

**SANDIP UNIVERSITY, SIJOU, MADHUBANI**  
**IV SEMESTER DIPLOMA IN ELECTRICAL ENGINEERING**  
**Skill Based Diploma in Engineering Course**  
**MANAGEMENT**

<b>Subject Code EE401T</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
			<b>CT</b>	<b>:</b>	<b>20</b>		

**CONTENTS: THEORY**

	Name of the Topic	Hours	Marks
Unit-01	Overview Of Business Types of Business Service Manufacturing Trade Industrial sectors Introduction to Engineering industry Process industry Textile industry Chemical industry Agro industry Globalization Introduction Advantages & disadvantages w.r.t. India Intellectual Property Rights (I.P.R.)	02	---
Unit-02	Management Process What is Management? Evolution Various definitions Concept of management Levels of management Administration & management Scientific management by F.W.Taylor Principles of Management (14 principles of Henry Fayol) Functions of Management Planning Organizing Directing Controlling	07	10
Unit-03	Organizational Management Organization :- Definition Steps in organization Types of organization Line Line & staff Functional Project Departmentation Centralized & Decentralized Authority & Responsibility Span of Control Forms of ownership Proprietorship Partnership Joint stock Co-operative Society Govt. Sector	07	10

Unit-04	Human Resource Management Personnel Management Introduction Definition Functions Staffing Introduction to HR Planning Recruitment Procedure Personnel– Training & Development Types of training Induction Skill Enhancement Leadership & Motivation Maslow's Theory of Motivation Safety Management Causes of accident Safety precautions Introduction to – Factory Act ESI Act Workmen Compensation Act Industrial Dispute Act	08	14
Unit-05	Financial Management Financial Management- Objectives & Functions Capital Generation & Management Types of Capitals Sources of raising Capital Budgets and accounts Types of Budgets Production Budget (including Variance Report ) Labour Budget Introduction to Profit & Loss Account ( only concepts) ; Balance Sheet Introduction to – Excise Tax Service Tax Income Tax VAT Custom Duty	08	14
Unit-06	Materials Management Inventory Management (No Numerical) Meaning & Objectives ABC Analysis Economic Order Quantity Introduction & Graphical Representation Purchase Procedure Objects of Purchasing Functions of Purchase Dept. Steps in Purchasing Modern Techniques of Material Management Introductory treatment to JIT / SAP / ERP	08	14

Unit-07	Project Management ( No Numerical) Project Management Introduction & Meaning Introduction to CPM & PERT Technique Concept of Break Even Analysis Quality Management <ul style="list-style-type: none"> <li>• Definition of Quality , concept of Quality , Quality Circle, Quality Assurance</li> <li>• Introduction to TQM, Kaizen, 5 'S',</li> </ul>	08	08
Total		48	70

Text/Reference Books:		
Titles of the Book	Name of Authors	Name of the Publisher
Industrial Engg & Management	Dr. O.P. Khanna	Dhanpal Rai & sons New Delhi
Business Administration & Management	Dr. S.C. Saksena	Sahitya Bhavan Agra
The process of Management	W.H. Newman E.Kirby Warren Andrew R. McGill	Prentice- Hall
Industrial Management	Rustom S. Davar	Khanna Publication
Industrial Organisation & Management	Banga & Sharma	Khanna Publication
Industrial Management	Jhamb & Bokil	Everest Publication , Pune
Management	Deepak Chandra	Foundation Publishing

## TESTING & MAINTENANCE OF ELECTRICAL MACHINES

<b>Subject Code EE402T</b>	<b>Theory</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>	
	<b>—</b>	<b>—</b>	<b>—</b>	<b>CT</b>	<b>:</b>	<b>20</b>	

### CONTENTS: THEORY

	Name of the Topic	Hours	Marks
Unit-01	<p>Safety &amp; Prevention of Accidents:                      Definition of terminology used in safety; safety, hazard, accident, major accident hazard, responsibility, authority, accountability, monitoring,                      I.E. Act &amp; statutory regulations for safety of persons &amp; equipments working with electrical installation,                      Dos &amp; don'ts for substation operators as listed in IS                      Meaning &amp; causes of electrical accidents factors on which severity of shock depends,                      Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration,                      Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.</p>	05	06
Unit-02	<p>General Introduction:                      Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests.                      Methods of testing a) Direct, b) Indirect, c) Regenerative.                      Concept of routine, preventive &amp; breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule,                      Factors affecting preventive maintenance schedule.                      Introduction to total productive maintenance.</p>	08	12
Unit-03	<p>Testing &amp; maintenance of rotating machines:                      Type tests, routine tests &amp; special tests of 1 &amp; 3 phase Induction motors, Routine, Preventive, &amp; breakdown maintenance of 1 &amp; 3 phase Induction motors as per IS 9001:1992                      Parallel operation of alternators, Maintenance schedule of alternators &amp; synchronous machines as per IS 4884-1968                      Brake test on DC Series motor.</p>	07	10
Unit-04	<p>Testing &amp; maintenance of Transformers:                      Listing type test, routine test &amp; special test as per I.S. 2026-1981                      Procedure for conducting following tests:                      Measurement of winding resistance, no load losses, &amp; no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil &amp; winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test.                      Preventive maintenance &amp; routine maintenance of distribution transformer as per I.S. 10028(part III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 &amp; 3 phase transformer, load sharing calculations (numerical)</p>	12	12

