Veermata Jijabai Technological Institute (V.J.T.I)

(Central Technological Institute, Maharashtra State, INDIA)
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Programme Name: Diploma In Electrical Engineering

Programme Code	**: DEE**	**With Effect From Academic Year**	**: 2025-26**
Duration of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Sixth**	**Scheme**	**: R-2023**

Sr No	Course Title	Abbreviation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Term Work + Assignment)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory					Based on LL & TL				Based on Self Learning		Total Marks
																		Practical						
						CL	TL	LL					FA-TH(MST)	SA-TH (ESE)		Total		FA-PR(CA)		SA-PR (PR/OR)		SLA		
													Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	SWITCHGEAR AND PROTECTION	SWP	DSC	232EE61		3		3		6	3	3	30	70	28	100	40	25@	10	25#	10	-	-	150
2	ELECTRICAL DRIVES	ED	DSC	232EE62		3		3		6	3	3	30	70	28	100	40	25@	10	25#	10	-	-	150
3	HIGH VOLTAGE ENGINEERING	HVE	DSC	232EE63		3		3		6	3	3	30	70	28	100	40	25@	10	25#	10	-	-	150
4	ELECTIVE-II	-	DSC			3		3		6	3	3	30	70	28	100	40	25@	10	25#	10	-	-	150
5	PROJECT (Major Project)	-	INP	232EE65				6	2	8	4							100@	40	75#	30	25	10	200
6	NEW TRENDS IN INDUSTRIES	NTI	AEC	232EE66				2	2	4	2	-	-	-	-	-	-	50@	20	-	-	25	10	75
7	DEVELOPMENT OF LIFE SKILLS	DOLS	AEC	232EE67				2	2	4	2							50@	20	-	-	25	10	75
Total						12		22	06	40	20		120	280		400		300		200		50		950

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

Course Category: Discipline Specific Course Core (DSC): 2, Discipline Specific Elective (DSE): 0, Value Education Course (VEC): 1, Intern. /Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0

Curriculum Coordinator

Head of Electrical Engineering (DEE)

Dean Diploma

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: SWITCHGEAR AND PROTECTION
COURSE CODE	: 232EE61

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL Practical				Based on SL		Total Marks
				CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR (CA)		SA-PR (OR/PR)		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE61	SWITCHGEAR AND PROTECTION	SWP	DSC	3	-	3	-	6	3	3	30	70	28	100	40	25@	10	25#	10	-	-	150

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

After studying this subject, students will be able

1) Learn the principles, concepts & procedural aspects of switchgear & protection.
2) Identify the various components of switchgear & protection Systems.
3) Know the specifications & select switchgear & protection system
4) Identify the faults & repairs

III. COURSE OUTCOMES:

Student should be able to

CO1	Know the importance of different types of faults along with necessity of protection and study different types of fuses
CO2	Describe the various types of circuit breakers and relays.
CO3	Apply different relays and circuit breakers in power system equipment for protection

CO4	Study of different types of surge arrestors and surge absorbers

IV. COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		**Topics/Sub-topics**	**Hours**	**Marks**	**CO**	**R Level (%)**	**U Level (%)**	**A Level (%)**
1		**Fundamental**	4	5	1	40%	30%	30%
	1.1	Necessity & functions of protective system						
	1.2	Normal & abnormal conditions.						
	1.3	Types of faults & their causes.						
2		**Circuit Interrupting Devices**	08	12	2	30%	40%	30%
	2.1	HRC fuses - construction, types, working, characteristics, ratings and applications						
	2.2	isolators- Introduction						
	2.3	Arc formation process, methods of arc extinction, related terms.						
	2.4	Definition: Arc voltage, Recovery voltage, Restriking voltage, RRRV, current chopping						
	2.5	Circuit breakers- Concept, Classification, Working principle, Construction, Sulpher-Hexafluoride circuit breaker (SF6). Vacuum circuit breaker. (other Circuit Breakers covered in practical)						
3		**Protective Relaying**	7	10	2	30%	30%	40%
	3.1	Requirements- relay time, related terms.						
	3.2	Classification - Electromagnetic attraction, induction static, microprocessor-based relays.						
	3.3	Protective transformers						
	3.4	Over current relay-Time current characteristics.						
	3.5	Distance relay						
	3.6	Directional relay						
	3.7	Differential Relay. (Simple numerical on relay setting)						
4		**Protection of Alternator**						
	4.1	Abnormalities & Faults						

	4.2	Differential protection	5	8	2,3	20%	40%	40%
	4.3	Over current, earth fault, inter-tum fault, negative phase sequence, overheating protection.						
	4.4	Reverse power protections. (Simple numerical on differential protection)						
SECTION-II								
5		**Protection of Transformer**	6	12	3	20%	70%	10%
	5.1	Abnormalities & faults.						
	5.2	Differential, over current, earth fault, inter-tum, restricted earth fault, overheating protection.						
	5.3	Buchholz relay (Simple numerical on differential protection)						
6		**Protection of motor**	5	08	3	40%	50%	10%
	6.1	Abnormalities & faults.						
	6.2	Short circuit protection, Overload protection, Single phase presenter.						
7		**Protection of Busbar and Transmission Line**	6	07	3	20%	40%	40%
	7.1	Abnormalities & faults.						
	7.2	Bus bar protection.						
	7.3	over current, distance protection. Pilot wire protection.						
8		**Over Voltage Protection**	7	08	4	30%	30%	40%
	8.1	Causes of overvoltage.						
	8.2	Lighting phenomena & over voltage due to lightning						
	8.3	Protection of transmission line & substation from direct stroke.						
	8.4	Types of lighting arresters & surge absorbers & their Construction & principle of operation.						
	8.5	Insulation co-ordination						

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Tutorials	Approx. Hours	CO
1	I) Identify the components of different types of circuit breakers with their specification (through visits, video or model). i) Low tension air circuit breaker. (including protective devices) ii) Minimum Oil Circuit Breaker (MOCB) iii) Miniature Circuit Breaker (M C B) iv) Moulded Case Circuit Breaker (M C C B) v) Earth Leakage Circuit Breaker (E L C B) or Residual Leakage Circuit Breaker (R L C B)	3	1,2
2	Plot performance characteristics of over current relay.	3	2,3
3	Simulation of alternator protection.	3	2,3
4	Simulation of transformer protection.	3	2,3
5	Collect data for different types and specifications of lightening arrestor.	3	4
6	Collect data about a typical HT/LT substation scheme.	4	1

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

Assignments (if any)

Report on industrial visit to substation.

