Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

1st to 6th Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	EL	23EL1105	**Lab :** Electrical and Electronics Workshop	P	0	0	2	2	1		60	40	
8	1	PC	EL	23EL1103	Fundamentals of Electrical Engineering	T	3	0	0	3	3	30	20	50	3
9	1	PC	EL	23EL1104	**Lab :** Fundamentals of Electrical Engineering	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE		**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

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(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00
		Date of Release	Version

Applicable for AY 2023-24 Onwards

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							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	23GE1302	Integral Transform	T	3	0	0	3	3	30	20	50	3
2	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
3	3	VEC-1	CV	23CV1311	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
4	3	PC	EL	23EL1301	Electrical Energy Generation System	T	3	0	0	3	3	30	20	50	3
5	3	PC	EL	23EL1302	**Lab:** Renewable Energy Sources	P	0	0	2	2	1		60	40	
6	3	PC	EL	23EL1303	Network Analysis	T	3	0	0	3	3	30	20	50	3
7	3	PC	EL	23EL1304	**Lab** : Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	3	PC	EL	23EL1305	Electrical Machines	T	3	0	0	3	3	30	20	50	3
9	3	PC	EL	23EL1306	**Lab :** Electrical Machines	P	0	0	2	2	1		60	40	
10	3	CEP	EL	23EL1307	**Community Engagement Project**	P	0	0	2	4	2		60	40	
11	3	OE I	OE		**Open Elective -I**	T	2	0	0	2	2	30	20	50	3
12	3	MDM	MDM		**MD Minor Course-I**	T	2	0	0	2	2	30	20	50	3
					TOTAL		**20**	**0**	**8**	**30**	**25**				

List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	**YCAP3 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

		July, 2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
2	4	**AEC-2**	GE	23GE1405 23GE1406	Marathi Language Hindi Language	T	2	0	0	2	2	30	20	50	3
3	4	PC	EL	23EL1401	Electrical Measurement and Instrumentation	T	3	0	0	3	3	30	20	50	3
4	4	PC	EL	23EL1402	**Lab :** Electrical Measurement and Instrumentation	P	0	0	2	2	1		60	40	
5	4	PC	EL	23EL1403	Electrical Machines in Power System	T	3	0	0	3	3	30	20	50	3
6	4	PC	EL	23EL1404	**Lab** : Electrical Machines in Power System	P	0	0	2	2	1		60	40	
7	4	VSEC-3	EL	23EL1405	**Lab :** Computer Programming	P	0	0	2	4	2		60	40	
8	4	VEC-2	EL	23EL1406	Digital Signal Processing	T	2	0	0	2	2	30	20	50	3
9	4	MDM	EL		**MD Minor Course-II**	T	2	0	0	2	2	30	20	50	3
10	4	OE-2	OE		**Open Elective-II**	T	2	0	0	2	2	30	20	50	3
					TOTAL		**16**	**0**	**6**	**24**	**20**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	**YCAP4 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

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SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	EL	23EL1501	Control System	T	3	0	0	3	3	30	20	50	3
2	5	PC	EL	23EL1502	**Lab** : Control System	P	0	0	2	2	1		60	40	
3	5	PC	EL	23EL1503	Power Electronics	T	3	0	0	3	3	30	20	50	3
4	5	PC	EL	23EL1504	**Lab** : Power Electronics	P	0	0	2	2	1		60	40	
5	5	PC	EL	23EL1505	Fundamentals of Power System	T	3	0	0	3	3	30	20	50	3
6	5	PC	EL	23EL1506	**Lab : Power System**	P	0	0	2	2	1		60	40	
7	5	PE	EL		**Professional Elective-I**	T	3	0	0	3	3	30	20	50	3
8	5	PE	EL		**Professional Elective-II**	T	3	0	0	3	3	30	20	50	3
9	5	**OE-3**	OE		**Open Elective-III**	T	3	0	0	3	3	30	20	50	3
10	5	MDM	EL		**MD Minor Course-III**	T	3	0	0	3	3	30	20	50	3
11	5	STR	EL	23EL1507	Internship and Indsutrial Visit	P	0	0	2	2	1		60	40	
					TOTAL		**21**	**0**	**8**	**29**	**25**				
List of Mandatory Learning Course (MLC)															
1	5	HS	T&P	MLC2125	**YCAP5 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	0				

Professional Elective - I

1	5	PE-I	EL	23EL1521	**PE-I :** Electric and Magnetic Field
2	5	PE-I	EL	23EL1522	**PE-I :** Electrical Machine Design
3	5	PE-I	EL	23EL1523	**PE-I :** Design of Photovoltaic System
4	5	PE-I	EL	23EL1524	**PE-I :** Electric Power Utilization
5	5	PE-I	EL	23EL1525	**PE-I :** Applications of Renewable Energy Sources
6	5	PE-I	EL	23EL1526	**PE-I :** Optimization Techniques
7	5	PE-I	EL	23EL1527	**PE-I :** Thermal Power Plant Familiarization

Professional Elective - II

1	5	PE-II	EL	23EL1541	**PE-II :** Illumination Engineering(MOOC)
2	5	PE-II	EL	23EL1542	**PE-II :** Electrical Wiring: Estimation and Costing
3	5	PE-II	EL	23EL1543	**PE-II :** Sensors and Actuators
4	5	PE-II	EL	23EL1544	**PE-II :** Distributed Generations in Power System
5	5	PE-II	EL	23EL1545	**PE-II :** 8085 Programming
6	5	PE-II	EL	23EL1546	**PE-II :** Analog and Digital Electronics

Coursera Elective

1	5	PE-II	EL	23EL1547	**PE-II :** Power Electronics

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
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							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	EL	23EL1601	Power System Analysis	T	3	0	0	3	3	30	20	50	3
2	6	PC	EL	23EL1602	Fundamentals of Electrical Drives	T	3	0	0	3	3	30	20	50	3
3	6	PC	EL	23EL1603	**Lab :** Fundamentals of Electrical Drives	P	0	0	2	2	1		60	40	
4	6	PC	EL	23EL1604	**Lab :** Electronics Engineering workshop	P	0	0	2	2	1		60	40	
5	6	PC	EL	23EL1605	**Lab :** Simulation in Power Electronics	P	0	0	2	2	1		60	40	
12	6	PC	EL	23EL1606	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
6	6	PE	EL		**Professional Elective -III**	T	2	0	0	2	3	30	20	50	3
7	6	PE	EL		**Lab : Professional Elective -III**	P	0	0	2	2	1		60	40	
8	6	PE	EL		**Professional Elective -IV**	T	3	0	0	3	3	30	20	50	3
9	6	MDM	EL		**MD Minor Course-IV**	T	3	0	0	3	3	30	20	50	3
10	6	**VSEC-4**	EL	23EL1607	**Lab**.:Substation Design	P	0	0	2	4	2		60	40	
11	6	STR	EL	23EL1608	Project Phase -I	P	0	0	4	4	2		60	40	
						TOTAL	**16**	**0**	**14**	**32**	**25**				
List of Mandatory Learning Course (MLC)															
1	6	HS		MLC2126	**YCAP6 :**	**A**	3	0	0	3	**0**				

Professional Electives-III					
1	6	PE-III	EL	23EL1621	**PE-III :** Electrical Installation Design
2	6	PE-III	EL	23EL1622	**PE-III : Lab :** Electrical Installation Design
3	6	PE-III	EL	23EL1623	**PE-III :** Electrical Energy Audit and Safety Analysis
4	6	PE-III	EL	23EL1624	**PE-III : Lab :** Electrical Energy Audit and Safety Analysis
5	6	PE-III	EL	23EL1625	**PE-III :** Project Planning and Management
6	6	PE-III	EL	23EL1626	**PE-III : Lab :** Project Planning and Management
7	6	PE-III	EL	23EL1627	**PE-III :** Power Electronics Converters for Renewable Energy
8	6	PE-III	EL	23EL1628	**PE-III : Lab :** Power Electronics Converters for Renewable Energy
9	6	PE-III	EL	23EL1629	**PE-III :** Embedded System
10	6	PE-III	EL	23EL1630	**PE-III : Lab :** Embedded System
11	6	PE-III	EL	23EL1631	**PE-III :** PLC and Industrial Automation
12	6	PE-III	EL	23EL1632	**PE-III : Lab :** PLC and Industrial Automation

Professional Electives -IV					
1	6	PE-IV	EL	23EL1641	**PE-IV :** Advanced Power Electronics
2	6	PE-IV	EL	23EL1642	**PE-IV :** Advanced Electrical Drives
3	6	PE-IV	EL	23EL1643	**PE-IV :** Grid integration in Renewable Energy Systems
4	6	PE-IV	EL	23EL1644	**PE-IV :** Power System Operation and Management
5	6	PE-IV	EL	23EL1645	**PE-IV :** Microgrid
6	6	PE-IV	EL	23EL1646	**PE-IV :** Advanced Control System
7	6	PE-IV	EL	23EL1647	**PE-IV :** Environmental, Social, and Governance (ESG) frameworks in Industry 4.0
Coursera Elective					
1	6	PE-IV	EL	23EL1648	**PE-IV :** Energy Production, Distribution and Safety

		July, 2023	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2023-24 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

1st Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	EL	23EL1105	**Lab :** Electrical and Electronics Workshop	P	0	0	2	2	1		60	40	
8	1	PC	EL	23EL1103	Fundamentals of Electrical Engineering	T	3	0	0	3	3	30	20	50	3
9	1	PC	EL	23EL1104	**Lab :** Fundamentals of Electrical Engineering	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE		**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00
		Date of Release	Version

Applicable for AY 2023-24 Onwards

I SEMESTER

23GE1102 : Differential Equations, Matrices and Statistics

Course Outcomes
The students will be able to
1. Use appropriate Methods to solve first order and higher order differential equations and apply it to find solution of engineering problems.
2. Use Matrix method to solve linear system of equations, evaluate eigen values - eigen vectors and its applications.
3. Make use of probability distributions to solve real life problems.
4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit I: Differential Equations I	**(7 Hrs.)**
Linear differential equations of first order and first degree, Differential equation reducible to linear form, Exact differential equations (excluding the case of integrating factor) and their applications to various fields. **(Contemporary Issues related to Topic)**	
Unit II: Differential Equations II	**(7 Hrs.)**
Higher order linear differential equations with constant coefficients, Complementary functions and Particular Integral for different cases, Method of variation of parameters, Examples on application to various fields. **(Contemporary Issues related to Topic)**	
Unit III: Differential Equations III	**(6 Hrs.)**
Cauchy's homogeneous linear differential equations, Legendre's linear differential equation, Applications of differential equations to various fields (only up to second order). **(Contemporary Issues related to Topic)**	
Unit IV: Partial Differential Equations	**(6 Hrs.)**
Partial Differential Equations of first order, first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(Contemporary Issues related to Topic)**	
Unit IV: Matrices	**(7 Hrs.)**
Rank of a matrix, Consistency of system of equations using rank, Characteristics equations, Eigen values and Eigen vectors, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem-statement and its application. **(Contemporary Issues related to Topic)**	
Unit VI: Statistics	**(6 Hrs.)**
Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

Textbooks:	
1.	Erwin Kreyzig, Advance Engineering Mathematics, 6th Edition, John Wiley and Sons, INC.
2.	H.K. Dass, Engineering Mathematics, 11th revised edition, S. Chand, Delhi.
3.	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.
4.	Dr. B.S. Grewal, Higher Engineering Mathematics, 42th edition, Khanna Publishers.
5.	P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4th Edition, Vidyarthi GrihaPrakashan.

Reference Books:	
1.	G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999.
2.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/111103070
2.	https://onlinecourses.nptel.ac.in/noc19_ma28/preview
3.	https://nptel.ac.in/courses/111/106/111106100/

I SEMESTER

23GE1108 : Engineering Physics

Course Outcomes :

Upon successful completion of the course the students will be able to

1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles.
2. Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and Energy bands.
3. Examine the intensity variation of light due to interference, diffraction, laser and its applications.
4. Analyze the motion of charged particles in electric and magnetic field and its applications to electron optic devices.
5. Illustrate the nature and characterization of magnetic materials and superconductors for engineering applications.

Unit I: Quantum Physics	**(7 Hrs.)**
Wave-particle duality, de-Broglie's hypothesis, Wave packet, Heisenberg's uncertainty principle: significance and applications, Wave function and its probability interpretation, Schrodinger Equation, Particle in infinite potential well. **(Contemporary Issues related to Topic)**	
Unit II: Semiconductor Physics	**(7 Hrs.)**
Formation of energy bands in solids; Classification of solids, Energy band diagram of Si and Ge, Intrinsic and extrinsic semiconductors, Conductivity, Law of mass action, Fermi function, Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, Hall effect. **(Contemporary Issues related to Topic)**	
Unit III: Geometrical Optics	**(7 Hrs.)**
Interference: Interference in thin films, Wedge shaped film, Newton's rings, Applications of interference Diffraction: Fraunhofer diffraction from a single slit. **(Contemporary Issues related to Topic)**	
Unit IV: Laser	**(6 Hrs.)**
Coherence and its types, Interaction of radiation with matter, Population Inversion, Pumping: methods and schemes, Optical resonant cavity, Ruby laser, Semiconductor diode laser, Properties and engineering applications of laser. **(Contemporary Issues related to Topic)**	
Unit V: Electron Ballistics	**(7 Hrs.)**
Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens. Cathode ray oscilloscope and its application. **(Contemporary Issues related to Topic)**	
Unit VI: Magnetic Materials & Superconductors	**(6 Hrs.)**
Introduction to magnetic materials, Interpretation of Hysteresis curves, Superconductors: Type-I and Type-II, Meissner effect, Applications. **(Contemporary Issues related to Topic)**	
Total Lecture	**40 Hours**

Textbooks	
1	M. N. Avadhanulu, P.G.Kshirsagar, A Textbook of Engg. Physics, S.Chand and Company.
2	Hitendra K Malik , A K Singh , Engineering Physics, 2nd Edition, Tata McGraw Hill Education Private Limited,

Reference Books	
1	David Halliday, Robert Resnick and Jerle Walker, John-Wiley India, Fundamentals of Physics, 10th John Wiley & Sons Inc.
2	Brijlal and Subramanyam, Text Book of Optics, Revised edition, S. Chand and Company.
3	M.N. Avadhanulu, 2nd Edition, Laser, S.Chand and Company.
4	A.Beiser, Concept of Modern Physics, 6th Edition, Laser, Tata McGraw-Hill.
5	Thyagarajan K. and Ghatak A.K, LASERS: Theory and Applications, 2nd Edition, Macmillan Publication
6	S.O.Pillai, Solid State Physics, 9th Edition, New Edge International Publishers.
7	Palanisamy, Solid State Physics, 8th Edition, New Edge International Publishers.
8	C. Kittel, Solid State Physics, 8th Edition, Willey Publication.
9	B. K. Pandey, S. Chaturvedi, Engineering Physics, 1st Edition, Cengage Learning.
10	John Allision, Electronic Engineering Materials and Devices, TMH edition, 10th reprint, Tata McGraw Hill.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/Eisberg%20&%20Resnick%20-%20Quantum%20Physics.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/2016_Book_ThePhysicsOfSemiconductors.pdf
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/Dekker%20-%20Solid%20State%20Physics.pdf

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/115106066 - Quantum Physics
2	https://archive.nptel.ac.in/courses/115/105/115105121/ -CRO
3	www.digimat.in/nptel/courses/video/115102124/L36.html- Laser

I SEMESTER

23GE1109 : Lab. Engineering Physics

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles. 2. Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and Energy bands. 3. Examine the intensity variation of light due to interference, diffraction, laser and its applications. 4. Analyze the motion in electric field and magnetic field and its applications to electron optic devices. 5. Illustrate the nature and characterization of magnetic materials and superconductors for engineering Applications.

List of Experiments :

Sr. No.	Experiments based on
1	Determination of Planck's constant.
2	Study of Tunnel Diode.
3	Determination of Hall coefficient and density of charge carriers using Hall effect.
4	Dependence of Hall coefficient on temperature.
5	Determination of Band gap in a semiconductor by four probe method.
6	Determination of Band gap in a semiconductor using reverse biased p-n junction diode.
7	Determination of radius of curvature of Plano convex lens using Newton's rings.
8	Determination of thickness of thin paper using air wedge.
9	Determination of wavelength of sodium light using diffraction grating.
10	Determination of wavelength of laser using diffraction grating.
11	Determination of divergence of laser beam.
12	Determination of amplitude and frequency of sinusoidal signal using CRO.
13	To measure the phase shift introduced by a phase shift network using Dual beam CRO.
14	Determination of the velocity of Ultrasonic waves in a non -electrolytic liquid by ultrasonic interferometer.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mechanical Engineering)

B.Tech in Mechanical Engineering

SoE No. 23ME-101

I SEMESTER

23ME1101 : Engineering Graphics

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Construct orthographic drawing and isometric drawing of a given object
2. Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects
3. Develop the lateral surfaces of various solids, their section and intersection**.**
4. Practice the use of software tools used for Two dimensional drawings.

Unit I: Theory of Orthographic Projections:	**(3 Hrs.)**
Introduction, Quadrant system, Theory of orthographic projection, Projection method and principal planes, First and Third angle projections,	
Unit II: Theory of Isometric Projections:	**(2 Hrs.)**
Theory of isometric projection, Method for drawing isometric views, Different problems on isometric projections.	
Unit III: Lines:	**(2 Hrs.)**
Projection of points, Projection of lines, True lengths and inclinations, apparent lengths and inclinations, various positions of lines in different quadrants, Traces of lines, projection of line on auxiliary plane.	
Unit IV: Planes and Solids:	**(4 Hrs.)**
Projection planes: (Polygonal Lamina, Circular Lamina), Projection of Perpendicular planes and oblique planes. Auxiliary views (Auxiliary planes) Projection of Solids :(Inclined to One Plane Only) - Polyhedra (Regular and Irregular Polyhedra), Solids of Revolution	
Unit V: Section of Solids and Development of Surfaces:	**(2 Hrs.)**
Types of Section planes, Sectional top view, True shape. Development of different solids using Radial line and parallel line methods.	
Unit VI: Intersection of Surfaces of solids:	**(2 Hrs.)**
Intersection between similar solids, Intersection between dissimilar solids, Lines and Curves of Intersection.	
Total Lecture	**15 Hours**

Textbooks:	
1.	D.M. Kulkarni, A. P. Rastogi and A. K. Sarkar , Engineering Graphics with AutoCAD PHI learning Pvt. Ltd., Revised Edition(2014),
2.	N. D. Bhatt ,Engineering Drawing Charotar Publishing House Pvt. Ltd, 53 rd Edition 2017

Reference Books:	
1.	D. A. Jolhe Engineering Drawing , Tata McGraw Hill Publications , 2008,
2.	K. L. Narayana & P. Kannaiah , Engineering Drawing SciTech Publication , 2010
3.	R. K. Dhawan Engineering Drawing S. Chand Publication Multicolor revised edition 2015

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	Intranet on address 172.16.1.10. data/CCC/software / AutoCAD Software Setup.

MOOCs Links and additional reading, learning, video material	
1.	https://youtube.com/playlist?list=PLLy_2iUCG87Bw9XPfEF3r3EW5UlAOv8iz
2.	Eng https://nptel.ac.in/courses/112105294

I SEMESTER

23ME1102 : Lab. Engineering Graphics

Course Outcomes :
Upon successful completion of the course the students will be able to
1. Construct orthographic drawing and isometric drawing of a given object
2. Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects
3. Develop the lateral surfaces of various solids, their section and intersection**.**
4. Practice the use of software tools used for Two dimensional drawings.

Practical's to be performed from the list as below

SN	**Experiments based on**	**No.of Practical's**
1	Introduction of AutoCAD Basic Commands	02
2	Orthographic Projection	03
3	Isometric Projection	03
4	Projection of Straight Line	03
5	Projection of Planar Surface	03
6	Projection of Solid	03
7	Section and Development of Solid	04
8	Intersection of Surfaces	03
9	Drawing Sheet 1: Convention for various lines, Dimensioning and Orthographic Projection	02
10	Drawing Sheet 2: Projection of line, planar surface or solid. (Any one)	02
	Total Practical's	**28 Hours**

I SEMESTER

23EL1101 : Basic Electrical and Electronics Engineering

Course Outcomes:

1. Understand the fundamental concepts of Analog Electronic and Electrical Circuits
2. Apply the concepts of Electrical and Electronic Circuits to obtain the desired parameter
3. Analyze analog Electrical Circuits for given application.
4. Analyze analog Electronic Circuits for given application

Unit I: Circuit Elements and Energy Sources	**(8 Hrs.)**
DC Circuits - Circuit Elements, Series and Parallel Combination of Resistances, Equivalent Resistance, Star-Delta Connection, Energy Sources, Source Transformation, Kirchhoff's Laws, Current Division, Voltage Division, Nodal and Mesh Analysis of Electric Circuits, (Contemporary Issues related to Topic)	
Unit II: Analysis of Network	**(8Hrs.)**
AC Circuits –Resistance, Inductance and Capacitance, Sources with Periodic Waveforms, A.C. in Resistance, Inductance and Capacitance, Series – Parallel AC circuits **(Contemporary Issues related to Topic)**	
Unit III: Generator and Motors	**(8 Hrs.)**
Introduction to Generator, Construction, working principle, Types of Generators, Introduction to DC Motor, Working Principle of DC Motor, Types of Motors. Introduction to transformer, Introduction to Induction Motors - Construction, working principle, Types. **(Contemporary Issues related to Topic)**	
Unit IV: Diode and Transistor	**(7 Hrs.)**
Introduction to Semiconductor, P-N junction diodes, Biasing & Characteristics of diodes. Diode Circuits - Half wave rectifier, full wave rectifier, bridge rectifier. Introduction to BJT- NPN and PNP, Modes of operation,. **(Contemporary Issues related to Topic)**	
Unit V: Operational Amplifier and Its Application	**(7 Hrs.)**
Introduction to Op-Amp, Inverting and Non-Inverting Amplifier, Linear Applications of OP-AMP like adder, Subtractor, integrator, differentiator and non-linear application using Comparator. **(Contemporary Issues related to Topic)**	
Unit VI: Electronics Measurement	**(7 Hrs.)**
Introduction to Measurement System, Generalized block diagram of Measurement System, Static & Dynamic characteristics of measurement system, Types of errors & their sources, Statistical analysis, Electromechanical Instruments (PMMC) **(ContemporaryIssues related to Topic)**	
Total Lecture	**45 Hours**

Textbooks:	
1.	Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford Higher Education, First Edition2005
2.	Electronics Devices and circuits, Millman Jacob, McGraw Hill Education, Fourth Edition (2015)
3.	Circuit Theory (Analysis and Synthesis) , by A. Chakrabarti, Dhanpat Rai & Co., Reprint Edition 2014

Reference Books:	
1.	OP-AMP and Linear Integrated Circuit, by Ramakant A. Gayakwad, Prentice Hall India Learnin Private Limited, Published in 2002
2.	Electrical & Electronic measurement & Instrument, A. K. Sawhney, Dhanpat Rai & Co.,18th edition 2008

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1.	https://onlinecourses.nptel.ac.in/noc22_ee113/preview

I SEMESTER

23EL1105 : Lab : Electrical and Electronics Workshop

Course Outcomes:

Upon successful completion of the course the students will be able

1. To choose the electrical and electronics components/equipment for various application
2. To select various sensors and measuring instruments for different applications.
3. To build the various electrical wiring for different application

Sr. No.	Experiments based on
1	Introduction of Tools, Electrical Materials and Electrical Drawing Symbols
2	Introduction to basic Electrical Components (R, L, C) with its number and color coding.
3	Introduction to Different types of Measuring Instruments and its demonstration.
4	To implement 12 V DC power supply using 7812 IC
5	Fabrication of four switch socket Electrical Distribution Board
6	To fabricate Staircase Wiring and Godown Wiring
7	Fabrication of solar powered electric fan
8	To monitor the output voltage of solar panel using voltage Sensor
9	Introduction to Different sensor devices and its demonstration.
10	To Study different protection devices and Importance of Earthing.

I SEMESTER

23EL1103 : Fundamentals of Electrical Engineering

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Reproduce fundamentals of dc circuits, magnetic circuits, single phase, and three phase ac circuits.
2. Compute basic electrical and magnetic quantities for electrical and magnetic circuits respectively.
3. Explain construction, working, testing, and applications of single-phase transformers.