Unit-05	<p>Testing &amp; maintenance of Insulation:  Classification of insulating materials as per I.S. 8504(part III)1994, factors affecting life of insulating materials, measurement of insulation resistance &amp; interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines &amp; applying the correction factor when the machine is hot. Properties of good transformer oil, list the agents which contaminates the insulating oil, understand the procedure of following tests on oil as per I.S. 1692-1978  a) acidity test b) sludge test c) crackle test e) flash point test. Filtration of insulating oil protection of electrical equipments (insulation) during the period of inactivity.  Methods of cleaning the insulation covered with loose, dry dust, sticky dirt, &amp; oily viscous films, procedure for cleaning washing &amp; drying of insulation &amp; Revarnishing Methods of internal heating &amp; vacuum impregnation.</p>	10	14
Unit-06	<p>Installation:  Factors involved in designing the machine foundation,  Requirement of different dimension of foundation for static &amp; rotating machines procedure for levelling &amp; alignment of two shafts of directly &amp; indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992.  Use of various devices &amp; tools in loading &amp; unloading, lifting, carrying heavy equipment.</p>	06	08
Total		48	70

Text/Reference Books:

Titles of the Book	Name of Authors	Name of the Publisher
Electrical Technology Vol I To IV	B. L. Theraja	S. Chand & Co., New Delhi
Operation & Maintenance Of Electrical Machines Vol - I	B. V. S. Rao	Media Promoters & Publisher Ltd. Mumbai
Operation & Maintenance Of Electrical Machines Vol - II	B. V. S. Rao	Media Promoters & Publisher Ltd. Mumbai
Preventive Maintenance Hand Books & Journals	C.J. Hubert	-----
Testing & Maintenance of Electrical Machines	Manoj Sinha	Foundation Publishing

## POWER ELECTRONICS AND DRIVES

<b>Subject Code</b>  <b>EE403T</b>	<b>Theory</b>					<b>Credits</b>  <b>03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>			<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>		<b>70</b>
	<b>03</b>	—	—	<b>TA</b>	<b>:</b>		<b>10</b>
	—	—	—	<b>CT</b>	<b>:</b>		<b>20</b>

### CONTENTS: THEORY

	Name of the Topic	Hours	Marks
Unit-01	<p>Power Semiconductor Devices: Thyristor (SCR) Construction, Operation and Symbol V-I Characteristics</p> <p>1. 4 Thyristor Turn Methods: Voltage Triggering, Gate Triggering, dv/dt Triggering and Light Triggering. Gate Control: DC Gate Signal, AC Gate Signal and Pulse. Thyristor Turn off Process or commutation method. Thyristor Specifications and Ratings Voltage Ratings, Current Ratings, Power Ratings and Temperature Ratings. Heat Sinks and Mountings Thyristor Family: Symbols &amp; V-I Characteristics</p>	06	12
Unit- 2	<p>Converters:</p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Single Phase Fully Controlled Half Wave Converter                             <ul style="list-style-type: none"> <li>- With Resistive Load</li> <li>- With RL Load and Freewheeling Diode.</li> </ul> </li> <li>- Single Phase Fully Controlled Full Wave Converter                             <ul style="list-style-type: none"> <li>- With Resistive Load</li> <li>- With RL Load.</li> </ul> </li> <li>- Single Phase Fully Controlled Bridge Converter                             <ul style="list-style-type: none"> <li>- With Resistive Load</li> <li>- With RL Load</li> </ul> </li> <li>- Comparison of 3 <math>\phi</math> and 1 <math>\phi</math> Phase Converters.</li> </ul> <p>2.6- Effect of Source Impedance on Converter Operation. 2.7 – Cycloconverters principle of operation, Input output waveforms. (1-Q only)</p>	08	14