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam

- Micro-project/Assignments
- Tutorial Performance

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1.	Ram Badri	Power System Protection and Switchgear	l" Edition Tata McGraw-Hill.
2.	Sunil S Rao	Switchgear Protection and **Power** Systems	2008 Edition Khanna Publishers.
3.	U A Bakshi	Switchgear and Protection	1" Edition, Technical Publications, Pune
4.	Deshpande M	Switchgear and Protection	1st Edition, Tata McGraw-Hill
5.	Haroon Asfaq	Switchgear and Protection	2n Edition, Khanna Publishing Book Company (P) Ltd
6.	Singh,Ravindra	Switchgear and Power System Protection	PHI Publications
Websites:			
https://www.youtube.com/live/T1m_Wsd2Ppw?si=F4B8H5PtGbX29yVk			
https://www.youtube.com/live/LOcqOoZNotU?si=FLlq7YKiP6vaJ0D3			
https://www.youtube.com/live/LOcqOoZNotU?si=8Wv4EM_ABdvA5Da2			
https://www.youtube.com/live/Jamak9rY_gY?si=TrMaR2TpJuvxoE_i			
https://www.youtube.com/live/Jamak9rY_gY?si=rUfovRO4QySjJVWs			
https://www.youtube.com/live/820RB7xyy7o?si=aInqRSQJf4krrpXZ			

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	-	-	1	1	1	1	3	1	1	2
CO2	3	3	3	3	1	2	1	3	2	3	1
CO3	3	3	2	2	1	1	1	3	-	-	2
CO4	3	-	2	3	2	1	1	3	-	-	1

Curriculum Coordinator

Head of the department
Diploma in Electrical Engineering

Dean-Diploma

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: FIFTH
COURSE TITLE	: ELECTRICAL DRIVES
COURSE CODE	: 232EE62

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbrevation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme												
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL Practical				Based on SL		Total Marks
												FA-TH (MST)	SA-TH (ESE)		Total	FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE62	ELECTRICAL DRIVES	ED	DSC	3		3	2	8	2.5	03	30	70	100	40	25 @	10	25#	10			150	3

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

- Control dc and ac power using proper power electronic device.
- Understand the steady state and dynamic behavior of electrical drives

III. COURSE OUTCOMES:

Student should be able to

CO1	Select the appropriate electric motor and drive for an application
CO2	Employ various techniques for Induction motor control
CO3	Propose appropriate method of control for a DC machine and Synchronous machine

IV.COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Electrical Drives**	6	8	CO1	60%	30%	10%
	1.1	Electrical Drives-An introduction						
	1.2	Parts of Electrical Drives						
	1.3	Choices of Electrical Drives						
	1.4	Status of dc and ac drives						
	1.5	Advantages of Electrical Drives						
2		**Dynamics of Electric Drives**	8	15	CO1	50%	30%	20%
	2.1	Fundamental Torque equation						
	2.2	Types of load, Passive and Active loads						
	2.3	Quadrantal speed torque characteristics of Motor and load combination.						
	2.4	Dynamics of motor-load combination.						
3		**Control of Electrical Drives**	6	12	CO2	50%	30%	20%
	3.1	Modes of operation						
	3.2	Speed control & Drive Classification.						
	3.3	Closed loop control of Drives Current limit control, Closed loop motor control, Closed loop speed control, closed loop control of multi motor drive, Phase locked loop control						

		SECTION-II						
4		**DC Drives:**	8	15	CO2, 3	40%	30%	30%
	4.1	Speed control & braking operation						
	4.2	Single Phase Half Wave Converter Drives.						
	4.3	Single Phase Full Converter Drives						

	4.4	Three Phase Half Converter Drives.						
	4.5	Three Phase Full Converter Drives						
	4.6	Dual Converter Drive						
5		**DC Drives using Chopper**						
	5.2	Classification based on output voltage and quadrant operation	6	10	CO2, 3	40%	30%	30%
	5.3	Chopper Controlled DC Drives A) Class A Chopper Drive B) Class B Chopper Drive C) Class C Chopper Drive D) Class D Chopper Drive Class E Chopper Drive						
	5.4	Applications						
	5.2	Classification based on output voltage and quadrant operation						
	5.3	Chopper Controlled DC Drives E) Class A Chopper Drive F) Class B Chopper Drive G) Class C Chopper Drive H) Class D Chopper Drive Class E Chopper Drive						
	5.4	Applications						
6		**AC Drives**	6	10	CO2, 3	40%	30%	30%
	6.1	Modeling of induction machine (Review),						
	6.2	Speed control methods for three phase cage induction motor						
	6.3	Starting and Braking methods						
	6.4	Scalar control of induction motor – Stator Voltage Control						
	6.5	Principle of vector control and field orientation						
	6.6	VSI fed induction motor drive						
	6.7	closed loop speed control block diagram, Stator current control methods fed induction motor drive						
	6.8	Sensorless control and flux observers, Direct torque and flux control of induction motor						

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Unit	Tutorials	Approx. Hours	CO
1		Verify Speed – Torque characteristics of chopper fed D. C. series motor.	2	1
2		Demonstrate operation and application of single-phase full wave, half controlled converter for open loop speed control of D. C. shunt motor.	2	1
3		Demonstrate operation and application of single-phase full wave, full controlled converter for open loop speed control of D. C. shunt motor.	2	1
4		Demonstrate speed control of Induction motor using V/f method.	2	1
5		Demonstrate speed control of Induction motor using Kramer speed control method.	2	2
6		To perform regenerative braking on three phase Induction Motor	2	2
7		To control the speed of a three-phase slip ring Induction motor using rotor impedance control	2	3