Unit I: D. C. Circuits	**(7 Hrs.)**

Basics of electrical circuits, Equivalent resistance, Kirchhoff's Laws. Current and Voltage division rule. Mesh and Nodal analysis of dc circuits. Superposition theorem. **(Contemporary Issues related to Topic)**

Unit II: Electromagnetism & Magnetic Circuits	**(6 Hrs.)**

Magnetic Field, Magnetic Flux, Magnetic Flux Density, Permeability, Relation between magnetic flux density and field intensity, Magnetic field due to current carrying conductor and a coil. Right hand grip rule, Force on a current carrying conductor placed in a magnetic field, Magnetomotive Force, Magnetic Field Strength. Reluctance, Magnetization curves of magnetic materials, Magnetic hysteresis and hysteresis loss. Eddy current and eddy current loss, Leakage flux and fringing, Faraday's laws of electromagnetic induction, Lenz's Law, Types of induced EMF, Magnetic Circuits **(Contemporary Issues related to Topic)**

Unit III: A.C. Fundamentals & Single-Phase Series A. C. Circuits	**(7 Hrs.)**

Generation of alternating voltage. Values of alternating quantity. Average and rms value by mid – ordinate method and method of integration. Form factor and peak factor. Concept of phasor and its mathematical representation. Concept of phasor diagram. Phasor algebra. Power in a.c. circuit. Concept of power factor, reactive power and apparent power with power triangle.

Analysis of purely resistive (R), inductive (L), and capacitive (C) circuits. Concept of inductive and capacitive reactance.

Analysis of series R – L, R – C, and R – L – C circuits for voltages and current, their waveforms, phasor diagram, impedance triangle, power factor. Series resonance. **(Contemporary Issues related to Topic)**

Unit IV: Single Phase Parallel & Series – Parallel A. C. Circuits	**(6 Hrs.)**

Concept of conductance, susceptance and admittance. Admittances in series and parallel. Analysis of single phase parallel and series – parallel a.c. circuits with their phasor diagram. Parallel resonance. **(Contemporary Issues related to Topic)**

Unit V: Three Phase A.C. Circuits	**(7 Hrs.)**
Advantages of three – phase systems over single – phase systems. Generation of three phase a.c. supply. Phase sequence. Interconnection of three phases. Star or Wye connection. Phase and line voltages/currents in star connection and their relationships. Delta or Mesh connection. Phase and line voltages/currents in delta connection and their relationships. Concept of balanced load. Active, reactive, and apparent power in balanced three phase circuits. **(Contemporary Issues related to Topic)**	
Unit VI: Single Phase Transformer	**(6 Hrs.)**
Working principle. EMF equation. Voltage ratio and turns ratio. Step up and step-down transformers. Construction of a single-phase transformer. Types of transformers and their applications. Ideal transformer. Transformer on no load with phasor diagram and equivalent circuit. Practical transformer and its equivalent circuit. Referred values. Transformer on load with phasor diagram and equivalent circuit. Voltage Regulation. Losses in transformer. Load Test. Open circuit and Short circuit tests on transformers. Efficiency and condition for maximum efficiency. Autotransformer operation, kVA rating of autotransformer **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

Textbooks:	
1.	D. C. Kulshreshtha , "Basic Electrical Engineering" ,Tata McGraw - Hill Education Private Limited.
2.	T. K. Nagsarkar , M. S. Sukhija , "Basic Electrical Engineering" , Oxford University Press , Third Edition.

Reference Books:	
1.	V. N. Mittle , Arvind Mittal , "Basic Electrical Engineering" , Tata McGraw - Hill Publishing Company Limited , Second Edition.
2.	B. L. Theraja , A. K. Theraja , "A Text Book Of Electrical Technology Volume I & II" , S. Chand & Company Pvt. Ltd. , Twenty Third Edition.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-540-43965-3

MOOCs Links and additional reading, learning, video material	
1.	Course on Basic Electrical Technology By Prof. Dr. L. Umanand https://archive.nptel.ac.in/courses/108/108/108108076
2.	Course on Fundamentals Of Electrical Engineering By Prof. Debapriya Das https://nptel.ac.in/courses/108105112
3.	Course on Basic Electrical Technology By Prof. N.K. De, Prof. G.D. Roy, Prof. T.K. Bhattacharyahttps://nptel.ac.in/courses/108105053

I SEMESTER

23EL1104 : Lab. Fundamentals of Electrical Engineering

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Reproduce fundamentals of dc circuits, magnetic circuits, single phase, and three phase ac circuits.
2. Compute basic electrical and magnetic quantities for electrical and magnetic circuits respectively.
3. Explain construction, working, testing, and applications of single-phase transformers.
4. Determine performance of single-phase transformers.
5. Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data,communicating and presenting effectively through laboratory journals.

SN	**Experiments based on**
1	To verify Kirchhoff 's voltage law and Kirchhoff 's current law.
2	To study R – L – C series circuit.
3	To verify Superposition theorem.
4	To study R – L – C parallel circuit.
5	To study balanced three phase star (Y) connected load.
6	To find transformation ratio, regulation, and efficiency of a single-phase transformer by direct loading.
7	To study balanced three phase delta (Δ) connected load.
8	To perform open circuit test and short circuit test on a single-phase transformer.
9	To draw B - H curve of a magnetic material.

Nagar Yuwak Shikshan Sanstha's

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Civil Engineering)

B.Tech in FYC

SoE No. 23FY-101

I SEMESTER

23GE1117-Get Set Go

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Students will understand the importance of building trust in communication and learn how to use the 3Vs of communication (Visual, Vocal, Verbal) to energize their interactions.
2. The course will focus on leadership principles and styles, emphasizing how effective communication can motivate others and gain willing cooperation. Students will participate in activities like skits and team presentations to demonstrate their leadership skills.
3. The course will equip students with team management and organization skills, enabling them to lead and participate in team-building activities effectively.

Unit:1	Build a foundation for success	6 Hours
Explain the Importance of Process of improvement, stating your Name with Impact, Recall and Use Names, Name Remembering Formula o LIRA o PACE – Individual Activity o BRAMMS o Chaining Method, Introduce "My Vision" Communication Fundamentals for Building Trust- Be a good listener, use conversation links, show genuine interest Hi-Five of Success ♣ Build on Memory Skills and Enhance Relationships ♣ PEG words ♣ Explain Permanent PEG Memory System, energize our Communications – Explain 3Vs of communication – Visual-Vocal-Verbal Activity – Practice Conversations, Pause-Part-Punch, Group Activity		
Unit:2	**Increase Self Confidence**	**6 Hours**
Use our experiences to communicate more confidently • Communicate with clarity and conciseness • Discover how past experiences influence behaviour ,Motivate Others and Enhance Relationships- • Learning Objectives • Explain Gain Willing Cooperation Principles • Group Presentation • Explain Demonstration of Leadership Principles • Explain "Evidence" critical in establishing credibility Individual Activity – Sharing of defining moment, Skit to demonstrate Leadership Principles, Stranded on Island .		
Unit:3	**Fundamentals of Communication**	**6 Hours**
Fundamentals of Communication (Earn the right – Excite -Eagerness) ♣ Elevator Pitch ♣ Develop more Flexibility, ♣ Recap and Summarize Activities - – Individual Presentation, Flexibility Drills, Individual Presentations – My Vision Assignment		
Unit:4	**Team Management and Organization skills**	**5 Hours**
Team Management and Organization skills, Leadership Styles, Effective Communication Activity- Team Presentation, Team building activities.		
EVALUATION	**1 Hour**	**EVALUATION**
WRITTEN TEST		
Total Lecture Hours		**24 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Reference Books	
1	Soft Skills - Enhancing Employability: Connecting Campus with Corporate. - M S Rao
2	Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H Wentz
3	Soft Skills: Know Yourself and Know the World - Alex

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Yeshwantrao Chavan College of Engineering

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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

2nd Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-B)															
1	1	BS	GE	23GE1102	Differential Equations, Matrices and Statistics	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1108	Engineering Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1109	**Lab:** Engineering Physics	P	0	0	2	2	1		60	40	
4	1	BES	ME	23ME1101	Engineering Graphics	T	1	0	0	1	1	30	20	50	3
5	1	BES	ME	23ME1102	**Lab :** Engineering Graphics	P	0	0	4	4	2		60	40	
6	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
7	1	BES	EL	23EL1105	**Lab :** Electrical and Electronics Workshop	P	0	0	2	2	1		60	40	
8	1	PC	EL	23EL1103	Fundamentals of Electrical Engineering	T	3	0	0	3	3	30	20	50	3
9	1	PC	EL	23EL1104	**Lab :** Fundamentals of Electrical Engineering	P	0	0	2	2	1		60	40	
10	1	VSEC	GE	23GE1117	Get Set Go	…	…	…	…	…	2		60	40	
11	1	CC2	GE		**Liberal Learning Course (LLC2)**	…	…	…	…	…	2		60	40	
					TOTAL FIRST SEM		**13**	**0**	**10**	**23**	**22**				
MANDATORY LEARNING COURSES															
1	1	HS		GE2131	Universal Human Values (UHV)	**A**	2	0	0	2	0				
SECOND SEMESTER (GROUP-B)															
1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1204	Applied Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1205	**Lab:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1212	Professional Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
6	2	BES	CV	23CV1201	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3
7	2	BES	CV	23CV1202	**Lab:** Engineering Mechanics	P	0	0	2	2	1		60	40	
8	2	BES	IT	23IT1203	Programming for Problem Solving	T	2	0	0	2	2	30	20	50	2
9	2	BES	IT	23IT1204	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
10	2	VSEC	GE	23GE1218	Functional English	…	…	…	…	…	2		60	40	
11	2	CC1	GE		**Liberal Learning Course (LLC1)**	…	…	…	…	…	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**6**	**21**	**22**				

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	2	CC2	GE	23LLC1201	Music (Vocal)
2	2	CC2	GE	23LLC1202	Music (Instrumental)
3	2	CC2	GE	23LLC1203	Indian Classical Dance
4	2	CC2	GE	23LLC1204	Other forms of Dances
5	2	CC2	GE	23LLC1205	Painting
6	2	CC2	GE	23LLC1206	Theatre and acting
7	2	CC2	GE	23LLC1207	Photography
8	2	CC2	GE	23LLC1208	Yoga
9	2	CC2	GE	23LLC1209	Chess
10	2	CC2	GE	23LLC1210	Athletics
11	2	CC2	GE	23LLC1211	Basket Ball
12	2	CC2	GE	23LLC1212	Judo
13	2	CC2	GE	23LLC1213	Elements of Japanese Language
14	2	CC2	GE	23LLC1214	Elements of German Language
15	2	CC2	GE	23LLC1215	Elements of French Language
16	2	CC2	GE	23LLC1216	Elements of Spanish Language
17	2	CC2	GE	23LLC1217	Basics of Vedic Maths
18	2	CC2	GE	23LLC1218	Skilling in Microsoft Visio and Inkscape

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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	1	CC1	GE	23LLC1101	Music (Vocal)
2	1	CC1	GE	23LLC1102	Music (Instrumental)
3	1	CC1	GE	23LLC1103	Indian Classical Dance
4	1	CC1	GE	23LLC1104	Other forms of Dances
5	1	CC1	GE	23LLC1105	Painting
6	1	CC1	GE	23LLC1106	Theatre and acting
7	1	CC1	GE	23LLC1107	Photography
8	1	CC1	GE	23LLC1108	Yoga
9	1	CC1	GE	23LLC1109	Chess
10	1	CC1	GE	23LLC1110	Athletics
11	1	CC1	GE	23LLC1111	Basket Ball
12	1	CC1	GE	23LLC1112	Judo
13	1	CC1	GE	23LLC1113	Elements of Japanese Language
14	1	CC1	GE	23LLC1114	Elements of German Language
15	1	CC1	GE	23LLC1115	Elements of French Language
16	1	CC1	GE	23LLC1116	Elements of Spanish Language
17	1	CC1	GE	23LLC1117	Basics of Vedic Maths
18	1	CC1	GE	23LLC1118	Skilling in Microsoft Visio and Inkscape

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	July, 2023	1.00
		Date of Release	Version

Applicable for AY 2023-24 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

II SEMESTER

23GE1201: Calculus and Vector

Course Outcomes :
The students will be able to 1. Apply the knowledge of differentiation to solve the Engineering problems. 2. Determine the derivatives of functions of several variables and develop the relations among the derivatives of variables. 3. Apply the knowledge of Beta and Gamma functions to find area, volume and mass. 4. Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single and multiple variables.

Unit I: Differential Calculus	**(6 Hrs.)**
Successive differentiation, n^{th} derivative of rational function, Trigonometrical transformations, n^{th} derivative of the product of two functions (Leibnitz's theorem), Taylor's theorem, Use of Maclaurin's theorem for one variable, standard expansions, Examples on Taylor's Theorem. **(Contemporary Issues related to Topic)**	
Unit II: Partial Differentiation	**(7 Hrs.)**
Functions of several variables, First and higher order derivatives, Homogeneous functions, Euler's theorem on homogeneous function, Chain rule and total differential coefficient of composite functions. Jacobians. **(Contemporary Issues related to Topic)**	
Unit III: Integral Calculus	**(6 Hrs.)**
Improper integrals: Gamma and Beta functions, applications of integral calculus in computing area, length, volumes, and surface of solids of revolutions. **(Contemporary Issues related to Topic)**	
Unit IV: Multiple integrals	**(6 Hrs.)**
Double integral, change of order of integral, change of variables, triple integrals and its applications. **(Contemporary Issues related to Topic)**	
Unit V: Vector Calculus	**(7 Hrs.)**
Vector fields, Vector differentiation, Gradient, Divergence and Curl, Directional derivatives with physical interpretation, Solenoidal and irrotational motions. **(Contemporary Issues related to Topic)**	
Unit VI: Vector Integration & Applications	**(7 Hrs.)**
Vector integration: Line, surface and volume integrals, Statement of Stoke's theorem, Gauss divergence theorem and Green's theorem (without proof), Simple applications of these theorems. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Textbooks:	
1.	Erwin Kreyzig, Advance Engineering Mathematics, 10th Edition, John Wiley and Sons, INC.
2.	H.K. Dass, Engineering Mathematics, 11th revised edition, S. Chand, Delhi.
3.	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.
4.	Dr. B.S. Grewal, Higher Engineering Mathematics, 42th edition, Khanna Publishers.
5.	P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4th Edition, Vidyarthi GrihaPrakashan.

Reference Books:	
1.	G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999.
2.	Michael Spivak and Tom Apostol, Calculus, VolI & Vol II 2nd edition, Wiley.
3.	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1.	https://nptel.ac.in/courses/111/106/111106146/
2.	https://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf

I/II SEMESTER
23GE1104/23GE1204: Applied Chemistry

Course Outcomes:

Upon successful completion of the course the students will be able to:

1. **Build** the knowledge of qualitative and quantitative aspects of water for industrial and domestic applications. (L3)
2. **Apply** fundamental principles of electrochemistry to understand corrosion, energy storage devices and their industrial applications. (L3)
3. **Develop** insight into engineering materials for industrial applications. (L3)
4. **Utilize** knowledge of advanced engineering materials for technological applications. (L3).

Unit I: Water Chemistry	**(8 Hrs.)**
Introduction, Potable water quality parameters. Hardness, Types of hardness. Sterilization. Desalination of water by R.O. Softening of water by Zeolite process and Ion Exchange Process (principle, advantages, and limitations). Numerical based on Hardness and Zeolite process. Boiler trouble (Scale and sludge). Contemporary issues related to the topic	
Unit II: Electrochemistry	**(8 Hrs.)**
Introduction, Redox reactions, EMF of a cell, standard electrode potential, Nernst equation, numerical and applications to chemical cells. Conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Electrolysis, laws of electrolysis and numerical. Industrial applications: Electroplating, Electrolytic refining. **Corrosion:** Definition, Causes, theories of corrosion- dry, wet and differential aeration. Contemporary issues related to the topic	
Unit III: Energy storage devices	**(7 Hrs.)**
Battery: Introduction, Characteristics, and General applications Lithium-ion battery, Glass battery, H_2-O_2 Fuel cell. Differences between Battery and Fuel cell. Recycling and safe disposal of batteries. **Supercapacitors:** Definition, Types, Characteristics,and Application. **H_2 as a green fuel:** Introduction, Production, Storage, and Utilization.Contemporary issues related to the topic	
Unit IV: Fuels	**(8 Hrs.)**
Introduction, Calorific value, HCV & LCV. Determination of calorific value of fuels by Bomb & Boy's calorimeter. Dulong's formula Numerical. Significance of Proximate and Ultimate analysis. Knocking in Internal combustion petrol and diesel engines, Octane and Cetane number, Knocking and its relationship with structure of fuels. Catalytic cracking & advantages. Contemporary issues related to the topic	
Unit V: Engineering Materials	**(7 Hrs.)**
Cement: Introduction, Manufacturing of Portland cement. Role of microscopic constituents. Properties-setting and hardening, heat of hydration and soundness. Types of cement-Rapid hardening cement, Low heat cement, High alumina cement. Ready-mix concrete.	

Lubricants: Introduction, Classification, Mechanism of Lubrication.
Properties & Significance of liquid lubricants–Viscosity and viscosity index, Flash and fire point, Cloud and pour point, Aniline point, acid value, saponification number. Numerical on V.I. Contemporary issues related to the topic.

Unit VI: Advanced Materials	**(7 Hrs.)**

Nanomaterials: Definition, Carbon Nanotubes and types. Applications of Nanomaterials in Electronics, Environment and Medicine.
Liquid Crystal Polymers: Introduction**,** General properties and applications.
Polymers in electronic industries: Introduction**,** Piezo, pyroelectric, Ferroelectric polymers.
Smart materials: Introduction**,** Properties and applications of Chromoactive, Photoactive and Magneto rheological materials.
Spectroscopic techniques: Introduction and applications. Contemporary issues related to the topic

Total Lecture	**45 Hours**

Textbooks:

1.	S S. Dara , A Text book of Engineering Chemistry , S.Chand & Co New Delhi. Eleventh Edition.
2.	P.C. Jain and Monica Jain , Engineering Chemistry , Dhanpat Rai & sons New Delhi , Sixteenth Edition.
3.	P. W. Atkins, Physical Chemistry ,Oxford Publications, Eighth edition .

Reference Books:

1.	Eskel Nordell , Water treatment for industrial and other use ,Rein hold Publishing Corporation, New York.
2.	Lloyd A.Munro, Chemistry in Engineering, Prentice-hall, Inc Nj, 2nd Edition.
3.	Robert B Leighou Mc Graw, Chemistry of Engineering Materials, Hill Book Company, Inc New York.
4.	B.K.Sharma Krishna, Engineering Chemistry, Prakashan media private LTD. 1st Edition, 2014.
5.	R.V.Gadag, A.Nityananda Shetty, Engineering Chemistry ,I K International Publishing House New Delhi , First Edition.
6	Fred. Billmeyer Jr., A textbook of polymer science, Wiley India ,Third Edition.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/SERIES%20WISE%20BOOKS/CHEMISTRY/

MOOCs Links and additional reading, learning, video material

1.	https://www.youtube.com/watch?v=XTt3gXB0a84
2.	https://www.youtube.com/watch?v=iihYXx79QiE
3.	https://www.youtube.com/watch?v=JfJ7MlP9Dco
4.	https://www.youtube.com/watch?v=L2VSOccUrSk
5.	https://www.youtube.com/watch?v=p5pk4Um6lsk
6.	https://youtu.be/-R7s17hD104
7.	https://youtu.be/Bmj85Ihfv7w

I/II SEMESTER

23GE1105/23GE1205: Applied Chemistry Lab

Course Objectives (PR)

1) Develop analytical ability.
2) Integrate chemistry fundamentals with practical applications.

Course Outcomes

Upon successful completion of the course the students will be able to

1. **Apply** the knowledge of quantitative and qualitative chemical analysis to perform record and analyze the results. (L3)
2. **Experiment** with instrumental and analytical techniques in Chemistry to solve engineering problems related to sustainability. (L3)
3. **Write** effective reports and communicate through oral presentations. (L3)
4. **Review a**nd apply laboratory safety protocols and procedures to acquire the ability for independent and lifelong learning. (L3)

Total 9 experiments are to be performed
(4 each from Lab I and Lab II and one demonstration experiment)

SN	**Experiments based on**
	List of Experiments-Lab- I
1	Estimation of Nickel.
2	Estimation of Fe^{2+} ions by redox titration
3	Determination of copper by iodometric titration
4	Determination of Cation exchange capacity of an ion exchange resin
5	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution
6	Determination of COD of water sample.
	List of Experiments-Lab- II
1	Determination of viscosity of lubricating oil by Redwood Viscometer I or II
2	Determination of molecular weight of a polymer.
3	Proximate analysis of coal

4	Determination of electrochemical equivalence of copper using Faradays Law
5	Determination of strength of the given acid conductometrically.
6	To verify Beer-Lambert law for $KMnO_4$ calorimetrically and determine the concentration of the given solution of $KMnO_4$.
	List of Demonstration Experiments
1	Synthesis of urea formaldehyde.
	Advanced Topics (CBS)
1.	To Determine optimum alum dosage for water or wastewater treatment by turbidity measurement using nephelometer and residual chlorine testing using chloroscope.
2.	Comparative study of effects of different drying techniques on the quality of fruits and vegetables.

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

II SEMESTER

23GE1212 : Professional Communication

Course Outcomes :
Upon successful completion of the course the students will be able to: 1.Apply different modes for effective communication 2.Produce competently the Phonology of English language 3.Apply nuances of LSRW skills 4.Practice Communication through different channels

Unit I: Basics of Communication	**(6 Hrs.)**
Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	
Unit II: English Phonetics	**(7 Hrs.)**
Speech Mechanism, Organs of speech, Consonant and Vowels sounds symbols, word stress rules	
Unit III: Presentation & Interview Skills	**(6 Hrs.)**
Presentation-Nuances of presentation- Kinesics, Proxemics, Chronemics, Vocalics, Modes of Presentation, Interview-Purpose , expectations of employer and preparation for Interview, Types, Types of Questions &Answering Techniques, Telephonic Interviews – preparation and guidelines	
Unit IV: Technical Reports, Memo & E-Mail Etiquettes	**(7 Hrs.)**
Report -Types, Characteristics, prewriting aspects of report and preparing writing of reports Memo- Objectives, Types, Structure and Layout Email-Etiquettes, acronyms.	
Total Lecture	**26 Hours**

Textbooks:	
1.	Meenakshi Raman & Sangeeta Sharma, Technical Communication, Raman & Sharma, Oxford University Press Orford University Press
2.	T. Balasubramaniam, Textbook of English Phonetics for Indian Students, Macmillan India Ltd
3.	

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Reference Books:	
1.	Dale Carnegie ,How to Develop Self – Confidence & Influence People by Public Speaking
2.	Asha Kaul, Communication Skills
3.	Allen Peas ,Body Language
4.	Gerson's Gerson, Technical Communication

MOOCs Links and additional reading, learning, video material	
1.	https://dl.uswr.ac.ir/bitstream/Hannan/141245/1/9781138219120.pdf
2.	https://www.pdfdrive.com/word-power-made-easy-the-complete-handbook-for-building-a-superiorvocabulary-e157841139.html
3.	https://www.pdfdrive.com/improve-your-communication-skills-present-with-confidence-write-with-stylelearn-skills-of-persuasion-e156963640.html
4.	https://www.pdfdrive.com/21-days-of-effective-communication-everyday-habits-and-exercises-to-improveyour-communication-skills-and-social-intelligence-e158273760.html

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

B.Tech First Year

SoE No. 23FY-101

II SEMESTER

23GE1215 : Indian Knowledge System

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Apply primary requirements pertaining towards awareness of Indian Knowledge System.
2. Analyze various Indian society, culture and literature to enhance their traditions.
3. Evaluate structure of Indian art.
4. Understand Indian heritage and architectural skills.

Unit:1	**Introduction to Indian Civilization**	**6 Hours**
Development of Human Civilization with specific reference: Stone age: Tool Technology and Cultural Development, Indus Valley civilization, Vedic Civilization. **(Contemporary Issues related to Topic)**		
Unit:2	**Indian Society, Culture and Literature**	**6 Hours**
Society and its types, Culture and its Characteristics, Foundational Literature. **(Contemporary Issues related to Topic)**		
Unit:3	**Tradition of Indian Art and Painting**	**7 Hours**
Indian Traditional Painting, Art style folk, mural with Gandhara and Mathura school of art. **(Contemporary Issues related to Topic)**		
Unit:4	**Indic Traditions of Architecture, Design and Planning**	**7 Hours**
Monumental studies of architectural skill: Rock Cut Caves, Stupa and Temple Architecture, The Ancient cities of Indus Saraswati region. Town Planning and drainage system. **(Contemporary Issues related to Topic)**		
	Total Lecture Hours	**26 Hours**

Textbooks	
1	Reader's Digest: Vanished Civilizations, THE READER'S DIGEST ASSOCIATION LIMITED, LONDON,NEWYORK.
2	Qaiser Zoha Alam ; Language and Literature Divers Indian Experience
3	Bal Ram Singh (Author), Nath Girish (Author) ; Science and Technology in Ancient Indian Texts
4	NCERT Books

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Reference Books	
1	B S Harishankar; Art and Archaeology of India: Stone Age to the Present, 2003.
2	Gupte R S and Mahajan B D; Ajanta, Ellora and Aurangabad, 1962.
3	Dharampal, Some Aspects of Earlier Indian Society and Polity and Their Relevance Today, New Quest Publications, Pune, 1987.
4	Michel Lorblanchet, "Rock Art In The Old World" IGNCA series, in India
5	Percy Brown, "Indian Architecture" D. B. Taraporevala sons & co. Pvt. Ltd. Bombay(1959).