Unit-03	<p>Inverters:</p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Classification: <ul style="list-style-type: none"> <li>Line Commutated &amp; Forced Commutated Inverters, Series, Parallel, &amp; Bridge Inverters.</li> </ul> </li> <li>- Series Inverter <ul style="list-style-type: none"> <li>- Operation of Basic Series Inverter Circuit</li> <li>- Modified Series Inverter</li> </ul> </li> <li>- Parallel Inverter <ul style="list-style-type: none"> <li>- Operation of Basic Parallel Inverter Circuit</li> </ul> </li> <li>- Single Phase Bridge Inverter <ul style="list-style-type: none"> <li>- Half Bridge Inverter</li> <li>- Full Bridge Inverter</li> </ul> </li> <li>- Pulse Width Modulation(PWM) Method: <ul style="list-style-type: none"> <li>- Single Pulse Width Modulation</li> <li>- Multiple Pulse Width Modulation</li> <li>- Sinusoidal Pulse Width Modulation</li> </ul> </li> </ul>	08	14
Unit-04	<p>Choppers:</p> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Chopper Principle</li> <li>- Control Techniques: <ul style="list-style-type: none"> <li>- Constant Frequency System</li> <li>- Variable Frequency System</li> </ul> </li> <li>- Classification of Choppers: <ul style="list-style-type: none"> <li>Class A, Class B, Class C, Class D and Class E</li> </ul> </li> <li>- Commutations Methods for Choppers: <ul style="list-style-type: none"> <li>Auxiliary Commutation, Load Commutation</li> </ul> </li> <li>- Jones Chopper</li> <li>- Step Up Chopper &amp; step down choppers with problems</li> </ul>	08	10
Unit-05	<p>Power Electronic Applications:</p> <ul style="list-style-type: none"> <li>- DC Drives: <ul style="list-style-type: none"> <li>- Speed control of DC series motor with single phase and three phase half and full controlled converter, step up and step down chopper.</li> </ul> </li> <li>- AC Drives: <ul style="list-style-type: none"> <li>- Speed control of three phase Induction Motor with Variable frequency PWM VSI, Variable frequency square wave VSI, Variable frequency CSI, Variable frequency Variable Voltage, Cycloconverters.</li> </ul> </li> <li>- Other Applications: <ul style="list-style-type: none"> <li>- Static Circuit Breakers (DC &amp; AC).</li> <li>- Induction Heating Control.</li> <li>- Di-electric Heating Control.</li> </ul> </li> <li>- Electric Welding Control. <ul style="list-style-type: none"> <li>- Battery Charging Control.</li> <li>- Static Excitation System for Alternators.</li> <li>- Static VAR Compensation System.</li> </ul> </li> </ul>	18	08 12
Total		48	70

Text/Reference Books:		
Titles of the Book	Name of Authors	Name of the Publisher
Power Electronics	B. R. Gupta ,V. Singhal	S. K. Kataria & Sons
Power Electronics	Muhammad H. Rashid	Prentice-Hall of India Pvt. Ltd.
Power Electronics	M. D. Singh, K. B. Khanchandani	Tata McGraw-Hill
Fundamentals of Electric Drives	G. K. Dubey	Narosa Publishing House
Electric Drives – Concepts and Applications	V. Subrahmanyam	Tata McGraw-Hill
Power Electronics and Drives	R.N. Dutta	Foundation Publishing

## **AUTOMATIC CONTROL SYSTEM**

<b>Subject Code</b> <b>EE404T</b>	<b>Theory</b>						<b>Credits</b> <b>03</b>		
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>				<b>:</b>	<b>100</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>				<b>:</b>	<b>70</b>
	<b>03</b>	—	—	<b>TA</b>				<b>:</b>	<b>10</b>
	—	—	—	<b>CT</b>				<b>:</b>	<b>20</b>

### Rationale and objectives :-

This course introduces various control mechanisms, modes and derives with are necessary to understand simple control systems in a process plants. With the knowledge of control system components one must here the idea about time and frequency response of the system with the objective to provide a logical understanding of the subject the topics are designed in a semiotic manner.