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

Assignments (if any)

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

a. Tutorials
b. Midterm Test Exam
c. Self-learning
d. Term Work
e. Seminar/Presentation

Summative Assessment (Assessment of Learning)

f. End Term Exam
g. Micro-project/Assignments

Tutorial Performance

VIII. TEXT BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	B. K. Bose	Modern Power Electronics and AC Drives	Pearson Education
2	G.K. Dubey	"Fundamentals of Electrical Drives	Narosa Publication, 2001

REFERENCE BOOKS

Sr. No.	Author	Title	Publisher and Edition
1	R. Krishnan	Modeling, Analysis and Control	Prentice Hall
2	P.C. Krause, O. Wasynczuk, and S. D. Sudhoff	Analysis of Electric Machinery	McGraw-Hill Book Company

IX. COs POs

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	-	1	2	-	-	2	3	-	2	1
CO2	3	2	2	3	2	1	2	3	2	2	2
CO3	2	2	3	3	2	1	2	2	3	2	2

Curriculum Coordinator **Head of the Department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: HIGH VOLTAGE ENGINEERING
COURSE CODE	:232EE63

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL				Based on SL		Total Marks
																Practical						
				CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR (CA)		SA-PR (OR/PR)		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE63	HIGH VOLTAGE ENGINEERING	HVE	DSC	3	0	3		6	3	3	30	70	28	100	40	25@	10	25#	10			150

Total IKS Hrs for Sem.: Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

The students will be able to:

1. To provide an understanding of high voltage phenomena and to present basic of high voltage insulation testing and designing.
2. Understand the generation and measurement of high voltages
3. Understand electric fields and field stress control around high voltage systems.
4. Understand the phenomena involved in non-destructive insulation and testing as well as over voltages in power systems.

III. COURSE OUTCOMES:

Student should be able to

CO1	Explain the various breakdown processes in solid, liquid and gaseous materials.
com	Illustrate sound knowledge of Testing, Generation & measurement methods of DC, AC and impulse voltages and current.
CO3	Describe lightning phenomenon, natural cause of overvoltage in detail with formation of charge in clouds

CO4	To develop ability to carry out various testing procedures as per IS in laboratory and Understand earthing, safety and shielding of HV laboratory with judiciary aspect.

IV. COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level (%)	U Level (%)	A Level (%)
1		**Electric Field Stress**	6	8	1	40%	30%	30%
	1.1	Concept of Electric field stress, its control and estimation						
	1.2	Analysis of Electrical field intensity in Homogenous Isotropic Single dielectric and in multi dielectric system.						
2		**Conduction and breakdown in air and other gaseous dielectrics in electric fields.**	07	15	1	40%	30%	30%
	2.1	Ionization processes, Townsend's current growth equation-Primary and secondary processes.						
	2.2	Townsend's criterion for breakdown in electronegative gases.						
	2.3	Paschen's law, breakdown in non-uniform fields and corona discharges.						
	2.4	Post-breakdown phenomena and application.						
	2.5	Practical considerations in using gas for insulation purposes.						
3		**Conduction and Breakdown in solid and liquid dielectrics.**	10	12	1	40%	40%	20%
	3.1	Intrinsic, Electro-mechanical and Thermal breakdown						
	3.2	Breakdown of solid dielectrics in practice						
	3.3	Breakdown of composite insulation						
	3.4	Application of insulating materials in electrical power apparatus and electronic equipment.						

SECTION-II								
4		**Generation of High Voltage and Currents**	8	10	2	20%	40%	40%
	4.1	Generation of HVDC						
	4.2	Generation of HVAC and Impulse Voltage						
	4.3	Introduction to working of Impulse Generator						
	4.4	**Measurement of** HVDC						
	4.5	Measurement of HVAC and impulse voltage and currents						
5		**Testing and evaluation of dielectric materials and power apparatus**	8	15	3	20%	40%	40%
	5.1	Non-destructive testing of dielectric materials, DC resistivity *measurement*						
	5.2	Dielectric and loss factor measurement,						
	5.3	Partial discharge measurements.						
	5.4	Testing of insulators, bushing, isolators, circuit breakers, cable, transformers, high voltage motors, surge diverters.						
	5.5	Radio interference measurement.						
6		**Lightning and Switching Over Voltages**	4	10	4	30%	30%	40%
	6.1	Causes of over voltages, lightning phenomenon, Different types of lightening strokes and mechanisms of lightening strokes						
	6.2	Over voltage due to switching surges and methods to minimize switching surges.						
	6.3	Statistical approach of insulation coordination						
7.		**High Voltage Safety Principles**	4	5	4	40%	10%	50%
	7.1	Judiciary Aspects, a. Effect of electrical currents on the human body b. Electrical clearances Safety signs and working procedures						
	7.2	Safety Earthing						
	7.3	**Safety** in the High Voltage Laboratory						
Legends: R- Remember, U — Understand, A — Apply and above levels (Blooms's Revised Taxanomy).								

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Tutorials
1	5 assignments based on the syllabus
2	Visit to High Voltage Lab (report to be made)

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

- Create a diagram of the substation layout and highlight the potential areas where smart devices can be integrated.
- Design and build a smart meter.