PPT's/Research papers	
1	https://www.researchgate.net/publication/360889208_STONE_AGE_TOOL_TECHNOLOGY_and_CULTURAL_DEVELOPMENT
2	https://scholar.google.com/citations?view_op=view_citation&hl=en&user=iT1KSV8AAAAJ&sortby=pubdate&citation_for_view=iT1KSV8AAAAJ:UeHWp8X0CEIC

MOOCs Links and additional reading, learning, video material	
1	https://prepp.in/news/e-492-indian-architecture-art-and-culture-notes
2	https://www.artzolo.com/blog/most-famous-indian-painting-styles
3	https://www.researchgate.net/publication/360889332_Stone_Age_Tool_Technology_Cultural_Development
4	https://testbook.com/ias-preparation/ancient-history-16-mahajanapadas

II SEMESTER

23CV1201 : Engineering Mechanics

Course Outcomes :
Upon successful completion of the course the students will be able to 1. Describe the fundamental concepts of statics and dynamics. 2. Apply the basic concepts of applied mechanics for solution of problems on planar force system. 3. Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body. 4. Analyze pin jointed truss frame structure and beam structure analytically and graphically. 5. Evaluate the dynamic variables of kinetics of particles and simple lifting machine

Unit I: Resultant of planar force System	**(7 Hrs.)**
Fundamental concepts, system of forces, laws of mechanics, principle of transmissibility of force, Moment of force, Principle of moment, Couple, Resultant of a planar force system, Equivalent force couple system. **(Contemporary Issues related to Topic)**	
Unit II: Equilibrium of planar force System	**(6 Hrs.)**
Free body diagrams, Conditions of equilibrium, types of supports, types of beams, types of loads on beam, Equilibrium of a planar force system **(Contemporary Issues related to Topic)**	
Unit III: Friction and Trusses	**(7 Hrs.)**
Friction: Coulomb's laws of dry friction, plane friction, belt friction. Trusses: Types of trusses, assumptions in analysis of truss, Analysis of truss by method of joint. **(Contemporary Issues related to Topic)**	
Unit IV: Properties of Surfaces	**(6 Hrs.)**
Centroid: Introduction, First Moment of Area, Centroid of composite areas. Moment of Inertia: Introduction, Second Moment of Area, Polar moment of Inertia, Radius of Gyration, Transfer formula for moment of Inertia, Product of Inertia, Moment of Inertia, and product of inertia for composite areas, Principal Moments of Inertia. **(Contemporary Issues related to Topic)**	
Unit V: Virtual Work Method and Kinetics of Particle	**(7 Hrs.)**
Virtual Work Method: Introduction, Principle of virtual work, Application to beam and frame. Kinetics of Particle: Introduction, Newton's law of motion for a Particle, D' Alembert's principle, Translation of particle and connected system. **(Contemporary Issues related to Topic)**	
Unit VI: Work Energy and Impulse Momentum Method	**(6 Hrs.)**
Work Energy Method: Introduction, Work energy equation for translation, Work energy applied to particle motion and connected system. Impulse Momentum Method: Introduction, Linear Impulse momentum, Conservation of linear momentum, coefficient of restitution, elastic impact, Impulse momentum in plane motion. **(Contemporary Issues related to Topic)**	
Total Lecture	**39 Hours**

Textbooks:	
1.	Nelson A., Engineering Mechanics (Statics and Dynamics), ed 2009, Tata Mc. Grew Hill Education Pvt. Ltd., New Delhi, 2009.
2.	Dubey N.H., Engineering Mechanics (Statics and Dynamics) first edition 2013, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi, 2013.
3.	Singer F.L, Engineering Mechanics (Statics and Dynamics), Harper and Rowe publication, New Delhi, 1994.
Reference Books:	
1.	Timoshenko S, Young D.H and Rao J.V, Engineering Mechanics, Mc. Graw Hill Publication, New Delhi, 2007.
2.	Bhattacharyya B., Engineering Mechanics, Oxford University Press, New Delhi, 2008.
3.	Hibbeler R.C, Engineering Mechanics (Statics and Dynamics), Pearson Publication, Singapore, 2000.
4.	Shames I.H. and Rao J.V., Engineering Mechanics (Statics and Dynamics), First Edition, Pearson Publication, New Delhi, 2003.
5.	Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata Mc. Graw Hill Publication, New Delhi. 2007.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/78.%20Engineering-Mechanics-Statics-and-Dinamics-E-W-Nelson-C-L-Best-W-G-McLean-1st-Ed-1997-Schaum-Outline-McGraw-Hill%20(1).pdf
2	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/79.%20Engineering%20Mechanics.%20Statics-%20MERIAM%20%20AND%20KRAIGE.pdf
3	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Civil%20Engineering/81.%20Engineering%20Mechanics%201.pdf
MOOCs Links and additional reading, learning, video material	
1.	https://www.youtube.com/watch?v=nGfVTNfNwnk
2.	https://www.youtube.com/watch?v=6nguX-cEsvw
3.	https://nptel.ac.in/courses/112103108

II SEMESTER

23CV1202 : Lab. Engineering Mechanics

Course Outcomes
Upon successful completion of the course the students will be able to
1. Describe the fundamental concepts of statics and dynamics.
2. Apply the basic concepts of applied mechanics for solution of problems on planar force system.
3. Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body.
4. Analyze pin jointed truss frame structure and beam structure analytically and graphically.
5. Evaluate the dynamic variables of kinetics of particles and simple lifting machine

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To find determine the support reactions of a Simply Supported Beam experimentally and analytically.
2	To determine the forces in the members of a Jib Crane Apparatus experimentally and graphically.
3	To determine the coefficient of friction between two surfaces of different material on Plane Friction Apparatus.
4	To determine the coefficient of friction of Coil Friction Apparatus.
5	To determine the forces in members of a Shear Leg Apparatus experimentally and manually.
6	To determine the mass moment of inertia of a fly wheel using Fly Wheel Apparatus
7	To determine efficiency and law of machine of Differential Axel & Wheel machine.
8	To determine efficiency and Law of machine of Single Purchase Crab machine.
9	To determine efficiency and Law of machine of Double Purchase Crab machine.
10	To verify law of polygonal of forces using Law of Polygon Apparatus.
11	To find support reactions of a simply supported beam using graphical method and hand calculation.
12.	To find the forces in the member of truss using graphical method and hand calculation.
13.	To find (1) Principle moment of inertia and (2) Moment of inertia and product of inertia about any inclined axis for a composite figure using Mohr's circle and hand calculation,

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(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Information Technology)

B.Tech in Information Technology

SoE No. 23IT-101

II SEMESTER

23IT1203 : Programming for Problem Solving

Course Outcomes :
1) Understand the basics of computer system operations and algorithms, flowcharts.
2) Apply the basics of C programming for problem solving.
3) Apply and analyze the different dimensional arrays for problem solving.
4) Understand the basics of string, structure, and union and apply them to problem solving.

Unit I: Computer System Basics:	**(3 Hrs.)**
Basics of programming and problem solving. Introduction to algorithms and flowcharts, Types of programming errors, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions,	
Unit II: Basic of C Programming	**(6 Hrs.)**
Basic building blocks of C: Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, , bitwise operators, precedence of operators, Expressions, sizeof() operator, constants, typedef statement, writing straight line programs. Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.	
Unit III: Loop Structures:	**(5 Hrs.)**
While, do while and for loops, break and continue statement, "goto" statement, real life programming examples based on these loop structures, real life programming examples.	
Unit IV: Modular Programming:	**(6 Hrs.)**
Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value , call by reference, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, real life programming examples	
Unit V: Arrays:	**(6 Hrs.)**
One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting technique – Bubble sort. Two-dimensional arrays: matrix representation, programs for basic matrix operations such as addition, multiplication and transpose, Array as function arguments. real life programming examples	
Unit VI: String, Structure and Union:	**(4 Hrs.)**
Strings: string representation and string handling functions, Introduction to pointer, structure and union. real life programming examples	
Total Lecture	**30 Hours**

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Text books	
1	The C Programming Language, J.B.W.Kernighan & D.M.Ritchie, Prentice Hall
2	Mastering C, K.R.Venugopal & S.R. Prasad, TMH, 2007.
3	Programming in ANSI C, E. Balaguruswamy, Mc Graw Hill Education

Reference Books	
1	Problem Solving And Program Design In C, Jeri. R. Hanly, Elliot B. Koffman, Pearson Education.
2	Programming with C, Byron Gottfried, Schaum;s Outline Series
3	How to solve it by computers, R. G. Dromey, Prentice Hall India

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106104128
2	https://nptel.ac.in/courses/106104128
3	https://www.youtube.com/watch?v=rQoqCP7LX60&list=PLxgZQoSe9cg1drBnejUaDD9GEJBGQ5hMt

Nagar Yuwak Shikshan Sanstha's

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Information Technology)

B.Tech in Information Technology

SoE No. 23IT-101

II SEMESTER

23IT1204 : Lab. Programming for Problem Solving

Course Outcomes: Students will be able to
1) Understand the basics of computer system operations and algorithms, flowcharts. 2) Apply the basics of C programming for problem solving. 3) Apply and analyze the different dimensional arrays for problem solving. 4) Understand the basics of string, structure, and union and apply them to problem solving.

Unit I: Computer System Basics:	**(3 Hrs.)**
Basics of programming and problem solving. Introduction to algorithms and flowcharts, Types of programming errors, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions,	
Unit II: Basic of C Programming	**(6 Hrs.)**
Basic building blocks of C: Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, , bitwise operators, precedence of operators, Expressions, sizeof() operator, constants, typedef statement, writing straight line programs. Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.	
Unit III: Loop Structures:	**(5 Hrs.)**
While, do while and for loops, break and continue statement, "goto" statement, real life programming examples based on these loop structures, real life programming examples.	
Unit IV: Modular Programming:	**(6 Hrs.)**
Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value , call by reference, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, real life programming examples	
Unit V: Arrays:	**(6 Hrs.)**
One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting technique – Bubble sort. Two-dimensional arrays: matrix representation, programs for basic matrix operations such as addition, multiplication and transpose, Array as function arguments. real life programming examples	
Unit VI: String, Structure and Union:	**(4 Hrs.)**
Strings: string representation and string handling functions, Introduction to pointer, structure and union. real life programming examples	
Total Lecture	30 Hours

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Text books	
1	The C Programming Language, J.B.W.Kernighan & D.M.Ritchie, Prentice Hall
2	Mastering C, K.R.Venugopal & S.R. Prasad, TMH, 2007.
3	Programming in ANSI C, E. Balaguruswamy, Mc Graw Hill Education

Reference Books	
1	Problem Solving And Program Design In C, Jeri. R. Hanly, Elliot B. Koffman, Pearson Education.
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1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106104128
2	https://nptel.ac.in/courses/106104128
3	https://www.youtube.com/watch?v=rQoqCP7LX60&list=PLxgZQoSe9cg1drBnejUaDD9GEJBGQ5hMt

List of Practical

SN	Unit	Name Of The Practical	Remark	CO'S Mapped	PO'S Mapped
1(A)		Introduction to Linux Operating system & it's different commands.	**Manual**	**CO 1**	**PO1**
1(B)		Introduction to Vi editor, Compilation and Execution of a program in Linux.	**Manual**	**CO 1**	**PO1**
2	**II**	Practical based on Arithmetic and Conditional operators.	**Operators**	**CO 1**	**PO1**
3	**II**	Practical based on Conditional and Unconditional Statements.	**Conditional Statements**	**CO 1**	**PO1**
4	**III**	Practical based on Entry Controlled Looping Statements.	**For / While Loop**	**CO 2**	**PO 1, PO 2**
5	**III**	Practical based on Exit Controlled Looping Statement	**Do while Loop**	**CO 2**	**PO 1, PO 2**
6	**IV**	Practical based on Functions and Recursion.	**Functions / Recursion**	**CO 3**	**PO2, PO3**
7	**V**	Practical based on 1-D Array.	**1D Array**	**CO 3**	**PO2, PO3**
8	**V**	Practical based on 2-D Array.	**2D Array**	**CO 3**	**PO2, PO3**
9	**VI**	Practical based on Strings.	**Strings & Pointers**	**CO 3**	**PO2, PO3**
10	**VI**	Practical based on Structures.	**Structures**	**CO 4**	**PO1, PO2, PO3**

Nagar Yuwak Shikshan Sanstha's

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B. Tech SoE and Syllabus 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Mathematics & Humanities)

SoE No. 23FY-101

B.Tech First Year

II SEMESTER

23GE1218 : Functional English

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand the concept of FE (Functional English) and its application in various real-life scenarios. 2. Develop basic interactive communication skills, including greetings, asking for information, stating opinions, and providing feedback. 3. Acquire knowledge of social networking, texting, instant messaging, blogs, and discussion boards, along with the ethical considerations associated with online communication. 4. Successfully complete quizzes and assignments assessing knowledge in the covered topics of FE, social media, tenses, and effective communication.

Unit:1	Introduction to Functional English	6 Hours
What is FE? And Areas of application. Basic Interactive sentences - Greetings & Replies, Asking for information, Telling people what you do, Asking somebody's opinion, Giving your opinion, Saying someone is correct, Saying that someone is wrong, Apologizing, Praising someone's work, Saying goodbye. Introduction & Basics of Common Expressions – Offer, Request, Gratitude, Apology. Modal Verbs - Words used often: Can- could, Will – would, Shall – should, Ought to-Must, May-might. Practice exercises, Practice Conversations, Script Activity		
Unit:2	**Internet & Social Media Communication**	**6 Hours**
Introduction & Basics to Social Networking, Texting & Instant messaging, Blogs & Discussion Board- discussion with examples, Ethics of social media & communication Topic: Introduction to Creative Ads Why Ads, What's in it for me? Characteristics of ads. Assignment Quiz on the above Topics, Exercises for Evaluation		
Unit:3	**TENSES**	**6 Hours**
Introduction & Basics, Simple Tense (Past, Present, Future), Continuous Tense (Past, Present, Future) – discussion with examples. Introduction & Basics, Perfect Tense (Past, Present, Future), Perfect Continuous Tense (Past, Present, Future) – discussion with examples Introduction to Movie Magic, Learn English with films, Film Vocabulary, Describing a film, Types of Films Assessment – Letter and Email Writing, Tenses – Quiz		
Unit:4	**Written Communication**	**5 Hours**
Introduction & Basics of Writing, five methods of communication, Mind your grammar, Commonly confusing words Letters – Format, Parts of a business letter, When does communication fail?, Things to remember, Positive language not negative language, Active voice not passive voice Effective emailing -How to make an effective e-mail, Few common e-mail habits that cause problems, Parts of an e-mail, Some other important aspects.		

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Assignment Presentation on Mad Ads, Quiz on Tenses and social media-Internet Communication
Topic: Activity Extempore

EVALUATION			**1 Hour**
WRITTEN TEST	**TA=60**	**ESE=40**	**TOTAL=100**
Total Lecture Hours			**24 Hours**

Reference Books	
1	How to win friends & influence people – Dale Carnegie
2.	Functional English for Communication - Ujjwala Kakarla
3	Functional English for Technical Students – Dr Prathibha Mahato & Dr Dora Thompson

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

3rd Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	23GE1302	Integral Transform	T	3	0	0	3	3	30	20	50	3
2	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
3	3	VEC-1	CV	23CV1311	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
4	3	PC	EL	23EL1301	Electrical Energy Generation System	T	3	0	0	3	3	30	20	50	3
5	3	PC	EL	23EL1302	**Lab:** Renewable Energy Sources	P	0	0	2	2	1		60	40	
6	3	PC	EL	23EL1303	Network Analysis	T	3	0	0	3	3	30	20	50	3
7	3	PC	EL	23EL1304	**Lab** : Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	3	PC	EL	23EL1305	Electrical Machines	T	3	0	0	3	3	30	20	50	3
9	3	PC	EL	23EL1306	**Lab :** Electrical Machines	P	0	0	2	2	1		60	40	
10	3	CEP	EL	23EL1307	**Community Engagement Project**	P	0	0	2	4	2		60	40	
11	3	OE I	OE		**Open Elective -I**	T	2	0	0	2	2	30	20	50	3
12	3	MDM	MDM		**MD Minor Course-I**	T	2	0	0	2	2	30	20	50	3
					TOTAL		**20**	**0**	**8**	**30**	**25**				

List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	**YCAP3 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

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III /IV SEMESTER
23GE1302/23GE1402 : Integral Transforms

Course Outcomes:
Upon successful completion of the course the students will be able to
1 Apply the knowledge of Laplace and Fourier transforms to solve the continuous problems.
2. Apply the knowledge of Z transforms to solve the discrete mathematical equations.
3. Determine Fourier series expansion of periodic functions, Fourier Transform.
4. Use appropriate methods to solve partial differential equations.

Unit I:	**7 Hrs.**
Laplace Transforms : Definition and examples of Laplace transforms, properties of Laplace transforms, Examples by using properties of Laplace transforms, Unit step function, periodic function.	
Unit II:	**8 Hrs.**
Inverse of Laplace Transform: Definition and examples of Inverse Laplace transforms, Inverse Laplace transform by using properties, Partial fraction method to find Inverse Laplace transforms, convolution theorem, Applications of Laplace transform to solve ordinary differential equations.	
Unit III:	**7 Hrs.**
Z-Transform: Some elementary concepts, Definition of Z-Transform, Examples of Z-Transform, Properties (without proof), Inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient.	
Unit IV:	**8 Hrs.**
Fourier Series: Periodic Functions, standard results, Fourier series expansion, Convergence of Fourier Series, Fourier Series for even and odd function, Change of interval, half range Fourier Series, Examples on half range sine and cosine series.	
Unit V:	**8 Hrs.**
Fourier Integral: Fourier Integral of a function formula and examples, Fourier Cosine integral, Fourier Sine integral, Complex Fourier integral, Evaluation of integration using Fourier integral.	

Unit VI:	**7 Hrs.**
Fourier Transforms: Fourier Transform, Fourier sine and cosine transformation and its examples, Properties of Fourier sine and cosine transform and its examples, Application of Fourier sine and cosine transform on Partial differential equation, Parseval's Identity.	
Total Lecture	**45 Hours**

Textbooks:	
1	Erwin Kreyzig, Advance Engineering Mathematics, 9th Edition, John Wiley and Sons, INC.
2	Dr. B. S. Grewal, Higher Engineering Mathematics, 40th edition, Khanna Publisher.
3	H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.

Reference Books:	
1	Chandrika Prasad, Mathematics for Engineers, 19th Edition, John Wiley and Sons, INC.
2	L. A. Pipes and Harville, Applied Mathematics for Engineers, 3rd Edition, McGraw Hill.
3	P.N. and J. N. Wartikar, A text book of Applied MAthematics, 3rd edition, Pune Vidyarthi Griha Prakashan
4	N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/111106111
2	https://onlinecourses.nptel.ac.in/noc22_ma41/preview
3	https://archive.nptel.ac.in/courses/111/101/111101153/

III SEMESTER
23GE1301: Fundamentals of Management & Economics

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Develop the Managerial Perspective and perform the various functions of management for optimum utilization of Engineering Resources 2. Identify and Analyze the role of Financial Accountancy and Marketing Management in the Organization 3. Develop perspective about economy based on logical reasoning and estimate the economic outcomes. 4. Interprets comparative advantage of resources.

Unit I:	**7 Hrs.**
Principles of Management: Evolution of Management Thought: Scientific and Administrative Theory of Management, Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Staffing and Controlling, Motivational Theories, Concept of Leadership.	
Unit II:	**8 Hrs.**
Marketing and Financial Management: Marketing and Financial Management –Marketing Theories and Concept-Marketing Mix, Market Segmentation, Targeting and Positioning and Functions Financial Management and Accountancy- Accountancy Rules and Capital, Preparation of Books of Account- Journal posting of Transaction into ledger and preparation of trial Balance, Introduction of Trading Account, Profit and loss account and balance sheet.	
Unit III:	**7 Hrs.**
Introduction to Microeconomics: Nature and Scope of Microeconomics, Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand - types and degrees, Utility analysis, Law of diminishing marginal utility, supply- law of supply, Law of Variable proportions and Return to Scale, Classification of market structure.	
Unit IV:	**8 Hrs.**
Introduction to Macroeconomics: Nature and Scope of Macroeconomics, Concept of GDP, GNP, NDP, NNP, Measurement of GDP; Economic Growth and development, Money – definition, types and function of money, Inflation – meaning, types, causes and measure to control, concept of deflation, functions of central and commercial bank , Sources of public revenue - direct and indirect taxes.	
Total Lecture	**30 Hours**

Textbooks:	
1	Principle of Management, 9th edition , Harold Koontz Ramchandra, Tata McGrow hills
2	Marketing Management: Planning, Implementation and Control, 3rd Edition, Ramaswamy V.S. and Namakumari S, Macmillian
3	Fundamentals of Accounting Gupta R.L. & Radhaswamy ;
4	Modern Economics, 13th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	Modern Economic Theory, 3rd edition, K. K. Devett, S. Chand Publisher,2007
6	Principle of Economics, 7th edition, Mankiw N. Gregory, Thomson, 2013

Reference Books:	
1	Foundations of Financial Markets and Institutions, 3rd Edition, Fabozzi, Pretice Hall
2	Fundamentals of Financial Instruments , 2nd Edition, Parameshwaran, Wiley India
3	Marketing Management , 3rd Edition , RajanSaxena, Tata McGraw Hill
4	Advance Economic Theory, 17th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	International Trade, 12th edition, M. L. Zingan, Vindra Publication, 2007
6	Macro Economics, 11th edition, M. L. Zingan, Vindra Publication, 2007
7	Monitory Economics:,1st Edition, M. L. Sheth, Himayalaya Publisher, 1995

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_mg104/preview
2	https://archive.nptel.ac.in/courses/110/101/110101131/
3	https://onlinecourses.nptel.ac.in/noc23_mg122/preview
4	https://onlinecourses.nptel.ac.in/noc21_hs52/preview
5	https://onlinecourses.nptel.ac.in/noc22_hs67/preview

III/IV SEMESTER
23CV1311/23CV1411
Environmental Sustainability, Pollution and Management

Course Outcomes :
Upon successful completion of the course, the students will be able to
The student will be able to 1. Gain insights into the efforts to safeguard the Earth's environment and resources. 2. Develop a critical understanding of the contemporary environmental issues of concern 3. Have an overview of pollution, climate change and national and global efforts to address adaptation and mitigation to changing environment through environmental management. 4. Learn about the major international treaties and our country's stand on and responses to the major international agreements.

