance of sustainable living for global peace and harmony.

Unit	Content	Hours
I	**Introduction to Human Values** **Tutorial:** Concept of values, value education, and need for value-based life. **Practical:** Group discussion on value conflicts; Case study on ethical dilemmas	
II	**Harmony in the Self, Family and Society:** **Tutorial:** Understanding self, needs, and happiness; Relationship and trust in the family and Humanistic society. **Practical:** Role-play on trust and respect in relationships; Reflective journal writing. Group debate on social ethics and justice; Local community interaction or survey.	
III	**Ethics in Professional Life:** **Tutorial:** Integrity, work ethics, professional responsibility. **Practical:** Case study analysis of ethical issues in professional environments.	
IV	**Environmental Ethics and Global Peace:** **Tutorial:** Environmental responsibility, sustainable development, peace and harmony. **Practical:** Field activity on local environmental issues; Poster presentation or awareness campaign	

Reference Books:

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1. R.R. Gaur, R. Sangal & G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2010.
2. Govindarajan M., Natarajan S., Senthil Kumar V. S., Professional Ethics and Human Values, PHI.
3. Bhatia, R. (2011), Values and Ethics in Business and Profession, PHI.

Online Reference:

1. https://www.uhv.org.in/uhve
2. https://fdp-si.aicte-india.org/UHVII.php

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Two-year UG Diploma in Engineering/Technology

Exit Course after Second Year of B.Tech. Electrical Engineering

Course Code: STEXELE421

Title of Course: **Repairing & Maintenance of Electrical Appliances**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	2	12	14	8	--	100	100	200

Course outcomes:

After completing the course, the students will be able to;

CO1 Understand types of industrial electrical systems and component

CO2 Master installation techniques for industrial electrical wiring and components

CO3 Understand the working and installation of major industrial electrical machines

CO4 Learn predictive, preventive, and corrective maintenance techniques

CO5 Understand electrical protection systems and efficient energy use

Unit	Content	Hours
I	**Introduction to Industrial Electrical Systems:** Overview of industrial power systems: LT, HT systems, Electrical supply systems (single-phase, three-phase), Load types (resistive, inductive, capacitive), Industrial electrical symbols, drawings, and layout diagrams, National and International electrical codes (NEC, IEC), Safety standards (OSHA, IS standards), PPE, lockout/tagout (LOTO)	8
II	**Electrical Wiring Systems & Installations:** Types of wiring: conduit wiring, busbar trunking, cable trays, Selection of cables and wires (based on current capacity, insulation, etc.), Earthing and grounding systems, Control panels: design and wiring, Installation of switches, MCBs, MCCBs, contactors, relays, Distribution boards, junction boxes, Cable jointing, termination, and testing procedures	8
III	**Industrial Electrical Machines and Drives:** Installation and maintenance of: Induction motors (DOL, Star-Delta starters), Synchronous motors, Transformers, Electrical drives and VFDs (Variable Frequency Drives), Motor control circuits (forward/reverse, interlocking), Load balancing and motor efficiency, Alignment, insulation resistance testing	8
IV	**Maintenance Practices and Troubleshooting:** Types of electrical maintenance (PM, CM, PdM), Troubleshooting methods: flowchart-based, circuit analysis, Tools and instruments: multimeter, megger, thermal camera, Common faults in motors, transformers, control panels, Insulation testing, earth resistance testing Record keeping and maintenance schedules, Condition monitoring techniques (vibration, thermography, oil analysis)	8
V	**Power Quality, Protection & Energy Management:** Overload, short circuit, earth fault protection, Fuses, relays, circuit breakers, surge protection, Lightning protection systems, Power quality issues: harmonics, voltage sags/swells, unbalance Power factor improvement methods (capacitor banks, APFC), Energy management and audit basics Renewable energy integration in industrial systems	8

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Text Books:

1. **"Electrician's Troubleshooting and Testing Pocket Guide" by** *John E. Traister*.
2. **"Practical Electrical Wiring"** *by Frederic P. Hartwell & Herbert P. Richter*
3. **"Household Electrical Appliances"** *by N.P. Bhatt & H.G. Kataria* (India-focused)

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Exit Course after Second Year of B.Tech. Electrical Engineering

Course Code: STEXELE422

Title of Course: **Industrial Electrical Systems Installation & Maintenance**

Teaching Scheme					Examination Scheme (Practical)			
Lecture	Tutorial	Practical	Periods/week	Credits	Duration in Hours	CA	UA	Total
--	2	12	14	8	--	100	100	200

Course outcomes:

After completing the course, the students will be able to;

CO1 **Identify and explain components of industrial electrical systems.**

CO2 **Interpret and design industrial wiring diagrams and single-line diagrams.**

CO3 **Perform safe installation, testing, and commissioning of electrical equipment.**

CO4 **Maintain and troubleshoot motors, control systems, and power circuits.**

CO5 **Apply preventive and corrective maintenance strategies in industrial settings.**

Unit	Content	Hours
I	**Industrial Electrical System Basics:** Types of electrical loads in industries, Power supply systems (LV, MV, HV), Industrial wiring systems – conduit, trunking, and cabling, Symbols, standards (IS, IEC), and safety regulations, Earthing & grounding systems (TN, TT, IT systems)	8
II	**Electrical Installation Planning:** Load calculation and demand factor, Selection of cables, circuit breakers, and protective devices, Wiring layout and panel design, Preparation of single line diagrams (SLD), Electrical installation tools and materials	8
III	**Motors and Control Circuits:** Industrial motors: DOL, Star-Delta, VFDs, Motor control circuits: push-button, selector switch, limit switch, relays, timers, wiring of control panels, Testing of motors and control circuits, Installation and alignment of motors	8
IV	**Switchgear and Protection:** Types of switchgear: MCB, MCCB, ACB, VCB, Protection systems: overload, short-circuit, earth fault, Contactors, relays, and interlocking circuits, Preventive and predictive maintenance of switchgear, Troubleshooting techniques and safety audits.	8
V	**Maintenance & Fault Diagnosis:** Types of maintenance: corrective, preventive, predictive, Use of tools: insulation tester, multimeter, megger, clamp meter, Fault detection and analysis techniques, Maintenance of lighting systems, power systems, and distribution boards, Logbook and documentation for maintenance.	8

Text Books:

1. **"Electrical Installation Work" by Brian Scaddan**
2. **"Industrial Electrical Systems" by Bhattacharya & Singh**
3. **"Electrical Power Systems" by C.L. Wadhwa**
4. **"Troubleshooting and Maintenance of Electrical Equipment" by B.V.S. Rao**

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