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignments

Tutorial Performance

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	Naidu M.S. and Kamaraju V	High Voltage Engineering	TMH Publication, 2nd edition., 1995
2	Wadhwa C.L.	High Voltage Engineering	Wiley Eastern Ltd, I" edition., 1994.
3	Kuffel E. and Abdullah M	Introduction to High Voltage Engineering	Pergamon, 1970
Website:			
https://youtube.com/playlist?list=PLLy_2iUCG87AjWoOk0A3y4hpGQVTdtl6G&si=l9oW79dsGk4MFqvy			
https://www.nsgm.gov.in/en/smart-grid			
https://www.nsgm.gov.in/en/sg-technologies			

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	-	-	1	1	1	1	3	1	1	2
CO2	3	3	3	3	1	2	1	3	2	3	1
CO3	3	3	2	2	1	1	1	3	-	-	2
CO4	3	-	2	3	2	1	1	3	-	-	1

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

List of electives for Semester VI

Serial No.	Course Code	Course Title
1.	232EE6E1	SMART GRID
2.	232EE6E2	ENERGY CONSERVATION AND AUDIT
3.	232EE6E3	SUBSTATION PRACTICES
4.	232EE6E4	SIGNALS AND SYSTEMS

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: SMART GRID
COURSE CODE	:232EE6E1

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											Total Marks
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL Practical				Based on SL		
				CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR (CA)		SA-PR (OR/PR)		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE6E1	SMART GRID	SG	DSC	3	0	3		6	3	3	30	70	28	100	40	25@	10	25#	10			150

Total IKS Hrs for Sem.: Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

After studying this subject, students will be able

a. Develop a comprehensive understanding of modern power systems, focusing on both their physical and economic operations.
b. Analyze the role of information and communication technologies in modernizing the electric energy infrastructure.
c. Gain knowledge of key technologies such as smart metering and electric vehicles, among others.
d. Evaluate the impact of energy efficiency and demand response within the context of a smart grid.
e. To Understand the challenges associated with smart transmission systems.

III. COURSE OUTCOMES:

Student should be able to

CO1	Develop a foundational understanding of the current electric grid and power system, which may evolve over time through the emergence of Smart Grid technologies also understand the technology behind electric vehicle.
CO2	Understand the effects of integrating renewable energy resources into the grid and the challenges involved in their integration.

CO3	Gain insight into the communication, networking, and sensing technologies used in Smart Grid systems, and explore the principles and technologies that enable demand participation and ensure reliable 24/7 power delivery.

IV. COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		**Topics/Sub-topics**	**Hours**	**Marks**	**CO**	**R Level (%)**	**U Level (%)**	**A Level (%)**
1		**Introduction to smart grids**	10	15	2	40%	40%	20%
	1.1	Smart grid concept						
	1.2	Representative Architecture						
	1.3	Smart Grid components and technologies at transmission systems						
	1.4	Function of smart grid components and technologies at distribution level						
2		**Smart Grid Communications and Measurement Technology**	07	10	2 & 3	40%	30%	30%
	2.1	Communication and Measurement						
	2.2	Monitoring, PMU, Smart Meters, and Measurements Technologies						
	2.3	GIS and Google Mapping Tools						
	2.4	Multiagent Systems (MAS) Technology						
	2.5	Microgrid and Smart Grid Comparison						
3		**Smart Metering**	10	10	1	40%	40%	20%
	3.1	Evolution of electricity metering						
	3.2	Key components of smart metering						
	3.3	Overview of the hardware used in smart metering						
	3.4	Communications infrastructure and protocols for smart metering						
	3.5	Demand-side integration						
SECTION-II								

4		**Electric Vehicle**	07	13	1	40%	40%	20%
	4.1	Electric vehicle technologies						
	4.2	Electric vehicle components						
	4.3	International and Indian standards						
	4.4	Vehicle Grid Integration (VGI)						
	4.5	Motivation of VGI						
	4.6	Challenges and opportunities in VGI						
	4.7	Smart grid role in VGI						
5		**Smart grid — Energy Efficiency and Demand Response (DR)**	07	12	2	40%	40%	20%
	5.1	History of energy efficiency in India						
	5.2	Acts and regulations relatedto energy efficiency						
	5.3	Regulatory approach for energyefficiency						
	5.4	Demand Side Management						
	5.5	Technological components of DR programs						
	5.6	DR processes, DR pricing as an ancillary service						
6		**Case Studies and Testbeds for smart grid**	07	10	3	40%	30%	30%
	6.1	Introduction						
	6.2	Demonstration Projects						
	6.3	Smart grid project: smart microgrid villagein Odisha, India - location, functionality, time period						
	6.4	Smart grid project: smart microgrid villagein Odisha, India - brief description, background, implementation andoutcomes						
	6.5	Challenges of Smart Transmission						
	6.6	Benefits of Smart Transmission						
Legends: R- Remember, U — Understand, A — Apply and above levels (Blooms's Revised Taxanomy).								

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Unit	Tutorials	Approx. Hours	CO
1	1	Describe the key components and structure of the current electric grid.	2	1
2	5 & 6	Investigate the integration of renewable energy sources (wind, solar, etc.) into the grid and the challenges involved.	3	2
3	2 & 3	Understand the role of communication, networking, and sensing technologies in ensuring Smart Grid reliability.	3	3
4	4	What are types of Electric Vehicles explain the Technology Behind Electric Vehicles.	3	1

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

- Create a diagram of the substation layout and highlight the potential areas where smart devices can be integrated.
- Design and build a smart meter.

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignments

Tutorial Performance

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	India Smart Grid Forum (ISGF)	Smart Grid Handbook For Regular And Policy Makers	
2	A Keyhani, M Marwali	Smart power grids	Springer
3	Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkin	Smart Grid Technology And Applications	A John Wiley & Sons, Ltd., Publication
4	James Momoh	Smart Grid Fundamentals Of Design And Analysis	A John Wiley & Sons, Inc., Publication
Website:			
https://youtube.com/playlist?list=PLLy_2iUCG87AjWoOk0A3y4hpGQVTdtl6G&si=l9oW79dsGk4MFqvy			
https://www.nsgm.gov.in/en/smart-grid			
https://www.nsgm.gov.in/en/sg-technologies			

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO- 2	PSO - 3	PSO - 4
CO1	3	-	-	1	1	1	1	3	1	1	2
CO2	3	3	3	3	1	2	1	3	2	3	1
CO3	3	3	2	2	1	1	1	3	-	-	2

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: ENERGY CONSERVATION AND AUDIT
COURSE CODE	:232EE6E2

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbrevation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL Practical				Based on SL		Total Marks
				CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE6E2	ENERGY CONSWRVATION AND AUDIT	ECA	DSC	3		3		6	3	3	30	70	28	100	40	25@	10	25#	10			150