Unit:1	**Environment and Sustainable Development**	**8 Hours**
The man-environment interaction; Overview of natural resources: renewable, and non-renewable energy resources; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Environmental issues: Global change, Climate Change and Mitigation.		
Unit:2	**Environmental Pollution and Health**	**7 Hours**
Understanding pollution: Production processes and generation of wastes, Air pollution, Water pollution, Soil pollution and solid waste, Noise pollution, Thermal and Radioactive pollution. Impact on biotic and abiotic things.		
Unit:3	**Environmental Management**	**8 Hours**
Environmental management system: ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Waste Management and sustainability; Ecolabeling /Eco mark scheme		
Unit:4	**Environmental Treaties and Legislation**	**7 Hours**
Introduction to environmental laws and regulation, An overview of instruments of international cooperation, Major International Environmental Agreements, Major Indian Environmental Legislations, Major International organizations, and initiatives		
	Total Lecture	**30 Hours**

Text books	
1	Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson
2	Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
3	Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
4	Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education
5	Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6	Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press
7	Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press

Reference Books	
1	Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press
2	Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
3	William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4	Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
5	Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/ standards
6	Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213
7	Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press
8	Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp- content/uploads/2020/02/ convention-V-16-CURVE-web.pdf
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
MOOCs Links and additional reading, learning, video material	
1	

III SEMESTER
23EL1301 : Electrical Energy Generation System

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Classify types of renewable energy sources and different factors associated with a generating station
2. Explain various parameters related to selection and application of Solar ,Wind Energy and Biogas
3. Illustrate design parameters for Hydro and Thermal Power generating Systems.
4. Explain various parameters related to generation of Nuclear Power

Unit:1	**Introduction to generation systems**	**7 Hours**

Importance of Electrical Energy, Generation of Electrical Energy, Relationships among Energy units, Calorificvalue of fuels.
Sources of Electrical energy- Coal, oil and natural gas, hydro, solar, wind and nuclear energy.Different factors associated with a generating station : connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve and load duration curve load survey, base load and peak load station, advantages of interconnection.
Tariff-: Definition, Objective, Characteristics of tariff, Types of Tariff (Numerical), economical choice of tariff.
Contemporary Issues related to Topic

Unit:2	**Solar Energy**	**8 Hours**

Solar radiation & its Measurement: - Solar constant, Solar radiation at earth's surface, Solar radiation geometry, Solar radiation on tilted surfaces, Solar radiation measurement, Solar Energy Collectors: - Physical principles of the conversion of solar radiation into heat, flat plate collectors. Applications of Solar energy: Solar Dryer, Solar Still, Solar cooker
Solar Photovoltaic Cell: Principle of solar photovoltaic energy conversion, Equivalent circuit of solar cell
Contemporary Issues related to Topic

Unit:3	**Wind Energy**	**7 Hours**

Principle of wind energy conversion, Power in the wind, Cut In, Cut Off Wind Speed ,Site selection considerations, Basic components of wind energy conversion systems(WECS),Classification of WEC systems, Advantages and Limitations of WECS,,Types of wind Machines(HAWT and VAWT), Application of wind energy.
Contemporary Issues related to Topic

Unit:4	**Hydro Power Station**	**8 Hours**

Schematic arrangement of Hydroelectric Power Station, Constituents of Hydroelectric power plant, Advantages and Limitations of Hydro-electric Plants , Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity, Water Power equation (Numerical), type of hydro power plants and their field of use, pumped storage plant and their utility, surge tanks. General study of Hydro Turbine, Introduction to Small hydro plants.
Contemporary Issues related to Topic

Unit:5	**Thermal Power Station**	**7 Hours**

Introduction, Site selection, size and number of units, general layout, major equipment, auxiliaries, electric supply to auxiliary, cost of generation ,effect of different factors on costs.
General study of steam Turbine.
Condenser: Different types of condensers. Construction and Working principle of Condenser
Contemporary Issues related to Topic

Unit :6	**Nuclear Power Plant and Biomass Energy**	**8 Hours**

Site selection for nuclear power plant, introduction to nuclear physics, chain reaction, Working Principle of nuclear Power Plant, Components of a nuclear reactor, types of nuclear reactor, material for moderator and control rods, control of nuclear reactors, , economics of nuclear power generation. Biogas production from waste biomass, classification of biogas plants, operational parameters, availability of raw material and gas yield.
Contemporary Issues related to Topic

Total: **45 Hours**

Text books	
1	M.L.Soni,P.V.Gupta,U.S.Bhatnagar,A Textbook on Power System Engineering, 2nd edition 2014, Dhanpat Rai and Co.
2	V.K.Mehta, Rohit Mehta, Principles of Power System, 2nd edition 2008,S.Chand
3	B.R.Gupta,Generation of Electrical Energy,5th edition 2007 ,S.Chand
4	G. D. Rai,Non-Conventional Energy Sources, 5th edition 2011, Khanna Publication

Reference Books	
1	T.K. Nagsarkar, M.S. Sukhija,Power System Analysis,1st edition 2007, Oxford Publication
2	Ashfaque Hussain,Electrical Power System,5th edition 2007, CBS Publication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Principles%20of%20Power%20Systems%20V.K%20Mehta.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/B.H.Khan%20Book%20RES.pdf
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/Solar%20Energy%20pdf.pdf

MOOCs Links and additional reading, learning, video material	
1	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems [Intro Video]
2	http://103.152.199.179/YCCE/DTEL%20Material/3.Electrical%20Engineering/DTEL%20PPTs/IV%20SEMESTER/EL-2253%20EEGS/

III SEMESTER
23EL1302: Lab. Renewable Energy Sources

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Summarize, classify types of renewable energy sources, outline as per Global and Indian context
2. Utilize ,analyze solar energy for various applications.
3. Classify, analyze wind energy conversion systems and estimate its parameters.

Minimum Eight Practical's to be performed from the list as below

S. N.	Experiments based on
1	To analyze I-V and P-V characteristics of single PV module
2	To analyze I-V and P-V characteristics of series connected PV modules
3	To analyze I-V and P-V characteristics of parallel connected PV modules
4	To observe effect of shading on power output of single PV module
5	To observe effect of tilt angle on power output of single PV module
6	To explain working of Solar Water Heater in natural convection and force convection mode
7	To explain the Biogas generation plant model set up at YCCE College
8	To explain working of Solar Cooker A)Box type B)Concentrated type
9	To design home Solar PV system
10	To explain Hydroelectric Power plant

III SEMESTER
23EL1303 : Network Analysis

Course Outcomes:
Upon successful completion of the course, the students will be able to: 1) Apply node voltage and mesh current analysis methods to electric circuits. 2) Apply network theorems to electric circuits. 3) Determine initial and final values of current and voltage of electric circuits containing energy storage elements. 4) Apply Laplace transform to electric circuits.

Unit:1	**Nodal Analysis of Electric Circuits**	**7 Hours**
Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. **Contemporary Issues related to Topic**		
Unit:2	**Mesh Analysis of Electric Circuits**	**8 Hours**
Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. **Contemporary Issues related to Topic**		
Unit:3	**Network Theorem**	**7 Hours**
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. **Contemporary Issues related to Topic**		
Unit:4	**Initial and Final Conditions, Impedance Functions And Circuit Analysis With Laplace Transform.**	**8 Hours**
Concept of initial and final conditions, behavior of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment. Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform. **Contemporary Issues related to Topic**		
Unit:5	**Transforms of other Signal Waveforms, Network Functions, Poles and Zeros Of Network Functions**	**7 Hours**
Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks. Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behavior from the pole – zero plot, network synthesis using pole – zero plot.		

Unit :6	Two Port Parameters	8 Hours
Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.		
Contemporary Issues related to Topic		
Total Lecture Hours		**45 Hours**

Text books	
1	M. E. Van Valkenburg , "Network Analysis" , PHI Learning Private Limited , Third Edition.
2	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin , "Engineering Circuit Analysis" , McGraw – Hill , Eighth Edition.
3	Decarlo , Lin , "Linear Circuit Analysis" , Oxford Univ. Press , Second Edition

Reference Books	
1	Syed A. Nasar , "Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2" , McGraw - Hill , First Edition.
2	Joseph A. Edminister , "Schaum's Outline Series : Theory and Problems of Electric Circuits" , McGraw - Hill , Fifth Edition.
3	Lawrence P. Huelsman , "Basic Circuit Theory" , PHI Learning Private Limited , Third Edition.
4	Ravish R. Singh , "Network Analysis And Synthesis" , McGraw - Hill Education (India) Private Limited.

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1	http://link.springer.com/openurl?genre=book&isbn=978-90-481-9442-1
2	https://web.p.ebscohost.com/ehost/detail/detail?vid=2&sid=4051e547-e3c2-4c21-8a54-384a6b804d38%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=2196243&db=e230xww
3	http://link.springer.com/openurl?genre=book&isbn=978-0-412-38310-6

MOOCs Links and additional reading, learning, video material	
1	Course on Circuit Theory By Prof. S. C. Dutta Royhttps://nptel.ac.in/courses/108102042
2	Course on Network Analysis By Prof. Tapas Kumar Bhattacharya https://archive.nptel.ac.in/courses/108/105/108105159/
3	Course on Basic Electric Circuits By Prof. Ankush Sharmahttps://nptel.ac.in/courses/108104139

III SEMESTER
23EL1304 : Lab : Electrical Engineering Workshop

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Describe the basic concept of various electrical components.
2. Demonstrate, formulate and solve the basic maintenance and troubleshooting of household Equipments, energy saving etc.
3. Outline the fundamentals of major electrical devices and actual operation of devices like AC and DC machines.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	To study the construction and working of ceiling fan and troubleshooting.
2	To find the fault of electric iron (ordinary and automatic) and study about them and prepare the maintenance chart of the possible faults and their remedies
3	To study about electric mixer and find out fault in it
4	To measure Earth Resistance by Earth Tester
5	To measure the value of insulation resistance of a given electrical equipment using the Megger instrument.
6	To construct the single phase centre tapped shell type transformer
7	To identify terminals and testing of DC Compound Motor
8	To assemble the Direct Online Starter – DOL Starter for Motors
9	To assemble the Star Delta Starter – (Y-Δ) for Motors
10	To demonstrate Solar Rooftop Installation
11	To study Electrical Insulator and Types of Insulator
12	To explain the basic design of a Transmission tower.
13	To study the Types of Electrical Power Cables (Sizes & Ratings)

III SEMESTER
23EL1305 : Electrical Machines

Course Outcomes:	
1.	Analyze the performance of Transformers.
2.	Illustrate proficiency in understanding the performance of D.C. Machines
3.	Evaluate the performance of Induction Motors.
4.	Explain working of Special Machines.

Unit:1	Three Phase Transformer	7 Hours

Types of 3 phase transformers, Construction, Labelling of terminals, Vector Groups, Polarity marking & Test, Transformer connections and their comparative features, Open Delta Connection, Parallel operation of three phasetransformers, All day efficiency. Harmonics effect due to saturation.

Contemporary Issues related to Topic

Unit:2	D.C. Generator	8 Hours

Construction, Magnetic structure, Field and Armature systems, Field and Armature windings (Both Lap and Wave Types),EMF Equation, Characteristics and applications of different types of D.C. Generators, Building of Emf in D.C. Shunt generator, Armature reaction, commutation, straight line commutation, inter-poles, compensating winding.

Contemporary Issues related to Topic

Unit:3	D.C. Motor	7 Hours

Principle, Torque Equation, Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Power flow in DC machines, Losses and Efficiency in D.C. machines.

Contemporary Issues related to Topic

Unit:4	Single Phase Induction Motor	8 Hours

Production of rotating magnetic field, Double-field revolving theory of Induction motor, Types of single phase Induction motors, Comparison of single phase and three phase Induction motor, Application of single phase Induction Motor.

Contemporary Issues related to Topic

Unit:5	Three Phase Induction Motor	7 Hours

Construction , Production of rotating magnetic field, Principle of operation, Speed and Slip, frequency of rotor voltage and current, Relationship between rotor copper loss and rotor input, Developed torque, Torque of an Induction Motor, Condition for maximum torque, Torque-slip and torque-speed characteristics.

Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, Losses and efficiency. Starting, Speed control, Crawling and Cogging, Application of three phase Induction Motor.

Contemporary Issues related to Topic

Unit :6	Special Machines	8 Hrs
Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, Applications. Stepper Motors, Permanent Magnet Brushless DC Motor: Constructional features, Principle of Operation,Torque prediction, Types, Applications. **Contemporary Issues related to Topic**		
Total Lecture Hours		**45 Hours**

Text books	
1	Dr. P. K. Mukherjee and S. Chakravarti,"Electrical Machines", Dhanpat Rai Publications (P) Ltd,2nd Edition -1993
2	I.J.Nagrath and Dr. D.P.Kothari,"Electrical Machines", Tata McGraw Hill , 3rd Edition-2010
3	Ashfaq Husain,"Electric Machines", Dhanpat Rai Publications (P) Ltd., 2nd Edition-2014
4	K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
5	A.E.Fitzgerald, C.Kingsley, S.D.Umans, "Electrical Machinery", Tata McGraw Hill. Sixth Edition 2002.

Reference Books	
1	Alexander S. Langdorf,**"**D.C. Machines",: Mcgraw-hill Book Company, 1915.
2	Nasser Syed, "Electrical Machines and Transformers", A New York, Macmillon 1984.
3	R.Srinivasan, 'Special Electrical Machines', Lakshmi Publications, 2013.
4	P.S.Bhimbra, 'Generalised Theory of Electrical Machine' , Khanna Publishers, Edition 7th -2008.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-642-25904-3
2	http://link.springer.com/openurl?genre=book&isbn=978-1-4614-0399-9
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Electrical%20Machines/

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/108/105/108105155/

III SEMESTER
23EL1306 : Lab. Electrical Machines

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Analyze the performance of Transformers. 2. Illustrate proficiency in understanding the performance of D.C. Machines 3. Evaluate the performance of Induction Motors. 4. Explain working of Special Machines.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	To study phasing out and polarity marking of a 3-phase transformer
2	To study voltage and current relations in a 3-phase, Delta-Star connected transformer
3	To perform Open Circuit and Short Circuit test on a 3-phase transformer
4	To plot magnetization characteristic of a DC generator
5	To study speed control of a DC shunt motor by varying – (a) field excitation and (b) armature voltage
6	To perform load test on a DC shunt motor
7	To study measurement of slip of a 3-phase induction motor by different methods
8	To study control of a 3-phase slip-ring induction motor by – (a) variation of a rotor resistance and (b) varying supply voltage
9	To perform open circuit test and blocked rotor test on a 3-phase induction motor
10	To perform load test on a 3-phase induction motor by direct loading.
11	To perform No-Load and Blocked rotor tests on a 1-phase induction motor
12	To study Induction generator operation.
13	To measure inrush current of three phase,60 Hp induction motor

III SEMESTER
23EL1307 : Community Engagement Project

Course Outcomes:
Activities related to following topics will be undertaken under this lab: 1. Calculation of electrical load of a particular site 2. Safety measures to be undertaken to avoid accidents at domestic level. 3. Safety measures to be undertaken to avoid accidents at commercial level. **4.** Measures to undertake for saving of electricity bill.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	
2	
3	
4	
5	
6	
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11	
12	
13	

III SEMESTER
Multidisciplinary Minor Courses

Track 1

Courses	Sem	MDMT1EL101 : Electric Vehicles
MDM-I	3	(MDM1EL101) Introduction to Electric Vehicles
MDM-II	4	(MDM2EL102) Energy storage devices
MDM-III	5	(MDM3EL103) Electric Machines
MDM-IV	6	(MDM4EL104) Power Electronics and Motor drives
MDM-V	7	(MDM5EL105) Drives and Autonomous Vehicle
MDM-VI	8	(MDM6EL106) Hybrid Electric Vehicle

Track 2

Courses	Sem	MDMT2EL201 : Solar Engineering
MDM-I	3	(MDM1EL201) Introduction to Solar -Thermal Energy
MDM-II	4	(MDM2EL202) Semi-conductor material for Solar Photovoltaic cells
MDM-III	5	(MDM3EL203) Solar Power Plant Design
MDM-IV	6	(MDM4EL204) Solar rooftop:Design and Installation
MDM-V	7	(MDM5EL205) Technical and economic analysis of Solar PV
MDM-VI	8	(MDM6EL206) Applications of Solar Energy

III SEMESTER
MDM1EL101: Introduction to Electric Vehicles

Unit:1	Electric Vehicle	7 Hours

Introduction:
History of EV, Components of Electric Vehicle, Comparison with Internal combustion Engine: Technology, Comparison with Internal combustion Engine: Benefits and Challenges, EV classification and their electrification levels.

Unit:2	Types of EV Chargers	8 Hours

Electric Vehicle Technology and Charging Equipment's, Basic charging Block Diagram of Charger, Difference between Slow charger and fast charger, Slow charger design rating, Fast charger design rating, AC charging and DC charging, Inboard and off board charger specification, Type of Mode of charger Mode -2 , Mode-3 and Mode-4, EVSE associated charge times calculation.

Unit:3	Selection and sizing of Common types of connectors and applications	7 Hours

Selection of AC charger type-1, type -2 and type -3, Communication between AC charger and EV, Selection of DC charger connector GB/T, CHAdeMO, CCS-1 and CSS-2, Communication methodology of DC fast chargers, IS/ IEC/ARAI/ standard of Charging topology, Communication and connectors (IEC 61851-1, IEC 61851-24,62196-2), Selection sizing of Charger connector cable.

Unit:4	Public Charging infrastructure / Electrical system design	8 Hours

Assessment of site Location for Public charging station, Selection and Sizing of – Distribution transformer, HT Equipment (VCB, CT, PT, Metering), HT Cables and LT cables, Distribution Board / feeders, LT and HT cable, Compact Substation (CSS for EV CS)/ Power Substation), relay and calculation, EV Charger Single Line Diagram

30 Hours

III SEMESTER
MDM1EL102: Introduction to Solar -Thermal Energy

Unit I: Flat plate collectors	**(7 Hrs.)**
Radiative Properties and Characteristics of Materials, Performance analysis, Transmissivity of the cover system, Transmissivity-Absorptivity product, Overall loss co-efficient and heat transfer calculations	
Unit II: Concentrating Collectors	**(8 Hrs.)**
General characteristics, Thermal analysis of concentrating collectors, Solar Concentration Ratio (C), Cylindrical parabolic collector	
Unit III: Thermal energy storage	**(7 Hrs.)**
Introduction, Sensible heat storage, Latent heat storage, Thermochemical storage	
Unit IV: Solar Pond	**(8 Hrs.)**
Introduction to Solar Pond, Description , Applications	
	30 Hours

Textbooks:	
1.	Solar photovoltaic: Fundamentals, Technologies and Applications by Chetan Singh Solanki, Published by PHI

Reference Books:	
1.	B.H.Khan , " Non Conventional Energy Resources" , 3rd edition 2017, Mc Graw Hill Publication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1.	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Principles%20of%20Power%20Systems%20V.K%20Mehta.pdf

MOOCs Links and additional reading, learning, video material	
1.	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems [Intro Video] http://103.152.199.179/YCCE/DTEL%20Material/3.Electrical%20Engineering/DTEL%20PPTs/IV%20SEMESTER/EL-2253%20EEGS/

III SEMESTER

Open Elective -I : Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chem. & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management

Link for Open Electives syllabus: https://ycce.edu/syllabus/

III SEMESTER
Mandatory Learning Course (Audit Course)
MLC2123 : YCAP3

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

4th Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
2	4	**AEC-2**	GE	23GE1405 23GE1406	Marathi Language Hindi Language	T	2	0	0	2	2	30	20	50	3
3	4	PC	EL	23EL1401	Electrical Measurement and Instrumentation	T	3	0	0	3	3	30	20	50	3
4	4	PC	EL	23EL1402	**Lab :** Electrical Measurement and Instrumentation	P	0	0	2	2	1		60	40	
5	4	PC	EL	23EL1403	Electrical Machines in Power System	T	3	0	0	3	3	30	20	50	3
6	4	PC	EL	23EL1404	**Lab** : Electrical Machines in Power System	P	0	0	2	2	1		60	40	
7	4	VSEC-3	EL	23EL1405	**Lab :** Computer Programming	P	0	0	2	4	2		60	40	
8	4	VEC-2	EL	23EL1406	Digital Signal Processing	T	2	0	0	2	2	30	20	50	3
9	4	MDM	EL		**MD Minor Course-II**	T	2	0	0	2	2	30	20	50	3
10	4	OE-2	OE		**Open Elective-II**	T	2	0	0	2	2	30	20	50	3
					TOTAL		**16**	**0**	**6**	**24**	**20**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	**YCAP4 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	**0**				

Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

		July, 2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV SEMESTER

23GE1401 : Entrepreneurship Development

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Appreciate role of entrepreneurs in society and develop entrepreneurial abilities by providing information about skill sets. 2. Develop an understanding of how and what form of business organization to choose for start up. 3. Stimulate to innovate, develop prototypes or ideas by applying theory into practice. 4. Identify the Support rendered by various Government Agencies.

Unit I:	**7 Hrs.**
Entrepreneur & Entrepreneurship: Meaning of Entrepreneur, Evolution of the concept – Theories and Models, Types of Entrepreneur, Stages in entrepreneurial process- Idea Generation, Screening, Selection and Managing Resources.	
Unit II:	**8 Hrs.**
Legal Compliances for Incorporating Start up: Fundamentals of choosing the Business Organization form for startup, Incorporation of Partnership, LL.P & Co – operative, Incorporation of One Person Company, Pvt. Ltd., Pub. Ltd. and not for profit company, Financing the legal Venture and Legal Compliances.	
Unit III:	**7 Hrs.**
Entrepreneurship and IP Strategy: Intellectual Property : Definition and Concept of Trade Mark, Patent, Copyright, Industrial Design, IP Strategy and Entrepreneurship.	
Unit IV:	**8 Hrs.**
Support to Entrepreneurs: Financing new ventures, Business Incubators – Government Policy for Small Scale Enterprises, Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Subcontracting.	
Total Lecture	**30 Hours**

IV SEMESTER

23EL1401: Electrical Measurement & Instrumentation

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Discuss the working principle of measuring instruments and circuit parameters
2. Explain the concepts of measurement of power and Energy.
3. Illustrate the fact and ideas related to instrument transformer.
4. Apply the knowledge of analog and digital instruments with transducers to measure physical quantities

Unit:1	**Measuring Instruments**	**7 Hours**

Electrical Measurement : Classification of Instruments , Deflection and null type instruments ,forces acting in Indicating instruments , Construction and working principle of PMMC and MI type instruments , Measurement of Resistance : Classification of Resistance, Wheatstone bridge , Kelvin's Double Bridge , Loss of charge method. Construction and working principle of Megger , Measurement of Earth Resistance.

Contemporary Issues related to Topic

Unit:2	**Potentiometers and AC Bridges**	**8 Hours**

D.C. Potentiometer: Basic Potentiometer circuit, Lab Type Potentiometer voltage ratio box. A.C. Potentiometer:- - Standardization of AC Potentiometer, Drysdale Polar potentiometer, Gall-Tinsley (Co-ordinate type) Potentiometer. AC Bridges: General equation of AC bridge balance, measurement of Inductance by Maxwell Inductance-capacitance Bridge, detectors used in AC Bridges, Measurement of Capacitance By High voltage Schering bridge , Measurement of Relative Permittivity by Schering bridge, Measurement of frequency By Wien'sBridge.

Contemporary Issues related to Topic

Unit:3	**Measurement of Power and Energy**	**7 Hours**

Wattmeter : Construction and operation of Electrodynamometer type wattmeter , LPF Wattmeter, Measurement of power using instrument transformer, Blondal's Theorem , Measurement of three phase power By single wattmeter, Two wattmeter , and Three wattmeter method , measurement of Reactive power for Balanced load using single wattmeter method. Energy Measurement : Induction type Energy meter (construction and operating principle)Errors and their compensation , Two element energy meter , maximum demand energy meter , phantom Loading (Merz – price). Power factor Meter : Three phase Electrodynamometer type power factor meter.

Contemporary Issues related to Topic

Unit:4	Instrument Transformers	8 Hours

Instrument Transformer : Use of instrument transformer , ratios in instrument transformer , burden , characteristics of CT , Effect of secondary open in CT. Potential transformer : Difference between CT and PT , Errors in PT , Reduction of errors in PT , characteristics of PT.

Unit:5	Analog Transducers	7 Hours

Transducers: Introduction, Types (Piezoelectric Transducer, Active , Passive transducers)
Transducers : Transducers required for the measurement of (Non electrical quantities) Linea displacement
,(LVDT), Strain , (Strain gauge, Un bounded metal Strain gauge, semi conductor Strain gauge),Pressure (Bourden Tube,Bellows, Pirani Gauge),Torque , Linear velocity, Angular Velocity Temperature,(Thermocouples
,First and Second Law of Thermocouple, Thermistors , Bimetallic Thermocouples), Flow (Electromagnetic Flov meter), Acceleration : LVDT Accelerometer. Digital Encoding transducers – Contacting or Brush type, Shat encoder.

Contemporary Issues related to Topic

Unit :6	Digital Instruments and Transducers	8 Hours

Digital Voltmeters, Digital Ammeters: Ramp type digital Voltmeter and Ammeter, Integrating type digital voltmeter and ammeter. Digital Frequency Meter: Basic circuit, Time base, start and stop Gate circuit for measurement of frequency. Electrical resonance type frequency meter, Weston frequency meter

Contemporary Issues related to Topic

Total Hours	**45 Hours**

Student activities:	
1.	Interview at least four entrepreneurs or businessman and identify Traits of successful entrepreneurs.
2.	Analyse case studies of any two successful entrepreneurs.
3.	Download product development and innovative films from internet.
4.	Identify your hobbies and interests and convert them into business idea

Textbooks

1.	Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
2.	Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.
3.	Corporate Law, 33rd ed. 2016, Taxman New Delhi.
4.	Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, (2006)
5.	Idris, K. (2003), Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888, Switzerland
6.	Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd.,Ram Nagar, New Delhi, 2013.
7.	Ramaiya's Guide to the Companies Act, 18th ed. 2014, Lexis Nexis New Delhi.