SL. NO.	TOPIC	PERIODS
1.	Introduction	6
2.	Lap lace Transform	6
3.	Mathematical modeling of physical systems	4
4.	Control system components	7
5.	Root locus Technique	4
6.	Time Response Analysis	6
7.	Concept of stability and Algebraic criteria	6
8.	Frequency Response Analysis	8
9.	Stability in Frequency Domain	8
10.	Introduction to state-space Approach	5
<b>Total-</b>		<b>60 Periods</b>

### **CONTENTS: THEORY**

	Name of the Topic	Hrs/Week	Marks
<b>Unit-01</b>	[1] <u>INTRODUCTION:</u>	[06]	[ 04 ]
	1.1 The Control system, open loop and closed loop control		
	1.2 Servomechanism		
	1.3 Control of physical quantity live temperature, flow, liquid lend etc.		
	1.4 Feedback and nonfeedback systems, Regenerative feedback		
Unit-02	[2] <u>LAP LACE TRANSFORM:</u>	[06]	[ 06 ]
	2.1 The lap lace transform		
	2.2 The inverse lap lace transform		
	2.3 Properties of Lap lace transform		
	2.4 Solving differential equations by lap lace transform method.		
<b>Unit-03</b>	[3] <u>MATHEMATICAL MODELING OF PHYSICAL SYSTEM:</u>	[04]	[ 04 ]
	3.1 Differential equations of physical system		
	3.2 Transfer Function		
<b>Unit-04</b>	[4] <u>CONTROL SYSTEM COMPONENTS:</u>	[07]	[ 06 ]
	4.1 Introduction		
	4.2 Controller Components		
	4.3 A.C & D.C Servomotor		
	4.4 Potentiometer, Synchros, Tachometer Amplidyne and Metadyne.		



<b>Unit-05</b>	[5] <u>ROOT LOCUS TECHNIQUE :</u>	[04]	[ 08 ]
	5.1 Introduction		
	5.2 The Root locus Technique		
	5.3 Construction of root loci & solution of problems		
<b>Unit-06</b>	[6] <u>TIME RESPONSE ANALYSIS :</u>	[06]	[ 12 ]
	6.1 Standard test signals		
	6.2 Time response of first order systems		
	6.3 Time response of second order system		
	6.4 Time response specification		
6.5 Steady state errors and error constants			
<b>Unit-07</b>	[7] <u>CONCEPT OF STABILITY AND ALGEBRAIC CRITERIA :</u>	[06]	[ 08 ]
	7.1 The concept of stability		
	7.2 Necessary conditions for stability		
<b>Unit-08</b>	[8] <u>FREQUENCY RESPONSE ANALYSIS :</u>	[08]	[ 08 ]
	8.1 Introduction		
	8.2 Correlation between time response and frequency response.		
	8.3 Bode plots and polar plots of different types of transfer function.		
<b>Unit-09</b>	[9] <u>STABILITY IN FREQUENCY DOMAIN :</u>	[08]	[ 10 ]
	9.1 Introduction		
	9.2 Nyquist stability criterion		
	9.3 Assessment of relative stability using nyquist stability Criterion, Phase margin, gain merging.		
9.4 Closed loop frequency response.			
<b>Unit-10</b>	[10] <u>INTRODUCTION TO STATE SPACE APPROACH :</u>	[05]	[ 04 ]
	10.1 Concept of state		
	10.2 State space Variables & models		
	10.3 Controllability and observability		
<b>Total</b>		<b>60</b>	<b>70</b>

**Books Recommended :-**

<b>1.</b>	Control system engineering	-	I.J Nagrath / M. Gopal
<b>2.</b>	Control system engineering	-	Sushil Das gupta
<b>3.</b>	Control system engineering	-	S. Hassan Saeed –s.k kataria & sons
<b>4.</b>	Control system engineering	-	Nise- Willey
<b>5.</b>	Automatic Control System	-	S.N. Goyal

## **ELECTIVE - (ANY ONE)-(i) ELECTRIC TRACTION - II**

<b>Subject Code EE405T</b>	<b>Theory</b>			<b>Credits</b>			
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>100</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>70</b>	
	<b>03</b>	—	—	<b>TA</b>	<b>:</b>	<b>10</b>	
				<b>CT</b>	<b>:</b>	<b>20</b>	