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

The students will be able to:

i. Identify areas for improvement, and learn to assess energy consumption.
ii. Identify areas for improvement, develop strategies to conserve energy in various sectors

III. COURSE OUTCOMES:

Student should be able to

CO1	Understand Energy Efficiency Principles
CO2	Apply Energy Audit Techniques and Methodology
CO3	Analyzing and Recommendations for Energy Conservation

IV. COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		**Topics/Sub-topics**	**Hours**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1		Energy Conservation	6	8	CO1	40 %	40%	20%
	1.1	Present energy scenario and Need of energy conservation.						
	1.2	State the meaning of term Energy Conservation. Energy Conservation Act — 2003.						
	1.3	Functions of Government Organization (NPC, MNRE, BEE, MEDA						
2		Energy Conservation in Lighting System	8	12	CO1, CO 2	30 %	30%	40%
	2.1	Basic terms used in Lighting system (Illumination).						
	2.2	Recommended Luminance levels						
	2.3	Procedure for assessing existing Lighting system in a facility.						
	2.4	Energy Conservation techniques in lighting system. • By replacing Lamp sources. • Using energy efficient luminaries. • Energy Conservation techniques in fans, Electronic regulators. Periodic survey and adequate maintenance programs.						
3		Energy Conservation techniques in Electrical Motors and Transformer	10	15	CO 1 CO 2 CO 3	20%	40%	40%
	3.1	Factors governing the selection of Induction motor.						
	3.2	Need for energy conservation in Induction motor.						
	3.3	Various energy conservation techniques in Induction motor.						

		By improving Power quality. By motor survey. • By matching motor. • By operating in star mode. By improving mechanical l) Power and transmission 2) Efficiency.						
	3.4	Energy Efficient motors.						
	3.5	Need of energy conservation in transformer.						
	3.6	Methods (related to material, design) to improve the performance of transformer.						
	3.7	Energy conservation techniques related to transformer. • Loading sharing Parallel operation						
Section II								
4		Energy Conservation in transmission and distribution system	5	9	CO1 CO2 C03	20%	40%	40%
	4.1	Scenario of transmission and distribution losses at state level, national level and at global level.						
	4.2	Types of losses in transmission and distribution system (commercial and technical losses)						
	4.3	Energy conservation techniques in transmission and distribution system related to technical losses. • By reducing 1^2 R losses. • By compensating reactive power flow. • By optimizing distribution • voltage • By balancing phase currents. By using energy efficient						
	4.4	Energy conservation techniques related to commercial losses.						
5		Relation Between Tariff And Energy Conservation	4	6	CO1 CO2 C03	20%	40%	40%
	5.1	Types of tariff structure.						
	5.2	Terms involved in tariff.						

	5.3	Specific tariff: • Two Part Tariff • Three Part Tariff • Flat rate Tariff • Block Rate Tariff • Power factor tariff Maximum Demand tariff Load factor tariff						
	5.4	Application of tariff system to reduce energy bill.						
	5.5	Simple numerical based on power factor and load factor tariff.						
6		Energy Conservation by Cogeneration	**5**	**5**	CO1 CO2 C03	20%	40%	40%
	6.1	What is cogeneration?						
	6.2	Need for cogeneration.						
	6.3	Classification of cogeneration system on the basis of sequence of energy use. Topping cycle Bottoming cycle						
	6.4	Classification of cogeneration system on the basis of technology. Steam turbine cogeneration. Gas turbine cogeneration Reciprocating engine cogeneration.						
	6.5	Factors governing the selection of cogeneration system.						
	6.6	Advantages of cogeneration						
7		Energy Conservation Equipment	**4**	**6**	CO2 C03	20%	40%	40%
	7.1	What is energy conservation equipment?						
	7.2	Energy conservation equipment related to Lighting system.						
8		Energy Audit	**6**	**9**	CO2 C03	20%	40%	40%
	8.1	Energy flow diagrams and its significance.						
	8.2	Energy audit instruments and their use						

	8.3	Prepare questionnaire for energy audit projects.						
	8.4	ABC analysis and it's advantages referred to energy audit projects.						
	8.5	Energy Audit procedure (walk through audit and detailed audit).						
	8.6	Calculation of simple pay back period (Simple numerical)						

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Unit	Tutorials	Approx. Hours	CO
1	1	Study of Electricity act 2003	4	CO1 CO2 CO3
2	2	Case study Energy Conservation in Lighting System in heavy industries	4	CO2 CO3
3	3	Study of Energy Conservation techniques in Electrical Motors and Transformer	4	CO2 CO3
4	4	Energy Conservation in transmission and distribution system	4	CO1 CO2
5	5	Case study of Relation Between Tariff And Energy Conservation	4	CO1 CO3
6	6	Energy Conservation by Cogeneration	4	CO2 CO3
7	7,8	Comparative study of energy efficient system	10	CO1 CO2 CO3
8	7,8	Visit at any residential or commercial organisation and prepare a report.	10	CO1 CO2 CO3

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

Assignments (if any)

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignments

Tutorial Performance

IX. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	S. Sivanagraju M. Balasubba Reddy D. Srilatha	Generation And Utilization Of Electrical Energy	Pearson, New Delhi
2	P. H. Henderson	India - The Energy Sector	University Press
3	Albert Thumann, C.E. M William J Younger C.E.M	Handbook Of Energy Audits	Fairmont Press, Inc, 7Th edition
4	B. G. Desai J. S. Rana A. V. Dinesh R. Paraman	Efficient Use And Management Of Electricity In Industry	Devki Energy Consultancy PVT. Ltd.