Reference Books	
1.	Mehta, Monica- The Entrepreneurial Instinct : How everyone has the innate ability to start a successful small business – McGraw – Hill Education, New Delhi 2012, ISBN 978-0-07-179742-9
2	Prasanna Chandra "Protect Preparation, Appraisal, Implementation" Tata McGraw Hill. New Delhi
3	S Anil Kumar "Entrepreneurship Development" New Age International Publishers
4	Nishith Dubey "Entrepreneurship Development" PHI Learning
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.swayam2.ac.in/cec23_mg24/course- entrepreneurship development
2	https://onlinecourses.nptel.ac.in/noc23_mg74/announcements?force=true-entrepreneur
3	https://onlinecourses.nptel.ac.in/noc23_mg126/announcements?force=true- Business fundamentals for entrepreneurship

IV SEMESTER

23EL1402: Lab. Electrical Measurement & Instrumentation

Course Outcomes:	
Upon successful completion of the course the students will be able to	
1.	Discuss the working principle of measuring instruments and circuit parameters
2.	Explain the concepts of measurement of power and Energy.
3.	Illustrate the fact and ideas related to instrument transformer
4.	Apply the knowledge of analog and digital instruments with transducers to measure physical quantities

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	To find high resistance using loss of charge method
2	To determine low resistance using Kelvin's double bridge.
3	To compute medium resistance using Wheatstone bridge
4	To measure inductance using Anderson's bridge.
5	To evaluate three phase power using two wattmeter method
6	To calculate electrical energy using electromechanical energy meter
7	To measure capacitance using Schering Bridge
8	Testing of single phase induction type energy meter
9	To calculate reactive power in balanced three phase ac circuit using single wattmeter.
10	To explain working of Strain gauge
11	To estimate Torque using sensors.
12	To explain working of an instrumentation amplifier
13	To explain working of Cathode Ray Oscilloscope.

IV SEMESTER

23EL1403: Electrical Machines in Power System

Course Outcomes:

1. Analyze steady state performance of synchronous machines
2. Illustrate Synchronization, load sharing and effect of variable excitation in parallel operation of alternators.
3. Evaluate the performance of Synchronous machine connected to infinite bus.
4. Describe the transient behaviour of Synchronous Machine.

Unit:1	**Armature Winding**	**7 Hours**

Full pitch coil, short pitched coil, Coil span factor, concentrated winding, distributed winding, distribution factor, introduction to armature winding and field winding, MMF of armature winding, induced EMF with and without harmonics.

Contemporary Issues related to Topic

Unit:2	**Steady State Operation of Three phase synchronous generators**	**8 Hours**

Introduction, Constructional features of cylindrical and salient pole rotor machines,Effect of loading on terminal voltage, Armature reaction, Effect of load power factor on armature reaction, concept of synchronous reactance, Phasor diagram on load, regulation by Direct loading, Emf method, Load characteristics, External Characteristic, Zero power factor characteristics (ZPFC), construction of Potier triangle..

Contemporary Issues related to Topic

Unit:3	**Parallel Operation of Synchronous Generators**	**7 Hours**

Conditions of synchronization of generator with another generator and or Infinite busbars, Parallel operation, Loadsharing between parallel connected generators. Effect of variable excitation and power input (speed) on generator operation

Contemporary Issues related to Topic

Unit:4	**Synchronous Motor**	**8 Hours**

Principle of operation, Methods of starting, phasor diagram, expression for torque, Excitation Emf, load/torque angle, Effect of variable excitation and load on motor operation, V and inverted V curves, Concept of synchronous condenser, Introduction to Permanent Magnet Synchronous motor, Reluctance and Hysteresis motor.

Contemporary Issues related to Topic

Unit:5	**Synchronous Machine Connected to Infinite Bus**	**7 Hours**

Power Angle Characteristic of Synchronous machines with and without armature resistance. Expression forelectrical and electromechanical power developed, losses and efficiency in synchronous machines.

Contemporary Issues related to Topic

Unit :6	Transient Behaviour	8 Hours
Short circuit ratio, unbalanced Loading, Sequence Component, Sudden 3-phase short circuit, Constant flux linkage theorem, Transient and sub–transient reactances, Time constants and equivalent circuit diagram, role of damper winding in both generator and motor operation. Experimental determination of steady state & transient parameters **Contemporary Issues related to Topic**		
Total Lecture Hours		**45 Hours**

Text books	
1	Dr. P. K. Mukherjee and S. Chakravarti,"Electrical Machines", Dhanpat Rai Publications (P) Ltd ,Edition 2nd -1993
2	I.J.Nagrath and Dr. D.P.Kothari, "Electrical Machines" , Tata McGraw Hill ,edition 3rd -2010.

Reference Books	
1	M.G. Say ,"Alternating Current Machines" ,Publishers ,Edition 1st -1983
2	P.S.Bhimbra ,"Electrical Machinery", Khanna Publisers, Edition 7TH -2008.
3	A.E.Fitzgerald, C.Kingsley, S.D.Umens , "Electrical Machinery", Mc Graw Hill, Edition 1ST-1985
4	Ashfaq Husain , "Electric Machines", Dhanpat Rai Publications (P) Ltd., 2nd -2008

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-642-25904-3
2	http://link.springer.com/openurl?genre=book&isbn=978-1-4614-0399-9
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Electrical%20Machines/

MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/108/105/108105131/

IV SEMESTER

23EL1404 : Lab. Electrical Machines in Power System

Course Outcomes:
1. Analyze steady state performance of synchronous machines
2. Illustrate Synchronization, load sharing and effect of variable excitation in parallel operation of alternators.
3. Evaluate the performance of Synchronous machine connected to infinite bus.
4. Describe the transient behaviour of Synchronous Machine.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	To determine voltage regulation of an alternator by direct loading
2	To determine voltage regulation of an alternator by synchronous impedance method.
3	To plot external characteristics of synchronous generator at different power factor loads
4	To perform slip test on a 3-phase synchronous machine.
5	To study synchronization of a 3-phase alternator with infinite bus-bars.
6	To determine sub-transient reactance of synchronous machine.
7	To determine negative sequence reactance of a 3-phase synchronous machine
8	To determine zero sequence reactance of a 3-phase synchronous machine.
9	To observe armature voltage and current waveforms of a 3-phase alternator during slip-test on C.R.O.
10	To plot V and inverted V curves of a 3-phase synchronous motor

IV SEMESTER

23EL1405 : Lab : Computer Programming

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Explain various programming constructs of SCILAB
2. Develop programs using SCILAB
3. Analyse and plot the results using SCILAB

Minimum Eight Practical's to be performed from the list as below

Sr. No.	Experiments based on
1	To discuss functions and keywords of SCILAB
2	To demonstrate operations on matrices
3	To Construct a function and demonstrate how functions are called
4	To Solve linear differential equations
5	To Calculate the roots of quadratic equation using if else statement
6	To Construct a function that returns the mean and standard deviation of a vector of numbers
7	To Construct a function that reverses the order of letters in a string, and returns the new string
8	To Compute the power factor of the RL series circuit. Plot the voltage and current
9	To Create the vector 0:pi/20:2*pi and use it to sample the sin() function. Plot the results with labels
10	To Determine the mesh currents for the given circuit diagram
11	Determine the node voltages for the given circuit diagram
12	Observe the for loop construct in Vlabs
13	Observe the if else, if else if constructs in Vlabs

IV SEMESTER

23EL1406 : Digital Signal Processing

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Classify mathematical representation of signals and systems in various domains. 2. Determine and analyze signals in time and frequency domain using Fourier series and Fourier transform. 3. Evaluate and analyze signals using Z-transform. 4. Analyze and design digital filter

Unit:1	**Continuous and Discrete time signals**	**7 Hours**
Continuous and discrete Signal representation, classification of signals, Signal Energy and Power, Periodic, Even & Odd, Real and Exponential Signals Discrete Signal properties: Linearity, causality, stability, static/dynamic. Time invariance/Time variance Convolution		
Unit:2	**Fourier Series Representation of Periodic Signals**	**8 Hours**
Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series.		
Unit:3	**Fourier Transform and Z-Transform**	**7 Hours**
Fourier Transform - Convergence of Fourier Transform and its Properties, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals. Z-Transform - The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Block Diagram Representations. The Unilateral z-Transform.		
Unit:4	**Introduction to Digital Signal Processing**	**8 Hours**
Sampling theorem, Basic Digital Filtering, FIR, and IIR Filter Designs		
	Total Lectures	**30 Hours**

Text books	
1	Signals and Systems 2nd Edition, 2013,Alan V. Oppenheim, Alan S. Willsky, with S. Hamid

Reference Books	
1	Signals & Systems,2nd Edition., 2005 Simon Haykin and Van Veen Wiley
2	Signals, Systems and Transforms 3rd Edition, 2004 C. L. Philips, J.M.Parr and Eve A.Riskin Pearson education
3	Schaum's Outlines of Signals and Systems 3rd Edition, 2002 Hwei P. Hsu McGraw Hill
4	Linear Systems and Signals 2nd Edition B.P. Lathi Oxford University Press

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4614-5331-4
2	http://link.springer.com/openurl?genre=book&isbn=978-3-540-92953-6

MOOCs Links and additional reading, learning, video material	
1	nptel video lect/ https://youtu.be/xrVWB9VYZ64 by Prof. Aditya K. Jagannatham
2	nptel video lect/ https://youtu.be/7Z3LE5uM-6Y by Prof. K.S. Venktesh

IV SEMESTER
Multidisciplinary Minor Courses

Track 1

Courses	Sem	MDMT1EL101 : Electric Vehicles
MDM-I	3	(MDM1EL101) Introduction to Electric Vehicles
MDM-II	4	(MDM2EL102) Energy storage devices
MDM-III	5	(MDM3EL103) Electric Machines
MDM-IV	6	(MDM4EL104) Power Electronics and Motor drives
MDM-V	7	(MDM5EL105) Drives and Autonomous Vehicle
MDM-VI	8	(MDM6EL106) Hybrid Electric Vehicle

Track 2

Courses	Sem	MDMT2EL201 : Solar Engineering
MDM-I	3	(MDM1EL201) Introduction to Solar -Thermal Energy
MDM-II	4	(MDM2EL202) Semi-conductor material for Solar Photovoltaic cells
MDM-III	5	(MDM3EL203) Solar Power Plant Design
MDM-IV	6	(MDM4EL204) Solar rooftop:Design and Installation
MDM-V	7	(MDM5EL205) Technical and economic analysis of Solar PV
MDM-VI	8	(MDM6EL206) Applications of Solar Energy

IV SEMESTER
Track1 : MDMT1EL101 : Electric Vehicles
MDM2EL102: Energy Storage Devices

Course Outcomes:

Upon successful completion of the course the students will be able to

1. To understand the fundamentals of advanced batteries, their sizing, and applications of super-capacitors.
2. To understand the aspects of battery hybridization, and fuel reforms.
3. To understand the various battery recycling, testing procedures, and verification of battery performances.
4. To understand the battery management systems, thermal management systems, and aspects of battery safety.

Unit:1	**BATTERIES**	**7 Hours**
Advanced Lithium-iron (Li-ion) battery, Nickel-metal hybrid battery, Advanced Nickel-metal hydride battery (Ni-MH) batteries for transportation, Advanced lead-acid batteries, applications of batteries for use of High-temperature, load leveling, large-scale grid operation, and space.		
Unit:2	**Battery hybridization and its application**	**8 Hours**
Hybridization and the applications of Battery and Supercapacitor, Battery and Fuel-Cell, Battery and Solar-Cell, Battery and Wind Turbine		
Unit:3	**Battery Recycling Technologies, Battery Chargers, and Battery Testing Procedures**	**7 Hours**
Technology and economic aspects of battery recycling, its applications, Constant current and constant voltage methods, Hybrid methods, Inductive chargers, Battery testing.		
Unit:4	**Battery Management Systems (BMS)**	**8 Hours**
Fundamentals of battery management systems and controls, passive and active cooling, regulations and safety aspects of high voltage batteries using codes and standards, Safe handling of lithium batteries, the safety of high voltage devices.		
		30 Hours

Text Books:

Sr. No.	Title	Author Details	Publication Details
1	Battery Technology Handbook	A. Kiehne	Marcel Dekker, NYC, 2003
3	Handbook of Batteries, 3rd Edition	D. Linden and T. S. Reddy	McGraw-Hill, 2002
4	Maintenance-Free Batteries	D. Berndt	John Wiley & Sons, NY, 1997

References:

Sr. No.	Title	Author Details	Publication Details
1	Electric Vehicle Technology Explained	James Larminie and John Lowry	John Wiley, NY, 2003

Online Resources

Sr. No.	Link
1	https://archive.nptel.ac.in/courses/113/105/113105102/

IV SEMESTER

Track2 : MDMT2EL201 : Solar Engineering

MDM2EL202: Semi-conductor material for Solar Photovoltaic cells

Unit I: Fundamentals of semi-conductor	**(7 Hrs.)**
Semi-conductors as solar cell material, arrangements of atoms in space, Bohr model of Hydrogen atom Metal, insulator and semiconductor, direct and indirect band gap, charge carriers in semiconductors, carrier motion in semiconductors	
Unit II: An introduction to solar cell	**(7 Hrs.)**
P-N junction-equilibrium condition, P-N junction in non-equilibrium condition, P-N junction under illumination, generation of photo voltage, light generated current, I-V equation of solar cell, solar cell characteristics.	
Unit III: Design of solar cell	**(8 Hrs.)**
Upper Limits of cell parameter: short circuit current, open circuit voltage, fill factor, efficiency Losses in solar cell	
Unit IV: Solar cell technologies	**(7 Hrs.)**
Production of Si, Si wafers, Si sheets, Si uses in solar PV, Use of Anti-reflective coating , introduction to bifacial solar cell.	
Total Lecture	**30 Hours**

Textbooks:	
1.	C.S.Solanki, Solar Photovoltaics - Fundamentals, Technologies and Applications, 2nd edition 2013, PHI Publication
Reference Books:	
1.	B.H.Khan , " Non Conventional Energy Resources" , 3rd edition 2017, Mc Graw Hill Publication
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Principles%20of%20Power%20Systems%20V.K%20Mehta.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/B.H.Khan%20Book%20RES.pdf
3	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/Solar%20Energy%20pdf.pdf
MOOCs Links and additional reading, learning, video material	
1	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems [Intro Video]
2	http://103.152.199.179/YCCE/DTEL%20Material/3.Electrical%20Engineering/DTEL%20PPTs/IV%20SEMESTER/EL-2253%20EEGS/

IV SEMESTER

Open Elective -II : Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management

Link for Open Electives syllabus: https://ycce.edu/syllabus/

IV SEMESTER
Mandatory Learning Course (Audit Course)
MLC2124 : YCAP4

			July,2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Dean OBE	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

5th Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	EL	23EL1501	Control System	T	3	0	0	3	3	30	20	50	3
2	5	PC	EL	23EL1502	**Lab** : Control System	P	0	0	2	2	1		60	40	
3	5	PC	EL	23EL1503	Power Electronics	T	3	0	0	3	3	30	20	50	3
4	5	PC	EL	23EL1504	**Lab** : Power Electronics	P	0	0	2	2	1		60	40	
5	5	PC	EL	23EL1505	Fundamentals of Power System	T	3	0	0	3	3	30	20	50	3
6	5	PC	EL	23EL1506	**Lab :** Power System	P	0	0	2	2	1		60	40	
7	5	PE	EL		**Professional Elective-I**	T	3	0	0	3	3	30	20	50	3
8	5	PE	EL		**Professional Elective-II**	T	3	0	0	3	3	30	20	50	3
9	5	**OE-3**	OE		**Open Elective-III**	T	3	0	0	3	3	30	20	50	3
10	5	MDM	EL		**MD Minor Course-III**	T	3	0	0	3	3	30	20	50	3
11	5	STR	EL	23EL1507	Internship and Indsutrial Visit	P	0	0	2	2	1		60	40	
						TOTAL	**21**	**0**	**8**	**29**	**25**				
List of Mandatory Learning Course (MLC)															
1	5	HS	T&P	MLC2125	**YCAP5 :** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	0				

Professional Elective - I					
1	5	PE-I	EL	23EL1521	**PE-I :** Electric and Magnetic Field
2	5	PE-I	EL	23EL1522	**PE-I :** Electrical Machine Design
3	5	PE-I	EL	23EL1523	**PE-I :** Design of Photovoltaic System
4	5	PE-I	EL	23EL1524	**PE-I :** Electric Power Utilization
5	5	PE-I	EL	23EL1525	**PE-I :** Applications of Renewable Energy Sources
6	5	PE-I	EL	23EL1526	**PE-I :** Optimization Techniques
7	5	PE-I	EL	23EL1527	**PE-I :** Thermal Power Plant Familiarization

Professional Elective - II					
1	5	PE-II	EL	23EL1541	**PE-II :** Illumination Engineering(MOOC)
2	5	PE-II	EL	23EL1542	**PE-II :** Electrical Wiring: Estimation and Costing
3	5	PE-II	EL	23EL1543	**PE-II :** Sensors and Actuators
4	5	PE-II	EL	23EL1544	**PE-II :** Distributed Generations in Power System
5	5	PE-II	EL	23EL1545	**PE-II :** 8085 Programming
6	5	PE-II	EL	23EL1546	**PE-II :** Analog and Digital Electronics

Coursera Elective					
1	5	PE-II	EL	23EL1547	**PE-II :** Power Electronics

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

Chairperson	Dean (Acad. Matters)	July, 2023	1.00	Applicable for AY 2023-24 Onwards
		Date of Release	Version	

V SEMESTER
23EL1501: Control System

Course Outcomes:

Upon successful completion of the course the students will be able to

1) Develop mathematical model for physical systems and evaluate their transfer function
2) Justify the need of negative feedback in control systems
3) Determine different time response specifications and analyze system response in time domain
4) Analyze system response in frequency domain using Bode plot

Unit:1	**Introduction to Control Systems**	**7 Hours**

History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.
Transfer Function, Block Diagram and Signal Flow Graph: Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.
Mathematical Modelling of Physical Systems: Mathematical modelling of physical systems such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic, etc., Analogous systems.

Unit:2	**Characteristics of Feedback Control Systems**	**8 Hours**

Effect of negative feedback compared to open loop system, such as sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection, and linearizing effect, Effect of positive feedback

Unit:3	**Time Domain Analysis of Control Systems**	**7 Hours**

Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

Unit:4	**Stability of Linear Control Systems**	**8 Hours**

Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.
State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

Unit:5	**Root Locus Technique**	**8 Hours**

Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

Unit:6	**Frequency domain analysis of control systems**	**7 Hours**

Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, experimental determination of transfer function, log magnitude versus phase plot.
Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polarplot and log magnitude versus phase plot. Constant M and constant N circles, Nicholas chart.

Total Lecture Hours	**45 Hours**

V SEMESTER
23EL1501 : Control System

Text books	
1	Control System Engineering,5th Edition, I. J. Nagrath & M. Gopal, New Age International
2	Automatic Control Systems, 7th Edition, B. C. Kuo, PHI Learning Private Limited
Reference Books	
1	Control Systems, 1st Edition, Ashok Kumar, McGraw–Hill Publication
2	Control Systems: Principles and Design, 4th Edition, M. Gopal, McGraw-Hill
3	Modern Control Engineering , 5th Edition ,Katsuhiko Ogata, PHI Learning Private Limited
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Control%20system/Control%20Systems%20Engineering.%20By%20I.J.%20Nagrath.pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/Cl23xQrvFhk?feature=shared
2	https://youtu.be/RcuGxWc0HyQ?feature=shared
3	https://youtu.be/RcuGxWc0HyQ?feature=shared

V SEMESTER
23EL1502: Lab: Control System

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Illustrate the operation of control system components 2. Justify the use of advance tools such as MATLAB for analysis of control systems 3. Analyze control systems for their time response specifications. 4. Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	To study transient response of a second order system.
2	Study of Stepper Motor
3	Study of Potentiometer as an Error Detector.
4	To study the Speed Torque Characteristic of AC Servo Motor
5	To study the Frequency Response of RLC network
6	To study the Synchros To plot the characteristics of Synchro transmitter. To plot the characteristics of Synchro receiver
7	Study of synchro as an error detector
8	Study of DC Position Servo Mechanism
9	Verification of Root Locus using MATLAB
10	Verification of Bode Plot using MATLAB
11	To Study the Effect of the Type of System on Steady State Error
12	To study PID Controller

23EL1503 : Power Electronics

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Demonstrate the working, characteristics, and show the need of protection of power semiconductor devices and select them for suitable application.
2. Analyze controlled single- and three-phase rectifiers, and cycloconverters
3. Demonstrate and examine the working and performance of DC – DC converters (Choppers).
4. Classify the different single and three phase DC/AC inverters and evaluate their performance.

Unit:1	**Power Semiconductor Devices**	**7 Hours**
SCR and its characteristics, Gate characteristics, SCR turn off Methods, ratings. Series and parallel connections of SCRs, TRIAC.		
Unit:2	**Single Phase Line Commutated Converters**	**8 Hours**
Single phase line commutated converters, single pulse converter, single phase bridge converter, effect of source inductance, effect of freewheeling diode, single phase half-controlled rectifier, single phase cycloconverter		
Unit:3	**Three Phase Line Commutated Converters**	**7 Hours**
Three phase three pulse converter, three phase bridge converter, speed control of DC motors (with single phase rectifier).		
Unit:4	**Forced Commutated Semiconductor Devices and Protection**	**8 Hours**
Characteristic and working of MOSFET, Gate turn off thyristor (GTO) and insulated gate bipolar transistor (IGBT) protection of SCR: gate circuit protection, over voltage and over current protection, snubber circuit design.		
Unit:5	**D.C. Choppers**	**7 Hours**
Principles of step-down chopper, step up chopper classification, Control strategies, time ratio control and current limit control. Voltage and load commutated choppers, Multiphase choppers, Application of choppers in speed control of DC Motor		
Unit 6	**Single Phase and Three Phase Bridge Inverters**	**8 Hours**
Single phase and three phase bridge inverters, Output voltage control, Harmonics in output voltage waveforms, Harmonic attenuation by filters, Harmonic reduction by pulse width modulation techniques, analysis of single pulse width modulation, working of current source inverters, applications.		
	Total Lecture Hours	**45 Hours**

Text books:				
		ON	OR	CATION
1	Power Electronics Circuit Devices and Applications	3rd Edition,2004	M. H. Rashid	Prentice Hall Limited
2	Power Electronics		D. Y. Shingare	Electrotech Publication Engineering Series

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1981	C. W. Lander	McGraw Hill
2	Thyristors Applications	2nd Edition 2002	Dr. M. Ramamoorty	East West Press
3	Thyristors and Their Applications	4th edition	Dr. G. K. Dubey, Doralda Sinha and Joshi	New Age International
4	Power Electronics	1989	Ned Mohan, T. M. Undeland, and W. P. Robbins	John Wiley and Sons

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20Electronics/Muhammad%20H.%20Rashid-Power%20electronics%20_%20devices,%20circuits,%20and%20applications-Pearson%20(2014).pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20Electronics/Power%20Electronics%20by%20Ps%20bimbhra.pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/B-_I5bQDQLU?feature=shared
2	https://youtu.be/m-uY4fja_Jw?feature=shared

V SEMESTER
23EL1504: Lab: Power Electronics

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Trace the static and dynamic characteristics of power semiconductor devices
2. Analyze the performance parameter of rectifier and cycloconverter
3. Calculate the performance parameter of buck/boost converter
4. Evaluate the performance parameter of DC/AC inverters

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	To plot V-I characteristics of SCR and measurement of holding and latching current of SCR.
2	To Perform Four modes operation of TRIAC
3	Analysis of Buck – Boost DC/DC converter
4	Study and analysis of single-phase half / full wave rectifier with Resistive load.
5	To plot Transfer and output characteristics of Power MOSFET.
6	Speed control of DC Shunt Motor with Semi Converter.
7	Performance analysis of single-phase step down Cycloconverter with Resistive load.
8	Study different Forced Commutation methods of SCR.
9	Study and analysis of single phase MOSFET based full Bridge inverter.

V SEMESTER
23EL1505: Fundamentals of Power System

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Describe basic components of Power System and per unit values of system components
2. Determine the transmission line parameters.
3. Explain the types of insulators, underground cables and the performance of system.
4. Evaluate the performance of distribution and transmission system.

Unit:1	**Introduction to Power system**	**7 Hours**
Structure of Electrical Power System, use of high voltage, idea about substation, classification, Indoor - outdoor substation, symbols for equipment used in substation, Per unit system: Representation of power system elements, models and parameters of generator, transformer and transmission lines		
Unit:2	**Inductance of Transmission Line**	**8 Hours**
Constants of transmission line, flux linkages, inductance of single-phase two-wire line, inductance of 3-phase overhead line, Symmetrical and unsymmetrical spacing, self-GMD and mutual GMD,		
Unit:3	**Capacitance of Transmission Line**	**7 Hours**
Electric Potential, Capacitance of single phase 2 wire line, capacitance of 3 phase overhead line, Symmetrical and unsymmetrical spacing		
Unit:4	**Distribution system and Load flow analysis**	**8 Hours**
Types of distribution systems, comparison, Feeders and distributors, DC and AC distribution, Y_{Bus} formation, Introduction to load flow studies.		
Unit:5	**Insulators and Cables**	**7 Hours**
Types, Potential distribution over suspension insulator string, String efficiency, Cables: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables		
Unit :6	**Transmission Systems**	**8 Hours**
Short, medium (Nominal T and Nominal Π method) and Long line, Voltage regulation & efficiency of power transmission lines, ABCD parameters of transmission lines.		
	Total Lecture Hours	**45 Hours**

V SEMESTER
23EL1505: Fundamentals of Power System

Text books	
1	V. K. Mehta, Rohit Mehta, Principles of Power System ,First Multicolour edition S. Chand Publication , (Reprint 2015)
2	Ashfaq Hussain, Electric Power System,5th edition, CBS Publication
3	I. J. Nagrath and D. P. Kothari, Modern Power System Analysis, 3rd edition, Tata McGraw Hill

Reference Books	
1	W. D. Stevenson ,Elements of Power system analysis,4th edition,MGH Publication.
2	C. L Wadhwa, Electrical Power system,3rd edition, New Age International Publication.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-642-17988-4
2	http://link.springer.com/openurl?genre=book&isbn=978-3-642-04281-2

MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/dhmYOIBcwOU (Prof A. K. Sinha, IIT Kharagpur)
2	https://youtu.be/VoeiDVLAmgc (Dr. Ganesh Kumbhar, IIT Roorkee)
3	https://youtu.be/uy9lZCdkQIM (Dr. D. P. Kothari, IIT Delhi)

V SEMESTER
23EL1506: Lab: Power System

Course Outcomes:
Upon successful completion of the course, the students will be able to
1. Review the fundamentals of the simulation environment specific to the power system
2. Estimate the performance of AC and DC distribution systems
3. Analyse various effects occurring on transmission lines and evaluate the performance of components connected in transmission lines
4. Deduce the performance parameters of transmission lines based on the length of the line

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Design and Analysis of a Capacitor for the Improvement of Power Factor
2	Analysis and verification of the Ferranti Effect of Transmission Line
3	Evaluate the efficiency of the string of insulators
4	Estimate the point of minimum potential of the DC distributor fed at both ends
5	Estimate the sending end voltage of the AC distributor fed at one end
6	Design and Analyse the performance of short Transmission Line
7	Design and Examine ABCD parameters of the "Pi" model Medium Transmission Line
8	Design and Analyse the performance of "T" model Medium Transmission Line

V Semester

23EL1507 : Internship ,Seminar and Report

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Demonstrate internship project and handle the practical situations on site.
2. Develop technical skills to address industry problems
3. Apply the theoretical knowledge in practical situation to realize industry problems
4. Summarize a detailed internship report.

V Semester

23EL1521 : PE-I: Electric and Magnetic Field

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explain the fundamentals of vector analysis and apply different coordinate systems (Cartesian, cylindrical, spherical) for electromagnetic field problems.
2. Apply Coulomb's Law, Gauss's Law, and electric field equations to analyze charge distributions and calculate electric field intensities.
3. Analyze the behavior of conductors, dielectrics, and boundary conditions to determine capacitance and electric flux.
4. Determine magnetic field intensity, inductance, and force using Biot–Savart's Law, Ampere's Law, and magnetic materials properties.
5. Evaluate time-varying electromagnetic fields using Maxwell's equations and determine power flow using Poynting theorem.

Unit:1	Vector Analysis	7 Hours
Scalars and vectors, vector algebra, the Cartesian coordinate system , the scalar and vector field, the dot product, the cross product, Cylindrical coordinate system, Spherical coordinate system		
Unit:2	**Coulomb's Law and Electric Field Intensity; Electric Flux Density, Gauss's Law, and Divergence**	**8 Hours**
Coulomb's Law, electric field intensity, types of charge distributions, electric field due to line charge density, surface charge density, and volume charge density, streamlines and sketches of fields. Concept of electric flux, electric flux density, Gauss's Law, application of Gauss's Law to symmetrical charge distributions, application of Gauss's Law to differential volume element, divergence, Maxwell's first equation in electrostatics, the vector operator, and the Divergence theorem		
Unit:3	**Energy and Potential; Conductors, Dielectrics, and Capacitance**	**7 Hours**
Energy expended in moving a point charge in an electric field, potential difference and potential, the potential field of a point charge, line charge density and surface charge density, the potential field of a system of charges, potential gradient, the dipole, energy density in the electrostatic field, Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of images, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, several capacitance examples.		
Unit:4	**Poisson's and Laplace Equations**	**8 Hours**
Poisson's and Laplace equations, Uniqueness theorem, examples of the solution of Laplace equation (involving one variable only).		
Unit:5	**Steady Magnetic Field; Magnetic Forces, Materials, and Inductance**	**7 Hours**
Biot – Savart law, magnetic field due to infinitely long current filament, finite length current filament, Amperes circuital law, magnetic field due to coaxial cable, uniform sheet of surface current, solenoid, toroid, curl and its physical interpretation, Stokes theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, Force on a moving charge, force on a differential current element,		

V Semester
23EL1521 : PE-I: Electric and Magnetic Field

force between differential current elements, force and torque on a closed circuit, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, potential energy and forces on magnetic materials, inductance and mutual inductance.		
Unit :6	**Time-Varying Fields and Maxwell's Equations, Uniform Plane Wave**	**8 Hours**
Faraday's Law, derivation of Maxwel's equations in point form and integral form, displacement current and its physical interpretation, concept of retarded potentials, Maxwell's equations in phasor form, wave equations, uniform plane waves, solution of wave equation in free space, perfect dielectric, loss dielectrics and good conductor, skin effect and skin depth, Poynting vector.		
	Total Lecture Hours	**45 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Engineering Electromagnetics	7th	W.H. Hayt J. A. Buck	McGraw Hill Publication.
2	Schaum's Outline Series Theory and Problems of Electromagnetics	2nd	Joseph A. Edminister	Schaum's Outline Series of Engineering
3	Principles of Electromagnetics	4th	Matthew N.O.Sadiku	Oxford University Press

Reference Books

SN	Title	Publication	Authors	Publisher
1	Applied Electromagnetic	1978	Plonus M. A.	MGH
2	Electromagnetics	1998	Kraus J. D.	MGH
3	Fundamentals of Electromagnetics with MATLAB	2nd Edition	Karl E. Lonngren, Sava V. Savov, Randy J. Jost	Scitech Publishing Inc.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/pGdr9WLto4A
2	https://youtu.be/0A45kt2U3U8
3	https://youtu.be/whv_d-fBCg0
4	https://youtu.be/whv_d-fBCg0

V Semester
23EL1522 : PE-I: Electrical Machine Design

Course Outcomes:
Upon successful completion of the course, the students will be able to 1. Classify various materials used in the construction of electrical machines and find their rating and performance 2. Determine the design parameters of the transformer 3. Compute stator, rotor design dimensions of induction motor 4. Evaluate the designed parameters of synchronous machine.

Unit:1	**Review of material used in construction of electrical machines**	**7 Hours**
Magnetic material such as amorphous, ferrite etc. Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil, standard specifications, C.M.R. andshort time of machines, Heating and cooling characteristics		
Unit:2	**Transformer design : Main Dimensions**	**8 Hours**
Output equation, equation for voltage per turn for power and distribution transformer, core design, overall dimensions of single phase and three phase transformer		
Unit:3	**Transformer design : Performance Characteristics**	**7 Hours**
Resistance and leakage reactance of winding for concentric cylindrical and sandwich type winding, estimation of no load current , method of cooling and cooling tank design.		
Unit:4	**Induction motors: Stator Design**	**8 Hours**
Total loading, specific loading on the machine, output equation, main dimension, estimation of axial lengths and air gap diameter based on different design criterion, estimation of number of slots, area of slot, stator teeth and stator core dimensions, length of mean turn, stator winding.		
Unit:5	**Induction motor rotor design**	**7 Hours**
Air gap length, no. of rotor slots, cage rotor and wound rotor , Design of rotor bar and slots, design ofend ring, design of wound rotor, rotor teeth and rotor core design, Calculation of no load current, stator and rotor resistance and other performance characteristics for design data.		
Unit:6	**Synchronous machines**	**8 Hours**
Types of synchronous machines, Output equation, specific loadings, Design of salient pole (Main dimensions, length of air gap, shape of pole face, armature design) and turbo alternators (Main dimensions, length of air gap, stator and rotor design), Effect of SCR on machine performance, ventilation of synchronous generator, cooling circuit design, Hydrogen and water as cooling media		
	Total Lecture Hours	**45 Hours**

V Semester
23EL1522: PE-I: Electrical Machine Design

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Performance and Design of A.C. Machine	1995	M.G. Say.	English L B S
2	Electrical Machine Design	2016	A.K. Sawhney	Dhanpat Rai & Sons, Delhi

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Electrical Machine Design	3rd	Balbir Singh	Brite Student Publication, Pune
2	Power Transformers	2nd	S.B.VasuBinsky	
3	Principles of Electrical Machine Design	4th	R.K.Agrawal	S.K.Kataria

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Electrical%20Machines/Electrical%20Machinery%20by% 20Dr.%20P%20S%20Bimbhra.pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/fgKE6FWdLXU?feature=shared
2	https://youtu.be/fgKE6FWdLXU?feature=shared

V SEMESTER

23EL1523: PE I: Design of Photovoltaic System

Course Outcomes:
Upon successful completion of the course, the students will be able to 1. Demonstrate the knowledge and apply key solar electric system concepts. 2. Select the Mounting, grounding, positioning, and installing the photovoltaic system. 3. Examine the performance, operation, and maintenance of the solar photovoltaic system. 4. Design of solar PV Plant with inclusion of costing and safety parameters.

Unit:1	**Solar Photovoltaic Fundamentals**	**8 Hours**
Introduction, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open circuit and peak power parameters, cell efficiency, Effect of temperature, Fill factor, Effect of clearness index.		
Unit:2	**Solar Photovoltaic Module / Array**	**7 Hours**
Connection of identical and non-identical PV cells in series and parallel circuits, Module in Series and Parallel, Load line, Estimation and Measurement of PV Module Power, Size Selection of PV Module		
Unit:3	**Batteries**	**8 Hours**
Fundamentals of batteries, Battery parameters, Selection of Battery, Series Parallel combination of Batteries, Energy and battery densities of batteries, Batteries for Photo voltaic System, Application of Batteries in Solar PV system, Battery Maintenance and Measurements, Battery Fault Detection and Test, Battery Installation for PV system.		
Unit:4	**Charge Controller, MPPT and Inverter**	**7 Hours**
Power MOSFET and IGBT, Opto coupler, Buck and Boost Converter, Fly back Converter, Full Bridge Inverter, Voltage and Current Feedback, DC to DC power converter, DC to AC Converter, AC to DC Converter, Battery Charge controller, Maximum Power Point Tracking, Specification of Inverter and charger.		
Unit:5	**Solar PV System Design and Integration**	**8 Hours**
Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of OFF grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant, Grid connected SPV,		
Unit :6	**Installation, Costing, Trouble Shooting and Safety**	**7 Hours**
Installation and Troubleshooting of Standalone Solar PV System, Maintenance of Solar PV System, Life cycle costing of SPV, Safety in installation of Solar PV System.		
	Total Lecture Hours	**45 Hours**

V SEMESTER
23EL1523: PE I: Design of Photovoltaic System

Text Books:				
Sr	**Title**	**Edition**	**Author**	**Publisher**
1	Solar Photovoltaics: fundamentals, technologies and applications	2nd	Chetan Singh Solanki	PHI Learning New Delhi, 2011
2	Photovoltaic Systems Engineering	2nd	Roger A Messenger and Jerry Ventre	CRC Press, Taylor & Francis Group, 2004.
	Reference Books:			
1.	Handbook of Photovoltaic Science and Engineering	1st	Antonio Luque, Steven Hegedus	John Wiley & Sons, 2011

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/B.H.Khan%20Book%20RES.pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/hr2sId412zU?feature=shared
2	https://youtu.be/XYbdPiplbp8?feature=shared
3	https://youtu.be/zQbPzKU4gW8?feature=shared

V SEMESTER

23EL1524: PE I: Electric Power Utilization

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Describe various types of heating and welding methods.
2. Calculate number of lamps required for Illumination.
3. Discuss different refrigeration and Air Conditioning systems for various application
4. Explain various types of fans, pumps, compressor and DG sets along with their application and their performance.

Unit:1	Electric Heating	7 Hours
Introduction, Advantages of electric heating, modes of heat transfer, methods of electric heating, resistance heating, arc heating, arc furnaces, induction heating, dielectric heating, infrared and radiant heating.		
Unit:2	**Electric Welding**	**8 Hours**
Definition, welding process, resistance electric welding, electric arc welding, submerged arc welding, MIG welding, Ultrasonic welding, laser beam welding, welding of various metals, underwater welding, defects in welding, testing of welding joints.		
Unit:3	**Illumination**	**7 Hours**
Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.		
Unit:4	**Refrigeration & Air conditioning**	**8 Hours**
Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective Temperature, summer/winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.		
Unit:5	**Fans & Pumps**	**7 Hours**
Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities. Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.		

V SEMESTER
23EL1524: PE I: Electric Power Utilization

Unit :6	Compressors and DG Sets	8 Hours
Compressors: Compressor types, Compressor efficiency, Compressed air system components. Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.		
	Total Lecture Hours	**45 Hours**

Text books:

S.N	Title	Edition	Author	Publisher
1	Utilization of Electric Energy	1st Edition	E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction	1st Edition	J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy	1st Edition	H Partap	Dhanpat Rai & Sons, Delhi
4	Utilization of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

S.No	Title	Edition	Author	Publisher
1	Guidebook for National Certification Examination for Energy Managers and Energy Auditors	BEEE	BEEE	Bureau of Energy Efficiency

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1. http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Power-plant-engineering-pk-nag1.pdf

MOOCs Links and additional reading, learning, video material

1. https://www.google.com/search?q=NPTEL+on+Electric+power+utilization&rlz=1C1OKWM_enIN974IN974&oq=NPTEL+on+Electric+power+utilization&aqs=chrome..69i57j33i160l2.16754j0j15&sourceid=chrome&ie=UTF-8#
2. https://youtu.be/fQrZMMWo1mA

V SEMESTER

23EL1525: PE I: Applications of Renewable Energy Sources

Course Outcomes:

Upon successful completion of the course the students will be able to

1) Explain the concepts of solar radiation and its measurement using appropriate models and techniques.
2) Analyze the performance of various solar energy collectors and storage systems..
3) Apply solar energy systems for different practical applications such as heating, cooling, and power generation
4) Evaluate wind energy systems in terms of site selection, components, and grid integration.
5) Describe and compare ocean, tidal, wave, biogas, geothermal, and MHD energy systems and their operating principles.

Unit:1	Solar radiation & its Measurement	7 Hours

Solar constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces.

Unit:2	Solar Energy Collectors	8 Hours

Physical principles of the conversion of solar radiation into heat, flat plate collectors, transmissivity of cover systems, energy balance equation and collector efficiency, concentrating collectors, comparison of concentrating and flat plate collectors, selective absorber coatings.

Solar energy storage systems (Thermal, Electrical, Chemical, Mechanical), Solar ponds.

Unit:3	Applications of Solar Energy	7 Hours

Solar water heating, space heating, space cooling, solar thermal heat conversion, photovoltaic solar energy conversion, solar pumping, solar cooking.

Unit:4	Wind Energy	8 Hours

Basic principles of wind energy conversion, wind energy conversion, wind data and energy estimation, site selection considerations, basic components of wind energy conversion systems (WECS), classification of WEC systems, generating system, energy storage, application of wind energy. Grid connection of Wind Power.

Unit:5	Ocean and Tides	7 Hours

Energy from oceans :- Ocean thermal electric conversion (OTEC), Claud& Anderson cycles, evaporators, Bio-fouling, hybrid cycle.
Energy from tides :- Introduction, basic principles of tidal power, components of tidal power plants, operation methods of utilization of tidal energy, estimation of energy & power in simple single basin tidal system, advantages and limitations of tidal power generations, energy & power from waves, wave energy conversion devices, small scale hydro electric power generation.

Unit :6	Biogas, Geothermal and MHD	8 Hours
Other non-conventional energy sources (brief introduction to operating principles only) – Energy from bio-mass, geothermal energy		
	Total Lecture Hours	45 Hours

Text books:

S.N	Title	Edition	Author	Publisher
1	Solar Energy: Principles of Thermal collection and storage	1994	S. P. Sukhatme and J. K. Nayak	Tata-McGraw Hill Publishing Company Limited, New Delhi
2	Energy Technology : Nonconventional, Renewable and Conventional	2000	S. Rao and B.B. Parulekar	Khanna Publisher, New Delhi

Reference books:

S.No	Title	Edition	Author	Publisher
1	Renewable Energy Sources Basic Principles and Applications	2015	G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House, New Delhi.
2	Renewable and Efficient Electric Power Systems	2010	G. M. Masters	Wiley Interscience, New Jersey
3	Wind and Solar Power System	2013	M. R. Patel	CRC Press, New York.

V SEMESTER
23EL1525: PE I: Applications of Renewable Energy Sources

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Power-plant-engineering-pk-nag1.pdf
MOOCs Links and additional reading, learning, video material	
1	https://www.google.com/search?q=NPTEL+on+Electric+power+utilization&rlz=1C1OKWM_enIN974IN974&oq=NPTEL+on+Electric+power+utilization&aqs=chrome..69i57j33i160l2.16754j0j15&sourceid=chrome&ie=UTF-8#

V SEMESTER
23EL1526: PE I: Optimization Techniques

Upon successful completion of the course, the students will be able to

1. Classify various types of optimization problems and explain their real-world engineering applications.
2. Apply classical optimization techniques, including Lagrangian and Kuhn–Tucker conditions, to solve constrained and unconstrained optimization problems.
3. Develop and solve linear programming models using the Simplex method, Two-phase method, and Revised Simplex method.
4. Analyze duality theory and its implications in linear programming, including the use of the Dual Simplex method and Transportation problems.
5. Evaluate and implement modern and non-linear optimization techniques such as Genetic Algorithms and Particle Swarm Optimization for solving constrained problems

Unit:1	**Introduction**	**8 Hours**
Concept of optimization, Engineering applications of optimization, Statement of optimization problem, classification of optimization problems, optimization techniques		
Unit:2	**Classical Optimization Techniques**	**7 Hours**
Single variable optimizations, multivariable optimization with no constraints and equality & inequality constraints, solution using Lagrangian multipliers, Kuhn – Tucker Conditions		
Unit:3	**Linear Programming – I (Simplex method)**	**8 Hours**
Application of linear programming. Standard form & geometry of linear programming problems, definitions & theorems, solution of systems of linear simultaneous equations, simplex algorithm, Two-phase Simplex method		
Unit:4	**Linear Programming – II**	**7 Hours**
Revised Simplex method, Duality in Linear Programming, Primal Dual Relations, Duality Theorems, Dual Simplex Method, Decomposition Principle, Transportation Problems.		
Unit:5	**Non – Linear Programming – One dimensional Minimization Methods**	**8 Hours**
Brief Introduction, Characteristics of Non – linear programming techniques, Classification of Non – Linear Programming methods, Unimodal Function, Introduction to One dimensional, Non – linear optimization problems		

Unit :6	Introduction to Modern Optimization Methods	7 Hours
Genetic Algorithm: Evolution in nature-Fundamentals of Evolutionary algorithms-Working Principles of Genetic Algorithm Selection, Crossover and Mutation, Reproduction, Genetic Operators **Particle Swarm Optimization :**Introduction, Computational Implementation of PSO, Improvement to the Particle Swarm Optimization Method , Solution of the Constrained Optimization Problem, Application of AI and ML.		
	Total Lecture Hours	**45 Hours**

Text books:

S.N	Title	Edition	Author	Publisher
1	Engineering Optimization: Theory & practice	5th Edition	S.S. Rao	John Willey Publication
2	Modern optimization techniques with applications in Electric Power Systems	2012	Soliman Abdel Hady, Abdel Aal Hassan Mantawy	Springer Publications

Reference books:

S.N	Title	Edition	Author	Publisher
1	Operations Research: An Introduction	Eighth Edition	Taha, H.A	Prentice Hall of India
2	Engineering Optimization: Methods and Applications	Second Edition (Wiley India Edition)	A.Ravindran, K. M. Ragsdell, G. V. Reklaitis	John Wiley Publication
3	Power System Optimization	2nd Edition, 2010	D.P.Kothari and J.S.Dhillon	PHI learning private limited
4	Multi objective optimization using Evolutionary Algorithms	2008	Kalyanmoy Deb	John Wiley and Sons
5	Optimization for Engineering Design	First edition,1988	Kalyanmoy Deb	Prentice hall of India

V SEMESTER

23EL1527: PE I: Thermal Power Plant Familiarization

Course Outcomes:
Upon successful completion of the course, the students will be able to 1) Understand the working principles and layout of a thermal power plant. 2) Describe the function and types of boilers, combustion systems, and fuel handling systems. 3) Analyse the operation of turbines, condensers, and power generation units. 4) Identify and explain the role of auxiliary systems and plant instrumentation. 5) Evaluate safety, environmental, and modern advancements in thermal power generation.

Unit:1	**Introduction to Thermal Power Plants**	**8 Hours**
Overview of global and Indian energy scenario, Classification of power plants, Rankin cycle and its modifications, Site selection for thermal power plants, General layout and flow diagram of a coal-based thermal power station.		
Unit:2	**Boilers and Combustion Systems**	**7 Hours**
Types of boilers: Fire-tube and Water-tube, Subsystems: Economizer, Super-heater, Re-heater, Air preheater, and Combustion of coal: Pulverized coal firing, Stokers, Draught system: Natural, Mechanical, Balanced Fuel handling systems and coal pulverisers, cold start-up, and hot shut-down. Basic control loops for combustion optimization.		
Unit:3	**Steam Turbines and Generators**	**8 Hours**
Types of steam turbines: Impulse and Reaction, Governing of turbines, Condensers and cooling systems, Direct coupling with alternators, Excitation systems and generator cooling		
Unit:4	**Auxiliary and Support Systems**	**7 Hours**
Ash handling systems: Wet and dry, Feed water and condensate systems, Circulating water system and cooling towers, Draft and flue gas system, Water treatment and demineralization plant.		
Unit:5	**Instrumentation, Control, and Automation**	**8 Hours**
Overview of control room operations, Distributed control systems (DCS) and SCADA, Temperature, pressure, and flow measurement, Interlocks and protections, Efficiency monitoring and performance indicators		
Unit :6	**Safety, Environmental Aspects, and Modern Developments**	**7 Hours**
Environmental impacts: Emissions, effluents, noise, ESP, scrubbers, and bag filters, Safety protocols, fire protection, and emergency response, Flue Gas Desulfurization (FGD), Modern trends: Supercritical and Ultra-supercritical plants, carbon capture		
	Total Lecture Hours	**45 Hours**

V SEMESTER
23EL1527: PE I: Thermal Power Plant Familiarization

Textbooks
1. P.K. Nag, Power Plant Engineering, 4th Edition, McGraw Hill Education, 2017,
2. Arora and Domkundwar, A Course in Power Plant Engineering, Revised Edition, Dhanpat Rai & Co., 2013
3. R.K. Rajput, Thermal Engineering, 10th Edition, Laxmi Publications, 2020,

Reference Books
1. M.M. El-Wakil, Power Plant Technology, 1st Edition, McGraw Hill, 1984
2. R. Yadav, Steam and Gas Turbines, 5th Edition, Central Publishing House, 2010
3. R.H. Perry and D.W. Green, Perry's Chemical Engineers' Handbook, 8th Edition, McGraw Hill, 2007

V SEMESTER
23EL1541: PE-II: Illumination Engineering (MOOC)

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
2. Explain the different parameters in designing an illumination system for a particular application.
3. Apply different illumination systems for different applications.
4. Devise proper illumination model for a specific application.
5. Justify the selection of proper illumination level and system for specific application.

Unit:1		**7 Hours**
Radiation & Colour , Eye & Vision , Different entities of illuminating systems		
Unit:2		**8 Hours**
Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers Luminaries, wiring, switching & control circuits		
Unit:3		**7 Hours**
Laws of illumination; illumination from point, line and surface sources, Photometry and spectrophotometry; photocells, Environment and glare		
Unit:4		**8 Hours**
General illumination design Interior lighting – industrial, residential, office, departmental stores, indoor stadium, theatre and hospitals		
Unit:5		**7 Hours**
Exterior lighting- flood, street, aviation and transport lighting, lighting for displays and signalling- neon signs, LED-LCD displays beacons and lighting for surveillance Utility services for large building/office complex & layout of different meters and protection units		
Unit :6		**8 Hours**
Different type of loads and their individual protections. Selection of cable/wire sizes, potential sources of fire hazards and precautions. Emergency supply standby & UPS. A specific design problem on this aspect		
	Total Lecture Hours	**45 Hours**

MOOCs Links and additional reading, learning, video material
https://youtu.be/kAmb5cut_VA?feature=shared
https://youtu.be/dQUvbbItNtU?feature=shared

V SEMESTER
23EL1543: PEII: Sensors and Actuators

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Classify control systems, the transfer function of the system with electrical and Mechanical systems 2. Illustrate the time response of the system 3. Analyze stability using the transfer function and state variable approach. 4. Estimate parameters using root locus and frequency domain methods.