Websites:

1) http://nptel.ac.in/courses/108105058/2
2) Website of bureau of energy and efficiency :www.bee-india.nic.in
3) Website of Akshay Urja News Bulletin :www.mnes.nic.in
4) Notes on energy management on :www.energymanagertraining.comwww.greenbusiness.com.www.worldenergy.org

X.COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2	PSO- 3	PSO- 4
CO1	2	1	1	2	1	1	3	2	1	3	2
CO2	2	3	2	2	3	2	2	2	2	3	2
CO3	3	3	3	2	3	2	3	2	2	3	3

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: FIFTH
COURSE TITLE	: SUBSTATION PRACTICE
COURSE CODE	: 232EE6E3

I. TEACHING, LEARNING AND EXAMINATION SCHEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL Practical				Based on SL		Total Marks
				CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE6E3	SUBSTATION PRACTICE	ED	DSC	3		3		6	3	3	30	70	28	100	40	25 @	10	25 #	10	-	-	150

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

The students will be able to: Understand the theory, practical experiences and relevant soft skills associated with this course. Taught to demonstrate industry oriented skills.

III. COURSE OUTCOMES:

Student should be able to

CO1	Understand safety rules and maintenance for substation practices.
CO2	Analyze earthing and neutral-grounding of substation equipment and bus-bar layout.
CO3	Operate and maintain Gas-Insulated substation.

IV. COURSE CONTENT:

SECTION-I								
Unit & Sub-Unit		**Topics/Subtopics**	**Hours**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1		**Sub- stations and its Safety.**	6			30%	50%	20%
	1.1	Definition of substation.						
	1.2	Switching Substations						
	1.3	Classification of substation. Typical sub-stations in distribution system						
	1.4	Temperature class (Ignition Group). Weather protection.						
	1.5	Requirements of Electrical safety.						
2		**Substation Earthing & Neutral Grounding.**	11			25%	40%	35%
	2.1	Equipment earthing. Functions of Substations earthing system. Connection of electrical equipment to the substation earthing system.						
	2.2	Substation earthing system. Earth electrodes. Integrated earthing systems for two or more installations. Step potentials and touch potentials. Earth resistance measurement. Earth screen.						
	2.3	Definition of neutral grounding. Disadvantages of ungrounded systems. Advantages of neutral grounding. Types of grounding. Reactance in neutral connection. Neutral point earthing of transformer L.V. circuits. Neutral grounding practice. Earthing transformer. Ratings of neutral devices.						
3		**Substation equipment and Bus-Bar layout**	8			30%	35%	35%
	3.1	Requirements of isolators & its rating. Ratings of relays. Location of Relays, C.B., C.T., P.T.						
	3.2	Bus bar arrangements in switch yards. Bus bar systems recommended for large important sub-stations.						
	3.3	Maintenance zoning. Uses of a load break switch. Isolated phase Bus systems. Continuous housing types isolated phase basis.						

SECTION-II								
4		**Maintenance procedure in substation**	9			50%	30%	20%
	4.1	Break Down Maintenance versus preventive maintenance. Inspections, servicing, overhaul. Guidelines of maintenance of switchgear. Field quality plans.						
	4.2	Insulation resistance measurement at site. Maintenance of SF6 circuit breaker. Relays & Isolators Typical maintenance of record cards.						
	4.3	Likely troubles and essential periodic checks. Installation of Draw out metal clad switchgear. Installation of outdoor circuit						
5		**Gas Insulated substation**	6			60%	20%	20%
	5.1	Gas Insulated Substation (GIS). Single line diagrams of substation.						
	5.2	SF6 insulated switchgear. Partial discharge monitoring.						
	5.3	Loss measurement and temperature rise tests Installation and maintenance of GIS.						

V. SUGGESTED SELF LEARNING ASSIGNMENTS / MICRO PROJECT / ACTIVITIES

Assignments (if any)

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignment
- Tutorial Performance

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	V. K. Mehta	Principles Of Power System	S.Chand & Co.Ltd, Reprint, 1996. ISBN: 81-219-0594-X
2	M. L. Soni, P. V. Gupta, U.S. Bhatnagar	A Course in Electrical Power	Dhanpat Rai & Co. (P) Ltd., First Edition, 1997-98.
3	Sunil S. Rao	Switchgear Protection and Power Systems	Khanna Publisher, 13th Edition, 2008 ISBN :10: 8174092323

WEBSITES

1) **http://nptel.iitm.ac.in**
2) **https://sa-nitk.vlabs.ac.in/List%20of%20experiments.html**
3) **http://www.edumedia-sciences.com**

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Lifelong Learning	PSO-1	PSO- 2	PSO - 3	PSO - 4
CO1	3	1	2	1	2	-	1	-	-	2	1
CO2	2	3	3	2	1	-	1	2	3	2	-
CO3	2	2	3	2	1	-	2	1	2	-	1

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: SIGNALS AND SYSTEMS
COURSE CODE	: 232EE6E4

I. TEACHING, LEARNING AND EXAMINATION SHCEME:

Course Code	Course Title	Abbrevation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.			SLH	NLH				Theory				Based on LL & TSL / Practical				Based on SL		Total Marks
				CI	TI	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE6E4	SIGNALS AND SYSTEMS	SS	DSC	3	-	3	-	6	3	3	30	70	28	100	40	25 @	10	25 #	10	-	-	150

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

III. COURSE OUTCOMES:

Student should be able to

CO1	Understand the fundamental concepts of signal processing.
CO2	Develop skills in analyzing and processing various types of signals.
CO3	Apply signal processing techniques in practical engineering applications.

IV. COURSE CONTENT:

SECTION-I							
Unit & Sub-Unit	**Topics/Sub-topics**	**Hours**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**

1.		**Introduction to Signals and Systems:**	8	13	1	30	50	20
	1.1	Definition and classification of signals.						
	1.2	Basic operations on signals.						
	1.3	Continuous and discrete-time systems.						
2.		**Fourier Analysis:**	12	22	**2**	20	40	40
	2.1	Fourier series representation of periodic signals.						
	2.2	Fourier transform for aperiodic signals.						
	2.3	Fourier series representation of periodic signals.						
	2.4	Properties and applications of Fourier transforms.						
SECTION-II								
3.		**Sampling Theorem:**	12	22	1,2	20	40	40
	3.1	Nyquist theorem.						
	3.2	Sampling and reconstruction of signals.						
	3.3	Aliasing and its effects.						
4.		**Discrete-Time Signal Processing:**	8	13	2	30	50	20
	4.1	Z-transform and its properties.						
	4.2	Discrete convolution.						
	4.3	Digital filters: FIR and IIR filters.						