Unit No.	Contents
1	Basics of Energy Transformation: Transducers, Sensors and Actuators, Understanding of thin film physics: Application in MOSFET and its variants
2	Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD), Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)
3	Basics understanding of Photolithography for pattering layer. Detailed overview of Etching methods, Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors
4	Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications, explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications
5	Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques, Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics
6	Understanding of Sensor Interfacing with Microprocessor to build electronic system, Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems.

V SEMESTER
23EL1543: PEII: Sensors and Actuators

Textbooks:				
SN	**Title**	**Year**	**Author**	**Publication**
1	Sensors and Signal Conditioning : Handbook of modern sensors	2008	Jacob Fraden, Stefan Johann Rupitsch	Wiley-Blackwell Springer
2	Piezoelectric Sensors and Actuators: Fundamentals and Applications	2018	Senturia S. D.	Springer
Reference Books:				
1	Microsystem Design	2001	J.D. Plummer, M.D. Deal, P.G. Griffin	Kluwer Academic Publisher
2	Silicon VLSI Technology	1998	S.M. Sze	Pearson Education
3	VLSI Technology	1998	Madou	McGraw Hill

V SEMESTER

23EL1544: PEII: Distributed Generations in Power System

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Classify the energy sources and its conversion for distributed energy generation 2. Distinguish Solar Photovoltaic, wind turbine systems and other renewable energy sources 3. Use of fundamental knowledge of energy storage devices in power system 4. Evaluate the Performance of power system with respect to power quality

Unit:1	**Introduction to Distributed Generation Systems**	**7 Hours**
Introduction - Advantages of DG systems system Energy sources, Functions of power electronics interface, Solar Energy for Distributed Generation, wind Energy for DG, fuel cell for DG, Anti-Islanding protection, Operating Conflicts, IEEE standard 11547-2003,Applications of DG systems		
Unit:2	**Solar and Wind Energy**	**8 Hours**
Solar photovoltaic (PV) systems –Photovoltaic solar energy conversion:- Introduction, Equivalent Structure of PV cell, Series – Parallel combination, Partial shading, Introduction to DC – DC converter, solar MPPT, Solar PV systems, Grid converters and control Wind energy conversion systems (WECS) Basic components of wind energy conversion systems(WECS), Classification of WEC systems Application of wind energy, On – land and off – shore applications, Stand alone and Grid Connected Applications, types of wind turbines, Introduction to soft starters, Reduced and full capacity converters and wind MPPT, Introduction to control mechanism		
Unit:3	**Hydro power station**	**7 Hours**
Small-scale hydroelectric power generation, Schematic arrangement of Hydroelectric Power Station, Constituents of Hydroelectric power plant, Advantages and Limitations of Hydro-electric Plants, Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity		
Unit:4	**Energy storage devices**	**8 Hours**
Introduction, Necessity of energy storage, specifications of energy storage, energy storage methos: mechanical, Electrochemical, chemical energy, electromagnetic, electrostatic ,thermal energy storage		
Unit:5	**Energy management system**	**7 Hours**
Load Curves-Load forecasting, Load Shaping Objectives Methodologies - Peak load shaving - Energy management-Role of technology in demand response- Demand Side Management – Numerical Problems		

Unit :6	Power Quality of Smart grid	8 Hours
Power quality: Introduction - Types of power quality disturbances - Voltage sag (or dip), transients, short duration voltage variation, Long duration voltage variation, voltage imbalance, waveform distortion, and voltage flicker - Harmonic sources: SMPS arcing devices, saturable devices, fluorescent lamps, harmonic indices (THD, TIF, DIN, C – message weights) Power quality aspects with smart grids.		
	Total Lecture Hours	**45 Hours**

Text Books				
1	Generation of Electrical Energy	2014	By B.R.Gupta	S.Chand
2	Non conventional energy sources	2017	B.H.Khan	Mc Graw Hill
3	Essentials of Distributed Generation System	2009	Massey	Jones & Bartlett Learning
Reference books				
1	Distributed Systems : Concept And Design-	2017	Coulouris George, Dollimore Jean, Kindberg Tim	PEARSON
2	Power Quality in Microgrids Based on Distributed Generators	2019	Ambrish Chandra and Hua Geng	MDPI AG publisher

YCCE e-library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Renewable%20Energy%20Sources/
MOOCs Links and additional reading, learning, and video material	
1	https://youtu.be/ui5zOmAX3cc
2	https://youtu.be/DlGSGJISxUI

V SEMESTER

23EL1545: PEII: 8085 Programming

Course Outcomes:
Upon successful completion of the course, the students will be able to 1. Explain types of memory devices and architecture of 8085 microprocessor. 2. Classify the instructions with the help of Addressing modes of 8085 with necessary programs. 3. Apply the knowledge of programming concepts of 8085 for various applications. 4. Analyze the architecture of various Interfacing Devices like 8255 PPI, 8253, ADC and DAC and Programming of all the Interfacing IC's.

Unit:1	**Memory devices**	**7 Hours**
Memory devices, RAM, ROM, Introduction to Intel‟s 8085 Architecture, Flag register, Instruction set, Addressing modes, assemblers, hand coding		
Unit:2	**Programming Instructions**	**8 Hours**
Branching instruction, Simple programmes, stack, PUSH, POP Instructions, CALL/RETURN instruction & Subroutines- simple & nested programmes, Programmes using Subroutines.		
Unit:3	**Timing Diagrams**	**7 Hours**
Timing Diagrams, Timing Diagram of instruction. Delay programmes, Serial data transfer, Interrupts - concept and structure in 8085 Interrupt service routine, advanced instructions & Programming of 8085A		
Unit:4	**Interfacing of Microprocessor**	**8 Hours**
Complete signal description of 8085, interfacing memory devices interfacing I/O devices. Methods of data transfer- serial, parallel synchronous and asynchronous. IN/OUT instructions. Hardware considerations bus contention, slow memory interfacing		
Unit:5	**Hardware interfacing and Handshaking**	**7 Hours**
Simple hardware interface to 8085 of standard latches & buffers as I/O ports. Architecture and interface of 8255 & 8085. Handshaking concepts. Interfacing of multiplexed keyboard/ display interface and assembler directives. Interfacing of ADC & DAC, stepper motor Interface with 8085		
Unit :6	**Architecture and Interface**	**8 Hours**
Architecture and interface of 8253 with & 8085, Different modes of 8253. Architecture and interface of 8257 with & 8085, Different modes of operation of 8257, Application of microcontroller.		
	Total Lecture Hours	**45 Hours**

V SEMESTER

23EL1546 : PEII: Analog and Digital Electronics

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand the working principles and characteristics of diodes, BJTs, and operational amplifiers.
2. Analyze and design Op-Amp-based circuits including amplifiers, filters, oscillators, and waveform generators.
3. Apply Boolean algebra and K-map simplification to design combinational digital circuits.
4. Design and implement sequential circuits using flip-flops, counters, and shift registers.
5. Interpret number systems, codes, and digital logic families to evaluate digital circuit performance.

Unit:1	**Semiconductor Devices and Applications**	**8 Hours**
Review of semiconductor basics – intrinsic and extrinsic semiconductors, doping, and charge carriers. PN junction diode: characteristics, diode equation, Zener diode, and applications (clipper, clamper). Bipolar Junction Transistor (BJT): Construction, operation (active, cutoff, saturation modes), Input-output characteristics, Biasing techniques (fixed, voltage divider), Small signal model and analysis, Applications of diodes and transistors in signal conditioning and switching.		
Unit:2	**Operational Amplifiers and Linear Applications**	**7 Hours**
Introduction to PSPICE, Operational Amplifier (Op-Amp) fundamentals: Ideal vs practical Op-Amp parameters, Inverting and non-inverting amplifiers, Summing, difference, integrator, and differentiator circuits Op-Amp applications: Voltage follower, comparator, Precision rectifier, Active filters: Low-pass and high-pass filters (first order) , Oscillators using Op-Amp: Wein Bridge oscillator, Phase shift oscillator,		
Unit:3	**Logic Gates, Boolean Algebra, and Combinational Circuits Part 1**	**8 Hours**
Number systems: Binary, Decimal, Octal, Hexadecimal, conversions Binary arithmetic: Addition, subtraction (1's and 2's complement) Codes: BCD, Gray, ASCII, Excess-3; Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR; truth tables		
Unit:4	**Logic Gates, Boolean Algebra, and Combinational Circuits Part 2**	**7 Hours**
Boolean algebra: Laws, DeMorgan's Theorems Simplification using Karnaugh Maps (K-maps) – 2, 3, 4-variable Combinational Circuits: Adders (Half, Full), Subtractors, Multiplexers (MUX), Demultiplexers (DEMUX), Encoders, Decoders, Comparators		
Unit:5	**Sequential Logic Circuits-Part 1**	**8 Hours**
Flip-Flops: SR, D, T, JK Flip-Flops, Truth tables and characteristic equations, Race-around condition, master-slave JK FF Registers: Serial-in Serial-out (SISO), Serial-in Parallel-out (SIPO), Parallel-in Serial-out (PISO), Parallel-in Parallel-out (PIPO)		
Unit :6	**Sequential Logic Circuits-Part 2**	**7 Hours**
Counters: Asynchronous (Ripple) counters, Synchronous counters, Up, Down, and Up/Down counters, Mod-N counters Applications of counters in digital clocks, frequency division		
	Total Lecture Hours	**45 Hours**

Text Books			
Title	**Edition**	**Author**	**Publisher**
Programming and Interfacing 8085	6th Edition	Gaonkar	Penram International Publishing
Programming of 8085	3rd Edition	D.V. Hall	McGraw-Hill Education
Reference books			
Microprocessor & Interfacing Manual, Intel Peripheral	8th Edition	Barry Brey	Pearson

V SEMESTER
Mandatory Learning Course (Audit Course)
MLC2125 : YCAP5

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2023

6th Semester

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 23EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	EL	23EL1601	Power System Analysis	T	3	0	0	3	3	30	20	50	3
2	6	PC	EL	23EL1602	Fundamentals of Electrical Drives	T	3	0	0	3	3	30	20	50	3
3	6	PC	EL	23EL1603	**Lab :** Fundamentals of Electrical Drives	P	0	0	2	2	1		60	40	
4	6	PC	EL	23EL1604	**Lab :** Electronics Engineering workshop	P	0	0	2	2	1		60	40	
5	6	PC	EL	23EL1605	**Lab :** Simulation in Power Electronics	P	0	0	2	2	1		60	40	
12	6	PC	EL	23EL1606	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
6	6	PE	EL		**Professional Elective -III**	T	2	0	0	2	3	30	20	50	3
7	6	PE	EL		**Lab : Professional Elective -III**	P	0	0	2	2	1		60	40	
8	6	PE	EL		**Professional Elective -IV**	T	3	0	0	3	3	30	20	50	3
9	6	MDM	EL		**MD Minor Course-IV**	T	3	0	0	3	3	30	20	50	3
10	6	**VSEC-4**	EL	23EL1607	**Lab**.:Substation Design	P	0	0	2	4	2		60	40	
11	6	STR	EL	23EL1608	Project Phase -I	P	0	0	4	4	2		60	40	
						TOTAL	**16**	**0**	**14**	**32**	**25**				
List of Mandatory Learning Course (MLC)															
1	6	HS		MLC2126	**YCAP6 :**	**A**	3	0	0	3	**0**				

Professional Electives-III					
1	6	PE-III	EL	23EL1621	**PE-III :** Electrical Installation Design
2	6	PE-III	EL	23EL1622	**PE-III : Lab :** Electrical Installation Design
3	6	PE-III	EL	23EL1623	**PE-III :** Electrical Energy Audit and Safety Analysis
4	6	PE-III	EL	23EL1624	**PE-III : Lab :** Electrical Energy Audit and Safety Analysis
5	6	PE-III	EL	23EL1625	**PE-III :** Project Planning and Management
6	6	PE-III	EL	23EL1626	**PE-III : Lab :** Project Planning and Management
7	6	PE-III	EL	23EL1627	**PE-III :** Power Electronics Converters for Renewable Energy
8	6	PE-III	EL	23EL1628	**PE-III : Lab :** Power Electronics Converters for Renewable Energy
9	6	PE-III	EL	23EL1629	**PE-III :** Embedded System
10	6	PE-III	EL	23EL1630	**PE-III : Lab :** Embedded System
11	6	PE-III	EL	23EL1631	**PE-III :** PLC and Industrial Automation
12	6	PE-III	EL	23EL1632	**PE-III : Lab :** PLC and Industrial Automation

Professional Electives -IV					
1	6	PE-IV	EL	23EL1641	**PE-IV :** Advanced Power Electronics
2	6	PE-IV	EL	23EL1642	**PE-IV :** Advanced Electrical Drives
3	6	PE-IV	EL	23EL1643	**PE-IV :** Grid integration in Renewable Energy Systems
4	6	PE-IV	EL	23EL1644	**PE-IV :** Power System Operation and Management
5	6	PE-IV	EL	23EL1645	**PE-IV :** Microgrid
6	6	PE-IV	EL	23EL1646	**PE-IV :** Advanced Control System
7	6	PE-IV	EL	23EL1647	**PE-IV :** Environmental, Social, and Governance (ESG) frameworks in Industry 4.0
Coursera Elective					
1	6	PE-IV	EL	23EL1648	**PE-IV :** Energy Production, Distribution and Safety

		July, 2023	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2023-24 Onwards

VI Semester
23EL1601: Power System Analysis

Course Outcomes:

Upon successful completion of the course the students will be able to

1.Apply symmetrical components concepts in fault analysis
2. Analyse different faults in power system
3. Evaluate stability and economic operation of power system
4. Differentiate different neutral grounding and compensation systems

Unit:1	**Symmetrical Fault Analysis**	**7 Hours**
Define fault & its causes, effect of fault on power system, purpose of fault analysis, assumptions made for fault analysis, transient in a series R-L circuit, short circuit analysis on synchronous machine at no-load & loaded condition, selection of circuit breaker & its short circuit MVA calculation, current limiting reactors.		
Unit:2	**Symmetrical Component**	**8 Hours**
Introduction, α-operator, symmetrical components of an unbalanced Three phase system, symmetrical components of voltage & current phasors, zero sequence components of voltage & current, power in terms of symmetrical components, phase shift in star-delta transformers, sequence network for fault calculation, sequence impedances of transmission line & synchronous machines, zero sequence networks of transformers, assembly of sequence networks of power system.		
Unit:3	**Unsymmetrical Fault Analysis**	**7 Hours**
Assumptions made for unsymmetrical fault analysis, sequence voltages of a generator, sequence voltages at a fault point, general procedure for analysis of various fault with and without fault impedance for Line to Ground (L-G), L-L-G, L-L, Open conductors faults analysis using symmetrical components.		
Unit:4	**Power System Stability**	**8 Hours**
Stability of power system:-Steady state, Dynamic and Transient stability definition, Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation, Steady state stability studies. Transient stability studies: - Swing curve, Equal Area criterion for transient stability, Application of equal area criterion for different disturbances. Solutions of swing equation by point by point method. Methods of improving transient stability.		
Unit:5	**Economic operation of power system**	**7 Hours**
Introduction, incremental fuel cost, economic dispatch neglecting transmission losses, transmission loss as a function of plant generation, general loss formula, and optimum load dispatch considering transmission losses		
Unit:6	**System Neutral Grounding & Reactive Power Compensation**	**8 Hours**
Neutral Grounding: - Introduction to neutral grounding, methods of neutral grounding, Peterson coil grounding. Compensation: - Series & shunt compensation, location of series capacitors, protective schemes for series capacitors, problem associated with series capacitors, Static VAR system with its different schemes.		
	Total Lecture Hours	**45 Hours**

Text books	
1	Electrical Power System ,5th edition 2007 ,Ashfaque Hussain, CBS
2	Modern PowerSystem analysis , 4th-2011 ,I. J. Nagrath & D. P. Kothari ,Tata McGraw Hill
Reference Books	
1	Elements of Power System Analysis,4th-1984,W. D. Stevenson,Tata McGraw Hill
2	Electrical Power System ,3rd – 2005 ,C. L. Wadhawa ,New Age International
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Power%20System%20Engineering/Electrical%20Power%20Systems%20D.Das%20(%20PDFDrive%20).pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/POWER%20SYSTEM/modern-power-systems-analysis-d-p-kothari-i-j-nagrath(2).pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/I-kQjugkQAY?feature=shared
2	https://youtu.be/fBm1dr_gRBk?feature=shared
3	https://youtu.be/dhmYOIBcwOU?feature=shared

VI SEMESTER
23EL1602: Fundamentals of Electrical Drives

Course Outcomes

Upon successful completion of the course the students will be able to

1. Explain the fundamental concepts of electric drives and their classification, including speed-torque.
2. Select appropriate motors and bearings for various industrial applications.
3. Analyse and differentiate the operation of AC and DC contactors, limit switches, and related control components.
4. Develop and simulate basic PLC ladder logic programs and demonstrate their applications in controlling electrical drives.
5. Evaluate the characteristics, control methods, and braking techniques of AC/DC traction motors

Unit:1	**Introduction to Drives and Speed Control**	**7 Hours**
Definition of a Drive, Classification of Drives, Brief idea about drives commonly used in industries, Speed-torque characteristics of common drive motors (DC and AC), Characteristics of Drives under starting and running, Types of braking, Speed Control of AC and DC motors.		
Unit:2	**Selection of motors**	**8 Hours**
Selection of motors and bearings of motor: Power capacity for continuous and intermittent periodic duties, Flywheel effect, Duty cycles of motor, transmission, enclosure systems for drives.		
Unit:3	**AC and DC contactor**	**7 Hours**
Analyze ,Categorize AC- DC Contactor, limit switch, working, applications, Power and Control circuit by using contactors		
Unit:4	**Programmable Logic Controllers**	**8 Hours**
Programmable Logic Controllers (PLC), programming methods, Ladder programming with few examples, Applications of PLC's in electrical drives.		
Unit:5	**Traction Drives**	**7 Hours**
Traction motors: Motors used in AC/DC traction and their performance and desirable characteristics, requirements and suitability of motor for traction duty, speed-time characteristics of the train, Traction motor control. Series parallel control with numerical method, starting and braking of the traction motor		
Unit :6	**Digital speed control of Electric motors**	**8 Hours**
Digital speed control of Electric motors, comparison with Analog method of speed control, Block Diagram arrangement for microprocessor-based speed control of AC/DC motor, Flowcharts and algorithms for speed control and speed reversal of motor. Digital Signal Processors (DSPs) for drive control. Introduction to Variable Frequency Drive (VFD)		
	Total Lecture Hours	**45 Hours**

Text books	
1	A Course in Electrical Power,1 st -2005,Soni, Gupta, Bhatnagar,Dhanpat Rai and Company Publication

Reference Books	
1	A Electrical Technology Volume III Transmission, Distribution, Utilization, B. L.Theraja, A. K. Theraja, 2nd - 2005, S.Chand
2	Magnetic control of motors, Industrial New York 1947, Heumann, Chapman and Hall Publication
3	Modern utilization of traction motor, 2003, J.B. Gupta,Dhanpat Rai and CompanyPublication

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-3-642-25904-3

MzOOCs Links and additional reading, learning, video material	
1	https://youtu.be/JZ6f_i4ao6Y
2	https://youtu.be/1AT1yuQ9awM
3	https://youtu.be/zWvcM-4aUgg

VI SEMESTER

23EL1603: Lab: Fundamentals of Electrical Drives

Course Outcomes
Upon successful completion of the course the students will be able to
1: Evaluate and interpret the control circuits of Star-Delta and Direct-On-Line (DOL) starters
2: Categorize and differentiate between various types of AC and DC contactors & LIMIT switch based on their construction and application.
3: Design basic ladder logic programs in PLCs to control lamps and implement real-time control operations
4: Design and simulate a sequence control logic for multiple lamps using ladder diagrams in PLC.

Minimum Eight Practicals to be performed from the list below

Sr. No.	List of Experiments
1	To evaluate and explain the control circuit of star delta starter
2	To evaluate and explain control circuit of direct online starter (DOL)
3	To explain function of side rotary limit switch.
4	To categorize different types contactors
5	To classify and explain programming logic control (PLC) M-1200, M-1400 and LOGO PLC.
6	To make use of operating limit switch to turn ON contactor (output device)
7	To design ladder programming in PLC to control lamp
8	To design ladder programming using LOGO PLC to control lamp.
9	To explain Implementation of timer using LOGO PLC
10	To design ladder programming in PLC to Control of lamps in pre- defined sequence
11	To design a program for Reversal of synchronous motor using PLC
12	To make use of limit switch, and sensors to turn ON contactor motor, lamp

VI SEMESTER

23EL1604: Lab: Electronics Engineering Workshop

Course Outcomes
Upon successful completion of the course the students will be able to 1. Explain the electrical characteristics and functions of Power Electronics components. 2. Apply PCB design principles to fabricate functional circuits. 3. Analyze and implement voltage regulators and timer circuits using Op-Amps, LEDs, and ICs. 4. Evaluate power diodes, transistors, and Op-Amps using systematic testing and measurement.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Design and fabrication of PCB
2	Design of voltage regulators
3	Design of different timers using operational amplifiers.
4	Study and testing of diodes
5	Study and testing of transistor
6	Study and testing of MOSFET, IGBT
7	Study and testing of Thyristor, power diodes
8	Study and testing of power transistors
9	Study and testing of operational amplifiers, LEDs, ICs etc

VI SEMESTER

23EL1605: Lab : Simulation in Power Electronics

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Demonstrate the fundamentals of the simulation environment of MATLAB/SIMULINK software
2. Describe MATLAB/SIMULINK as a tool to solve power system and power electronics problems
3. Develop simulation models in the power system and analyse the performance
4. Make use of SIMULINK to build and analyse models of power electronics

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Analysis and Improvement of Power factor by using MATLAB Simulation
2	Simulation of Fortescue's Theorem
3	Analysis and verification of Ferranti Effect of Transmission Line by MATLAB Simulation.
4	Simulation of single-phase full wave fully controlled rectifier.
5	Examine the Performance of Buck DC -DC regulator with Matlab/Similink Simulation.
6	Study, analysis, and simulation of full bridge square wave inverter
7	Analysis, and Simulation of Full Bridge (Three - Level H –Bridge) with Sinusoidal Pulse Width Modulation (SPWM) Technique
8	Simulate and Evaluate the Performance of Five-Level Cascaded H- Bridge (CHB) inverter with Sinusoidal Pulse Width Modulation (SPWM) Technique

VI SEMESTER
23EL1606: Design Thinking and Research Methodology

Course Outcomes:

Upon successful completion of the course the students will be able to

1) Comprehend the foundational concepts of research methodology
2) Identify and formulate research problems and conduct effective literature reviews and adhere to ethical research practices
3) Collect and analyze data using appropriate methods.
4) Interpret research findings and write scientific reports

Unit:1	Fundamentals of Design Thinking in Electrical Engineering	7 Hours

Introduction to Design Thinking: Definition and origins of design thinking in engineering contexts, Applications of design thinking in electrical engineering domains (power systems, electronics, control systems)
Identifying problems in Electrical Engineering: Real-world Electrical Engineering problems such as voltage instability, power quality degradation, high energy consumption, equipment failure, and renewable integration challenges etc.
Empathy Mapping for electrical stakeholders: Identifying stakeholders i.e. consumers, utility providers, maintenance personnel, regulatory body. Developing Empathy Maps using 5Ws+1H and interviews/observations to capture user perspectives.
Framing user-centered challenges: Transforming observed problems into well-defined design challenges.
Ideation Techniques: Brainstorming, Mind Mapping etc.

Unit:2	Prototyping and Application in Electrical Engineering	8 Hours

Creating Prototypes: Development of prototypes for Electrical Engineering applications using breadboards, PCB design, hardware setups, or simulation.
Simulation and Design Tools: MATLAB/Simulink Simulation, AutoCAD Electrical Design, Multisim.
Case Study: Identification of relevant Electrical Engineering problems, Application of the Design Thinking process to develop a solution, Presentation of the solution through technical storytelling, demo or documentation.

Unit:3	Research Fundamentals, Research Problem and Design, Literature Review	7 Hours

Research Fundamentals: Definition, objectives, and significance of research, Types of research: Basic, Applied, Descriptive, Analytical, Quantitative, and Qualitative.
Research Problem and Design: Criteria of good research, Techniques for defining and identifying a

research problem, Features of good research problem/design, Necessity of defining the problem, Meaning of research design, Types of research design – Exploratory, Descriptive, Diagnostic, and Experimental Literature Review: Importance and methods of conducting a literature review, Sources of information: Journals, conferences, patents, etc., Technical reading strategies.		
Unit:4	**Sampling and Data Collection, Data Analysis and Interpretation, Technical Writing, Research Ethics**	**8 Hours**
Sampling and Data Collection: Sampling techniques: Probability and Non-probability sampling, Characteristics of a good sample, Sample size determination, Data types: Primary and Secondary, Methods of primary data collection: Observation, Interview, Questionnaire, Schedule, Secondary data sources Data Analysis and Interpretation: Processing and analyzing data, Statistical tools: Measures of central tendency, Dispersion, Correlation, Regression, Hypothesis testing: Null and alternative hypothesis, Type I and II errors, Use of software tools (e.g., Excel/SPSS/MATLAB for analysis), Interpretation of results Technical Writing, Research Ethics: Publication ethics and responsibilities of researchers, Structure and components of research report, Types of technical reports and papers, Writing thesis and dissertations, Referencing and citation styles (APA, IEEE, etc.), Ethical considerations in engineering research., Plagiarism and research ethics		
	Total Lecture Hours	**30 Hours**

Text books	
1	I. Cuiñas and M. J. Fernández Iglesias, Design Thinking for Engineering: A Practical Guide. London, U.K.: The Institution of Engineering and Technology (IET), 2023.
2	C. Diderich, Design Thinking for Strategy: Innovating Towards Competitive Advantage. Cham, Switzerland: Springer International Publishing, 2019.
3	C.R. Kothari – Research Methodology: Methods and Techniques, New Age International.
4	Ranjit Kumar – Research Methodology: A Step-by-Step Guide for Beginners, Sage Publications.
Reference Books	
1 2 3	F. Darbellay, T. Lubart, and Z. Moody, Eds., Creativity, Design Thinking and Interdisciplinarity. Singapore: Springer Nature Singapore. S. R. Tiwari and R. R. Swarup, Design Thinking: A Comprehensive Textbook. New Delhi, India: Wiley India Pvt. Ltd. R. Panneerselvam – Research Methodology, PHI Learning. Dawson, C. – Practical Research Methods, UBS Publishers. Trochim, W.M.K. – Research Methods: The Concise Knowledge Base.

VI SEMESTER
23EL1607: Lab: Sub-Station Design

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explain single line diagram of substation with rating of different equipments, types of relays required and their settings.
2. Construct plan of equipment's and panels mounted in a substation
3. Analyze earthing system of substation.
4. Design of substation complete in regard to selection of equipment's, sizes, protective schemes and earthing system.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Introduction to Substation design
2	Demonstrate various components of 11 k V YCCE main substation
3	Demonstrate Single line diagram of 11 kV YCCE substation-2(Near canteen)
4	Analysis of Protection scheme of 33 k V YCCE BabasahebKedar Sutgirni substation,Hingna Nagpur
5	Analysis of Earthing layout of 33 k V YCCE MSEDCL Isasani substation
6	132 k V MSETCL Hingna-1 substation
7	To study 220 k V Butibori-1 MSETCL substation
8	Single line diagram of proposed 132 k V YCCE Substation
9	Study of Control panel layout
10	Study of Substation earthing

VI SEMESTER
23EL1621: PE-III : Electrical Installation Design

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Interpret key concepts of load forecasting and apply the Indian Electricity Rules (IER) to design domestic, commercial, and industrial electrical installations. 2. Select appropriate cables, wires, conductors, and insulators for various installations based on ratings, derating factors, and voltage drop calculations. 3. Design single line diagrams and layout plans for substations (11 kV to 33 kV). 4. Evaluate fault levels and select protective devices (relays, fuses, circuit breakers) and fire fighting requirements. 5. Perform testing of power transformers and access compliance with operational and safety standards before commissioning.

Unit:1	**Introduction**	**7 Hours**
Load forecasting, regression analysis, numerical based on linear and exponential trends, Electrical installation for domestic, commercial and industrial consumers, calculation of connected load, selection of transformers, switchgears, cables and wires, single line diagram, special provisions for high rise buildings (IER-50-A), earthing requirements, megger and earth tests, use of earth leakage circuit breakers (special reference to be given to IER 2 (i, n, o, p, v, aa, aaa, aq, aqq, ar, av).		
Unit:2	**Cables**	**8 Hours**
Cables: PVC and XLPE cables, their construction in brief, current ratings, specifications, derating factors, Megger and continuity test. Overhead distribution lines upto 33 kV, Line apparatus and basic construction, clearances, selection of AAC and ACSR conductors, voltage drop calculations, Selection of Insulators, earthing requirements. (Special reference to be given to IER 77, 79, 80, 81, 87, 89, 90, 91, 92)		
Unit:3	**Illumination**	**7 Hours**
Definitions, polar curves, simple calculations, working principles of fluorescent, sodium vapour and mercury vapour lamps, Capacitors and power factor improvement: Determination of rating and location of capacitors, calculation of payback period for additional capacitors.		
Unit:4	**Substation**	**8 Hours**
Single line diagram, plan, elevation and clearances for 11 kV pole mounted, 11 kV plinth mounted (upto 1000 kVA and above 1000 kVA), 33 kV (upto 2500 kVA and above 2500 kVA) substations. Single line diagram for substation with two transformers in parallel, specifications of isolators, lightening arrestors, horn gap fuses, D.O. fuses, circuit breakers, instrument transformers, power transformers, LV HRC fuses, LV circuit breakers, (Special reference to be given to IER 31, 33, 35, 43, 44, 47, 48, 50, 51, 54,58, 64, 64A, 67 and IS3043)		

Unit:5	Protection	7 Hours
Determination of fault levels of various locations in substation, use of current limiting reactors, philosophy of protective relaying, over current, earth fault, REF protection, earth leakage protection, OTI, WTI, Buchholz relays, Firefighting equipments, restoration of a person affected by electric shock, Earthing: types, measurement of earth resistance		
Unit:6	**Testing of transformer**	**8 Hours**
Site testing of transformer (Visual, pre-commissioning tests like megger, magnetic balance, turns ratio), testing of oil, operational test for Buchholz, OTI, WTI, alarm and trip functions.		
	Total Lecture Hours	**45 Hours**

Text books	
1	Electric Power, 2016, Soni, Gupta, Bhatnagar ,Dhanpat Rai Publication
2	Electrical Installation Design, 2012 ,Jain, Bajaj, Laxmi Publication
3	Power Electronics and AC Drives, 2003 , B.K. Bose ,Pearson Education
Reference Books	
1	Electric Power Distribution Systems, 2004 ,Pabla ,McGraw Hill
2	Electrical Substation,S.Rao, Khanna Publication
3	Electrical Engineering handbook , 2018, C.L.Wadhwa ,New Age International
4	IER (latest edition)
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/Electrical%20Installation/Electrical%20Installation%20Calculations%20Fourth%20Edition%20by%20Mark%20Coates%20and%20Brian%20Jenkins.pdf
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/vp5lAPbq0QU?feature=shared

VI SEMESTER
23EL1622: PE-III : Lab: Electrical Installation Design

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Identification of different parts of 4-Core cable and to conduct continuity test.
2	To design Godown wiring using lamps ,controlled switches.
3	Plot and Analyze the Characteristics of Fuse Wire.
4	Demonstrate Wiring and Operation of a Fluorescent Lamp Circuit.
5	Describe and Compare Different Types of Earthing Systems as per IEC Standards.
6	To measure Insulation resistance by Megger.
7	Design of Substation Layout for 11 kV and 33 kV Ratings.
8	Classify and Compare Different Types of Electrical Insulators.
9	Analyze and Interpret Tariff Structures Including TOD Tariff.
10	Plot and Analyze the Characteristics of Fuse Wire.
11	Calculate and Verify the Turns Ratio of a Single Phase Transformer.
12	Analyze and Interpret Tariff Structures Including TOD Tariff.

VI SEMESTER
23EL1623:PE-III : Electrical Energy Audit and Safety Analysis

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explain, the energy sources, methods of energy conservation and its pattern, electricity act 2003
2. Interpret different forms of electrical and thermal energy
3. Examine the Energy Management, Energy Audit, Energy Monitoring and Targeting
4. Determine the performance evaluation of Electric motors and drives and testing procedure, co-generation system and Electrical safety procedures

Unit:1	**Energy Scenario**	**7 Hours**
Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.		
Unit:2	**Basics of Energy and its various forms**	**8 Hours**
Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion		
Unit:3	**Energy Management & Audit**	**7 Hours**
Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.		
Unit:4	**Energy Monitoring and Targeting**	**8 Hours**
Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).		
Unit:5	**Performance Evaluation of Electric Motor and variable Speed Drives**	**7 Hours**
Methods for determining motor loading, methods of determining motor efficiency, evaluating performance of rewound motors, variable speed drive: principles and applications, factors for successful implementation of variable speed drive		
Unit:6	**Captive and Cogeneration Systems**	**Hours**
Introduction, purpose of the performance test, performance terms and definitions, reference standards, field testing procedure, examples, Case study of bottoming cogeneration in industries.		
	Total Lecture Hours	**45 Hours**

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Principles of Energy Conversion	1st Edition	,W Culp	w Hill
2	Energy Management Handbook	1st Edition	Wayne C Turner	John Willey and Sons
3	Bureauof Energy Efficiency Study Material for Energy Managers and Auditors Examination	1st Edition	BEE, India	Bureau of Energy Efficiency www.beeindia.in

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Handbook on Energy Auditand Management	1st Edition	Kumar Tyagi	

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Electrical%20Engineering/EEAS%20ebooks/1.3_energy_management_and_audit.pdf
MOOCs Links and additional reading, learning, video material	
1	https://www.youtube.com/live/WwBquDjDGOA?feature=shared
2	https://www.youtube.com/live/WwBquDjDGOA?feature=shared

VI SEMESTER

23EL1624:PE-III: Lab:Electrical Energy Audit and Safety Analysis

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Identify the lux level and power consumption using energy meter 2. Examine Phase sequence, characteristics of synchronous generator, Types of Earthing 3. Measure Energy Consumption and Measurement of Harmonics 4. Explain Electrical Shock, Fire Safety and efficiency evaluation of solar panels.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	To determine the efficiency of Industrial Compressor
2	To determine the lux level of offices, classrooms, corridors, labs, etc.
3	To assess the energy conservation opportunities in the electrical machines lab
4	To illustrate the percentage loading and the efficiency of a star-connected three-phase induction motor
5	To illustrate the percentage loading and the efficiency of a delta-connected three-phase induction motor
6	To determine Energy conservation in the Fan by using an Electronic Regulator
7	To determine the power factor improvement using PFC / APFC unit for various electrical loads
8	To determine the savings in electric power by replacing lamp replacement
9	To prepare an energy audit report

VI SEMESTER
23EL1625:PE-III: PE-III : Project Planning and Management

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Describe the methodologies involved in project planning and various project planning tools.
2. Analyze the project cost and the risk involved in project execution.
3. Survey the material handling and earth moving equipments.
4. Record the documents and formats involved in project execution and its control.

Unit:1	**Project and Project Management**	**7 Hours**
Introduction, Characteristic, Definition, Objectives, Stages, Project planning process, Establishing project organization, Life cycle of project, Project planning methodologies, and growth, Role of project manager.		
Unit:2	**Project Planning Tools**	**8 Hours**
Bar chart, Milestone chart, CPM, and PERT, Time estimates, Frequency distribution, Mean, Variance, and standard deviation, Probability distribution, Network analysis, slack, Float, Critical path, Crashing of activity.		
Unit:3	**Cost Analysis and Updating**	**7 Hours**
Introduction, Projects cost: Direct cost, Indirect cost, Slope of direct cost curve, Total project cost andoptimum duration, Cost optimization. Project Updating: Introduction, Updating process, Data required for updating, Steps in process updating		
Unit:4	**Risk analysis and Resource allocation**	**8 Hours**
Certainty, Risk and uncertainty, Risk management, Identification and nature of construction risks, Contractual allocation of risk, Types of risks, Minimizing risks and mitigating losses, Use of expected values, Utility in investment decisions, Decision trees, Sensitivity analysis		
Unit:5	**Construction Equipment**	**7 Hours**
Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoisting equipment's, Types of Material handling Equipment's and types of heavy earth moving equipment's.		
Unit:6	**Project Execution Monitoring and Control**	**8 Hours**
Types of Contract, Tendering (Techno-commercial aspects), Motivation Theories, Communication and reporting, Importance of coordination, Logistick management, Inspection, Testing, Transportation, Commissioning, Trial run, Documentation required for project handover, Preparing a project report for failure reference.		
	Total Lecture Hours	**45 Hours**

Textbooks:				
	Title	**Edition**	**Author**	**Publisher**
1	Project Management: A Systemic Approach to Planning, Scheduling and Controlling	2nd Edition	Horald Kerzner	CBS Publishers
2	Project Planning and Control with PERT and CPM	2nd Edition	B. C. Punmia, K.K. Khandelwal	Laxmi Publication.
Reference Book:				
	Title	**Edition**	**Author**	**Publisher**
1	Construction Project Scheduling	5th editions.	Callahan M. T., Quackenbush D. G. and rowing J. E.	McGraw Hill ,New York
2	Construction Planning and Equipment Methods	7th edition	Peurifoy R. L., Ledbetter W. B and schexnayder C.	McGraw Hill, Singapore.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4020-8392-1
MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/W2EdffbwgcM?feature=shared
2	https://youtu.be/W2EdffbwgcM?feature=shared

VI SEMESTER
23EL1626: PE-III: Lab: Project Planning and Management

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Contrast the main features and importance of the MS Project environment.
2. Develop Barchart,Gantt chart,Milestone chart.
3. Prepare Project Reoprt of Project Planning.
4. Establish CPM and PERT Project Planning Tools.

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	Introduction to CPM Techniques
2	Introduction to PERT Techniques
3	Identification of Critical path using Project Planning tool
4	To study Bar Chart for Project Planning
5	To Design Milestone Chart for Project Planning
6	To evaluate Project cost using direct cost and indirect cost
7	To study the risk and mitigation of losses techniques
8	To design decision tree and sensitivity analysis
9	To study various types of construction equipments
10	To study Project Planning Report

VI SEMESTER

23EL1627: PE-III: Power Electronics Converters for Renewable Energy

Course Outcomes:
Upon successful completion of the course the students will be able to
1. Outline the operating principles and characteristics of renewable energy sources for sustainable energy conversion.
2. Describe and analyze the various solar photovoltaic systems, inverter topologies and configurations.
3. Explain fixed speed and variable speed wind energy conversion systems and configurations.
4. Understand the power quality issues in grid-connected systems for ensuring the quality of power

Unit:1	**Introduction to Renewable Energy System**	**7 Hours**
Qualitative study of different renewable energy resources: Solar, wind, Fuel cell, and hybrid renewable energy systems.		
Unit:2	**Solar Photovoltaic System**	**8 Hours**
Solar Photovoltaic: PV cell equivalent and V-I, P-V characteristics, DC-DC Converters and its role in Maximum Power Point Tracking (MPPT), MPPT techniques. (Reference and non-reference cell-based algorithm)		
Unit:3	**Solar PV Converters and Configurations**	**7 Hours**
PV inverters: PV inverter Configurations, PV Configuration: Standalone, Grid interactive, Bi-Modal systems, Basic introduction to synchronization, Islanding, and control for PV inverters.		
Unit:4	**Wind Energy Conversion System (Fixed Speed)**	**8 Hours**
WECS: Introduction to WECS, Wind aerodynamics, Wind turbine technologies, WECS configurations, operation and analysis of fixed speed WECS.		
Unit:5	**Variable Speed Wind Energy Conversion System**	**7 Hours**
Variable speed WECS: Introduction, classification, configuration using Induction generator and synchronous generator based variable WECS.		
Unit:6	**Power Quality Issues in Grid Integrations.**	**8 Hours**
Type of Hybrid systems, PQ issues in grid interconnections for PV and wind systems, impact on voltage quality and remedial measures.		
	Total Lecture Hours	**45 Hours**

Text books	
1	Power Electronics Handbook book Rashid, M. H, Academic press, 2001
2	Power Electronics for Modern Wind Turbines 2006 F. Blaabjerg and Z. Chen, Morgan & Claypool Publishers, 2006
Reference Books	
1	Non-conventional Energy Sources 2006 B. H. Khan Tata McGraw-Hill
2	Modern Power Electronics and AC Drives 2001 B. K. Bose Prentice Hall PTR
3	Non-Conventional Energy Resources B H Khan McGraw-Hill Education (India) Pvt Limited, 2006
4	Non-Conventional Energy Sources J D Rai Khanna Publisher, 2008

VI SEMESTER
23EL1628:PE-III: Lab: Power Electronics Converters for Renewable Energy

Course Outcomes:

Upon successful completion of the course the students will be able to

1. To analyse their behaviour of power converters and understand its role in energy conversion
2. To integrate renewable energy sources like solar PV and wind turbines into electrical systems, including grid-connected and off-grid configurations
3. To design and analyse various power converters for specific renewable energy applications, such as DC-DC converters for solar PV and inverters for wind turbines.
4. TO understand the impact of power electronics on power quality and learn to identify and mitigate power quality issues in renewable energy systems

Minimum Eight Practical's to be performed from the list as below

Sr. No.	List of Experiments
1	To simulate solar V-I and P-V characteristics of solar photovoltaic cell
2	To study and simulate Wind power system
3	Analysing the performance of a grid-tied solar PV inverter and evaluating active and reactive power flow
4	To study the effect of DC-DC converter on solar PV characteristics
5	To study the the impact of capacitor banks on power quality at the point of common coupling (PCC)
6	To simulate the 2- level and 3- level NPC inverter
7	Analysis of 2-level and 3-level grid connected transformer less inverter in terms of various factors.
8	To study and realise islanding conditions using MATLAB Simulink
9	To study and simulate phase locked loop for synchronisation.
10	To realize the voltage sag, voltage flicker, and harmonics issues in case of PV/Wind based grid connected systems.

VI SEMESTER
23EL1629:PE-III: Embedded System

Course Outcomes
1. Program 8051 microcontroller to meet the requirements of the user. 2. Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc. 3. Apply concept & types of interrupts for the given context. 4. Design a microcontroller development board to meet the requirements of the user.

Unit:1	**Introduction to Microcontroller**	**7 Hours**
Difference between microprocessor and microcontroller, CISC Vs. RISC design philosophy, Von-Neumann vs. Harvard architecture. 8-bit and 16-bit microcontroller. Architecture of microcontroller. I/O ports, stack and use of stack pointer, priority. Memory structure, Data Memory, Program Memory and execution of programs, different registers (SFR's), addressing modes, timing diagram.		
Unit:2	**Microcontroller Integrated Development Environment (IDE)**	**8 Hours**
Editor, linker, loader, debugger, simulator, emulator. Instruction set, instruction formats, concept of assembler directives and various addressing modes of AVR and 8051 family of microcontroller. Basic programming using assembly instructions. Introduction to embedded- C, Integrated Development Environment (IDE), Cross Compiler, ISP, Simple program for delay generation.		
Unit:3	**Peripheral Interfaces-1**	**7 Hours**
I/O programming, Interfacing with simple switch, LED. 8 bit and 16 bit Timers, various modes of operations of timers, Counters, PWM programming.		
Unit:4	**Peripheral Interfaces-2**	**8 Hours**
Interrupt structure, Interrupt priority, Interrupt programming. Analog to Digital Converter, UART programming, RS232, RS 485 transceivers, I/O expansion techniques, Memory expansio		
Unit:5	**External Interfaces**	**7 Hours**
LCD, Keyboard interfacing, Digital to Analog Converters, Stepper Motor interfacing, DC motor interfacing. Introduction to CAN Protocol and its interfacing. Introduction to Bluetooth and USB protocols.		
Unit :6	**Introduction to Other Advanced Microcontrollers**	**8 Hours**
Introduction to ARM and PIC processors of MSP 430 microcontroller, 16 bit Microcontrollers overview; features, architecture, addressing modes. Low power feature of MSP 430. 32-bit microcontroller		
	Total Lecture Hours	**45 Hours**

Text books	
1	The 8051 Microcontroller: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2012.
2	The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.

Reference Books	
1	Arm System Developer's Guide: Designing and Optimizing System Software - Andrew N. Sloss, Elsevier Publication, 2005
2	Embedded System - Raj Kamal, 2nd Edition ,TATA McGraw Hill, 2009.
	Embedded C Programming and the ATMEL AVR by R H Barnett 2nd Ed., Cengage Learning Publication, 2006
3	Designing Embedded System with PIC microcontroller, Tim Wilmshurst, 2nd Ed., Newnes Publication, 2009
4	*Texas Instruments MSP 430 microcontroller, Guide and Datasheet

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4020-6066-3
2	http://link.springer.com/openurl?genre=book&isbn=978-3-540-25301-3
3	http://link.springer.com/openurl?genre=book&isbn=978-1-4020-8392-1
4	http://link.springer.com/openurl?genre=book&isbn=978-3-642-13635-1

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/117104072
2	https://nptel.ac.in/courses/108102045
3	https://onlinecourses.nptel.ac.in/noc20_ee98/preview

VI SEMESTER
23EL1630:PE-III: Lab: Embedded System

Minimum Eight Practical's to be performed from the list below

Sr. No.	Experiments based on
1	Study and familiarization of 8051 Microcontroller trainer kit
2	Write an Assembly Language Program for addition of 8-bit numbers stored in an array
3	Write an Assembly Language Program for Multiplication by successive addition of two 8-bit numbers
4	Write an Assembly Language Program for finding largest no. from a given array of 8-bit numbers
5	Write an Assembly Language program to arrange 8-bit numbers stored in an array in ascending order.
6	Stepper motor control by 8051 Microcontroller
7	Interfacing of 8-bit ADC 0809 with 8051 Microcontroller
8	Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC.
9	Implementation of Serial Communication by using 8051 serial ports.
10	Write an Assembly Language Program for use of Timer/Counter for various applications
11	Implement Traffic light controller/Real-time clock display
12	MINI PROJECT: design an application on MC developer kit

VI SEMESTER
23EL1631: PE-III: PLC and Industrial Automation

Course Outcomes

1. Explain architecture of industrial automation system.
2. Illustrate the process control, PLC architecture and interfacing
3. Develop PLC ladder logic for industrial applications
4. Demonstrate the function of SCADA with PLC systems

Unit:1	**Introduction to PLC and SCADA**	**7 Hours**
Automation overview, Automation requirement, systems, architecture of industrial automation system, introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus & profibus		
Unit:2	**Controllers & Actuators**	**8 Hours**
PID controller, mechanical switches, solid-state switches, electrical actuators: Solenoids, relays and contactors, ac motor, energy conservation schemes through vfd, dc motors, servo motor, pneumatic and hydraulic actuators.		
Unit:3	**PLC operation**	**7 Hours**
Definition, advantages and importance of PLC, history of PLC, architecture and block diagram, types of PLC, CPU unit architecture, memory classification.		
Unit:4	**PLC programming**	**8 Hours**
Basic ladder logic function, electrical wiring diagram, scan cycle, programming language of PLC, module addressing, basic relay, input, output and timer counter instruction, arithmetic and comparison function,		
Unit:5	**SCADA & distributed control system**	**7 Hours**
Introduction, block diagram, elements of SCADA, features of SCADA, MTU, RTU functions, applications of SCADA, communications in SCADA, introduction to DCS, architecture, input and output modules, specifications of DCS.		
Unit :6	**Material handling, automated storage system, and Identification Technologies**	**8 Hours**
The material handling function, its types, analysis for Material handling systems, Storage system performance, automated storage/retrieval systems, work-in-process storage, interfacing handling and storage with manufacturing. Product identification system: Barcode, RFID etc		
	Total Lecture Hours	**45 Hours**

Text books	
1	Programmable Logic controllers and Industrial Automation by Madhuchhanda Mitra, Samarjit Sen Gupta,Penram International Publishing India Pvt. Ltd,2017
2	The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.

Reference Books	
1	Programmable Logic Controllers, Principles and Applications, John W. Webb, Ronald A . Prentice Hall of India Pvt. Ltd,5th Edition,2002
2	Industrial Instrumentation and Control, S.K. Singh, The McGraw-Hill Companies, 2007

MOOCs Links and additional reading, learning, video material	
1	https://youtu.be/zno8BYcdQzk?si=I6xOQaDMfvfcn_ES
2	https://youtu.be/x3MUGVKWXdw?si=BVXQxV3YcxFYebhz
3	https://youtu.be/OOSO0VWhaMU?si=8XmrXHAwCv9Wqx8_
4	https://youtu.be/r3cW9AyFPB8?si=fGY2D8_V59Ps_2LR