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Unit	Tutorials	Approx. Hours	CO
1	3,4	To study application of signal processing in Audio and Speech Processing.	3	3
2	3,4	To study application of signal processing in Image and Video Processing.	3	3
3	3,4	To study application of signal processing in Telecommunications	3	3
4	3,4	To study application of signal processing in Radar and Sonar Systems	3	3
5	3,4	To study application of signal processing in Seismology and Earthquake Detection	3	3

6	3,4	To study application of signal processing in Machine Learning and Artificial Intelligence	3	3
7	3,4	To study application of signal processing in Control Systems	3	3
8	3,4	To study application of signal processing in Audio/Visual Effects	3	3
9	3,4	To study application of signal processing in Environmental Monitoring	3	3
10	3,4	To study application of signal processing in Biomedical Signal Processing	3	3

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

Assignments (if any)

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignments

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	Alan V. Oppenheim and Alan S. Willsky	Signals and Systems	Pearson Education.
2	John G. Proakis and Dimitris G. Manolakis.	Digital Signal Processing: Principles, Algorithms, and Applications	Pearson Education.

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	1	1	1	0	1	1	2	3	-	-
CO2	3	3	3	2	1	1	2	2	-	-	-
CO3	2	3	3	3	2	3	2	2	1	-	2

Curriculum Coordinator | Head of the department Diploma in Electrical Engineering | Dean-Diploma

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: PROJECT (Major Project)
COURSE CODE	: 232EE65

I. TEACHING, LEARNING AND EXAMINATION SCHEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme											
				Actual Contact Hrs.								Theory				Based on LL & TSL				Based on SL		Total Marks
																Practical						
				CL	TL	LL	SLH	NLH			FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE65	PROJECT (Major Project)	-	INP			8		8	4							100 @	40	100 #	40	-	-	200

Total IKS Hrs for Sem.: 00 Hrs
Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

To develop problem solving ability through scientific and systematic way using technical knowledge and skills gained during the program

III. COURSE OUTCOMES:

Student should be able to

CO1	Work in a team, plan and coordinate the work
CO2	Analyze the project requirements and review the available literature
CO3	Formulate the methodology to solve the identified problem

Project Topic Selection

The project topic can be selected from any of the broad areas listed below related to electrical discipline:

- Fabrication of small machines, devices, demonstration models, etc.
- Design and fabrication of mechanisms, machines, devices, etc.
- Development of computer programming for designing of machine components, simulation of movements and operations, 3D modeling, etc.
- Industry supported projects: Solving problem faced by industry
- Investigative projects: Causes for change in performance or structure under different constraints through experimentation and data analysis
- Maintenance based projects: Systematic maintenance of a machine/equipment/ system lying idle due to lack of maintenance, repair it and bring it to working condition
- Industrial engineering based projects: Projects based on work study, method study, method improvement or productivity improvement
- Low cost automation projects
- Innovative/ creative projects: Design, development and implementation of new concepts
- Environment based projects: Pollution control, waste management, waste recycling, energy conservation, etc.
- Market survey project: Identification of demand, sales forecasting, marketing strategies, distribution channels, etc.
- Project based on recent developments
- Technology application for rural areas

Activity Planning

1. Group formation (Maximum students 3 per group)
2. Literature survey and searching of topic
3. Project topic selection
4. Define problem statement for project work
5. Submission of synopsis of proposed work (2 to 5 pages)
6. Project planning and methodology
7. Allocation of work responsibility to team members
8. Procurement of raw material / collection of data/ survey/ Analysis
9. Project execution
10. Implementation of modules / Testing
11. Progressive presentation of work

Report Writing

- Each group shall submit one soft and one hard copy of project report to the department apart from individual copy.
- The project report shall be of 50 to 70 pages.
- The structure of the report shall be as follows:
- Title page
- Certificate
- Abstract
- Acknowledgement
- Table of contents
- List of tables
- Introduction
- Objective of project
- Methodology used: Design, Drawing Assembly, Testing, Costing
- Results
- Conclusions
- Scope for future work
- References
- Annexure
- The format shall be as below:
- Font type — Times new roman
- Font size: Heading — 14 font (bold), content - 12 font
- Alignment — Justified
- Line spacing — 1.5
- Header content — left side — name of apartments, right side — name of project
- Footer — Page number (Center)
- Numbering of chapters, sections and subsections: Decimal form e.g. Chapter 2, section 2.1, 2.2, etc and subsection 2.2.1, 2.2.2, etc.
- Numbering of tables and figures: Chapter wise e.g. Chapter 2, Table No. 2.1, 2.2, etc. and Figure No. 2.1, 2.2, etc.

Project Assessment

Continuous evaluation of individual team member shall be followed. Each student shall maintain a project diary giving details of planning, work execution, information collected, etc. on weekly basis assessed regularly by project guide. Attendance of the student shall also be taken into account during assessment. The project presentation and oral shall be jointly evaluated by external examiner and guide.

CO PO Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	2	3	2	2	2	-	1	2	3	-	-
CO2	2	2		-	-	-	1	2	-	-	-
CO3	2	3	3	-	-	-	1	2	1	-	2

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: NEW TRENDS IN INDUSTRIES
COURSE CODE	: 232EE66

I. TEACHING, LEARNING AND EXAMINATION SCHEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs.						Paper Duration		Theory				Based on LL & TSL				Based on SL		Total Marks
																Practical						
				CL	TL	LL	SLH	NLH			FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA		
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE66	NEW TRENDS IN INDUSTRIES	NTI	AEC			2	2	4	2							50 @	20			25	10	75

Total IKS Hrs for Sem.: 00 Hrs
Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

After studying this subject, students will be able to

1) Identify the new devices, drives, equipment's, machines, gadgets with specifications.
2) Collect the information about new trends and technologies.
3) Familiarization of new technology with various new devices and drives, etc.

III. COURSE OUTCOMES:

Student should be able to

CO1	Acquire information regarding various new devices, derives, machines, etc from different sources.
CO2	Interpret the data acquired from **various** sources.
CO3	Hands on practice on various new devices, gadgets, etc
CO4	Prepare a market survey report and procure the equipment as and when needed.

IV. COURSE CONTENT

SECTION-I							
Unit & Sub-Unit	**Topics/Subtopics**	**Hours**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1	Market Survey: A group of four or six students should collect information from the market and for industries regarding specifications, technologies, utility, applications, cost of any three manufactures/ industries devices, gadgets, machines, drives, etc.	6	12	CO1	30%	50%	20%
2	Product Report: Report is to be prepared by each group based on the survey done in the market industries and submit it as team work Seminar: Individual student from each group has to prepare for power point presentation on their surveyed product and submit the report.	6	13	CO2	30%	50%	20%
3	**New** equipment presents in various labs are to be utilized for doing practice for its operation and working. Acquire the knowledge about that new equipment used in industry.	6	13	CO3	30%	50%	20%
4.	**Procurement** new equipment the survey any equipment is new in technology and utilized in the electrical field procure it for practice and study.	6	12	CO4	30%	50%	20%

V. CO PO Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO- 2	PSO - 3	PSO - 4
CO1	2	3	2	2	2	-	1	2	3	-	-
CO2	2	2		-	-	-	1	2	-	-	-
CO3	2	3	3	-	-	-	1	2	1	-	2

Curriculum Coordinator **Head of the department** **Dean-Diploma**

Diploma in Electrical Engineering

DIPLOMA PROGRAMME	: DIPLOMA IN ELECTRICAL ENGINEERING
PROGRAMME CODE	: DEE
SEMESTER	: SIXTH
COURSE TITLE	: DEVELOPMENT OF LIFE SKILLS
COURSE CODE	: 232EE67

I. TEACHING, LEARNING AND EXAMINATION SCHEME:

Course Code	Course Title	Abbreviation	Course Category	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs.						Paper Duration	Theory					Based on LL & TSL				Based on SL	Total Marks
																Practical					
				CL	TL	LL	SLH	NLH			FA-TH (MST)	SA-TH (ESE)		Total		FA-PR		SA-PR		SLA	
											Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
232EE67	DEVELOPMENT OF LIFE SKILLS	DOLS	AEC			2	2	4	2							50 @	20			25	10	75

Total IKS Hrs for Sem.: 00 Hrs

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination

II. COURSE OBJECTIVES:

After studying this subject, students will be able to

1. To train students in overcoming stage fright, to attain composure, to organize thought process and develop voice modulation and body language.
2. To develop students' interpersonal skills and leadership quality, to improve their listening and persuasive skills, and train them in the ways of identifying the source of information, collecting and planning.
3. To prepare students for interview, make them aware of personal grooming and concept of time, to teach students positive thinking as an ongoing process, to have optimistic approach, to cultivate right values and attitude.

III. COURSE OUTCOMES:

Student should be able to

CO1	Understand and appreciate importance of life skills.
CO2	Use self-analysis and apply techniques to develop personality
CO3	Improve the presentation skills.
CO4	Improve reading, listening and notes taking skills.

IV. COURSE CONTENT

SECTION-I							
Unit & Sub-Unit	**Topics/Subtopics**	**Hours**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1	**Oral Skills and Writing Skills**	6	8	CO1	30%	50%	20%
1.1	**SELF ANALYISIS-** Need of Self Analysis, Attitude and types (positive, negative, optimistic and pessimistic) Guidelines for developing positive attitude.						
1.2	Group Discussion						
2	**SELF DEVELOPMENT**	6	12	CO2	30%	50%	20%
2.1	Goal setting and its importance						
2.2	Characteristics of Goal setting (SMART- Specific, Measurable, Attainable, Realistic, Time bound)						
2.3	Time Management - Importance, prioritization of work, time matrix, time savers, and time wasters.						
2.4	Stress Management - Definition, types of stress, causes of stress, managing stress, and stress busters2.2						
3	**PRESENTATION TECHNIQUES**	6	15	CO3	30%	50%	20%
3.1	Importance of presentation						
3.2	Components of effective presentation (Body language, voice culture, rehearsal,etc)						
3.3	Preparing for presentation						
3.4	Use of audio/video aids. (audio, video, transparency's, PowerPoint presentations, etc)						
3.5	Performing presentation (Seminars, paper presentations, compering, etc)						
4.	**Managerial Skills**	6	15	CO4	30%	50%	20%
4.1	Resume writing						
4.2	Interview Techniques						

V. LIST OF ASSIGNMENTS/TUTORIALS:

Sr. No.	Tutorials	Approx. Hours	CO
1	Students deliver a prepared speech.	3	3
2	Group discussion conducted in class.	3	3
3	Group of 6-7 students prepare a PowerPoint and deliver in class.	3	3
4	Assignments on resume writing and summarization	3	3
5	Mock interviews in class	3	3

VI. SUGGESTED SELF LEARNING ASSIGNMENTS / MICROPROJECT / ACTIVITIES

Assignments (if any)

Micro Project (if any)

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- Tutorials
- Midterm Test Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project/Assignments

VIII. REFERENCE BOOKS AND WEBSITES:

Sr. No.	Author	Title	Publisher and Edition
1	Raman Meenakshi	Business Communication-	Oxford, India,First edition, 2008
2	Sekaran Uma,	Organisational Behaviour,	New Delhi, Second edition,2008 Tata Mcgraw Hill

IX. COs POs Matrix

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)			
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3	PSO-4
CO1	3	1	1	1	0	1	1	2	3	-	-
CO2	3	3	3	2	1	1	2	2	-	-	-
CO3	2	3	3	3	2	3	2	2	1	-	2

Curriculum Coordinator **Head of the department** **Dean-Diploma**
Diploma in Electrical Engineering