### **CONTENTS: THEORY**

Chapter	Name of the Topic	Hours	Marks
Unit-01	<p>Electric Locomotives:</p> <ul style="list-style-type: none"> <li>- Nomenclature used For Electric Locomotives</li> <li>- Types of Electric Locomotives By Nomenclature.</li> <li>- AC Locomotive:</li> <li>- Equipments of AC Electric Locomotive:                             <ul style="list-style-type: none"> <li>- Power Circuit Equipments and Auxiliary Circuit Equipments.</li> </ul> </li> <li>1.3.2- Equipments in Power Circuit and their Functions:                             <ul style="list-style-type: none"> <li>- Power Circuit Diagram of AC Locomotive: Pantograph, Circuit breaker, Tap Changer Traction Transformer, Rectifier, Smoothing Choke Traction Motor.</li> </ul> </li> <li>- Equipments in Auxiliary Circuit &amp; their Functions: Head Light, Flasher Light, Horn, Marker Light, Batteries, Arno Converter, Blowers, Exhausters Compressors, Selsyn transformer.                             <ul style="list-style-type: none"> <li>- List and Purpose of Different Type of Relays:</li> <li>- List and Purpose of Different Type of Contactors:</li> </ul> </li> <li>- Three Phase Locomotive.</li> <li>- Power Circuit of Three Phase Locomotive.                             <ul style="list-style-type: none"> <li>- Power Supply Arrangement for Auxiliary Machines in Three Phase Locomotive.</li> </ul> </li> </ul>	14	18
Unit-02	<p>Maintenance of Locomotives:</p> <ul style="list-style-type: none"> <li>- Locomotive Maintenance</li> <li>- Need of Maintenance and Policy of Obselence.</li> <li>- Defects.</li> <li>- Ideal Maintenance:                             <ul style="list-style-type: none"> <li>- Means to Improve the Reliability of Locomotive.</li> <li>- Means to Improve Availability of Locomotive.</li> <li>- Means to Reduce Maintenance Cost.</li> <li>- Maintenance Record.</li> <li>- Training Facility.</li> <li>- Characteristics of Efficient Maintenance.</li> </ul> </li> <li>- Electrical Faults and Their Causes.</li> <li>- Fault Localisation.</li> <li>- Necessity of Testing.                             <ul style="list-style-type: none"> <li>- Testing Procedure.</li> <li>- Individual Equipment Tests.</li> </ul> </li> </ul>	10	18

Unit-03	<p>Protection of Electric Locomotive:</p> <ul style="list-style-type: none"> <li>- Introduction.</li> <li>- Broad Strategy For Protection.</li> <li>- Surge Protection: <ul style="list-style-type: none"> <li>- Direct Lightening Strokes.</li> <li>- Switching Surges: External and Internal.</li> </ul> </li> <li>- Overload Protection of Main Power Circuit.</li> <li>- Earth Fault Protection of Power and Auxiliary Circuit.</li> <li>- Protection from Over Voltage and Under Voltage.</li> <li>- Differential Current Protection of Traction Circuits.</li> <li>- Protection Against High and Low Air Pressure in the Compressed Air Circuit.</li> <li>- Temperature Monitoring.</li> <li>- Protection of Transformer By Buchholz's Relay.</li> <li>- Monitoring of Ventilation System of Key Locomotive Equipments.</li> <li>- Protection Against Accidental Contact with HT Equipment.</li> <li>- Protection Against Fire. <ul style="list-style-type: none"> <li>- Fire Prevention Strategy.</li> </ul> </li> </ul>	08	14
Unit-04	<p>LEM Propelled Traction:</p> <ul style="list-style-type: none"> <li>- Introduction.</li> <li>- Linear Electric Motor (LEM)</li> <li>- Linear Induction Based Traction System: <ul style="list-style-type: none"> <li>- Moving Primary Fixed Secondary Single Sided LIM.</li> <li>- Moving Secondary Fixed Primary Single Sided LIM.</li> <li>- Moving Primary Fixed Secondary Double Sided LIM.</li> </ul> </li> <li>- Strengths/Weaknesses of LIM Propelled Railway Traction: <ul style="list-style-type: none"> <li>- Strengths of LIM Propelled Railway Traction System.</li> <li>- Weaknesses of LIM Propelled Railway Traction System.</li> </ul> </li> <li>- Practical Possibilities of LIM Propelled Transportation.</li> <li>- Inputs/Modifications for Adoption of LIM Propulsion in the Existing System: <ul style="list-style-type: none"> <li>- Track Modification.</li> <li>- Vehicle Modification.</li> <li>- Voltage and Speed Control.</li> </ul> </li> <li>- LIM Propelled Underground Metro Rail System: <ul style="list-style-type: none"> <li>- Factors Influencing Adoption of LIM for Metro Rail.</li> <li>- International Scenario.</li> </ul> </li> <li>- Wheel Less Traction: <ul style="list-style-type: none"> <li>- Levitation Schemes.</li> <li>- Present Scenario.</li> </ul> </li> </ul>	10	10

Unit-05	<p>Application of Computers in Management of Electric Traction:</p> <ul style="list-style-type: none"> <li>- Introduction.</li> <li>- Computer's Capability Relevant to Electric Traction Management. <ul style="list-style-type: none"> <li>- Areas of Computer Application in Traction System Management: <ul style="list-style-type: none"> <li>- Optimisation of OHE and Power Supply Installation Designs.</li> <li>- Computer Aided Locomotive Designs.</li> <li>- Monitoring of Maximum Demand.</li> <li>- Energy Saving Driving Approach.</li> <li>- Training of Drivers on Simulators.</li> <li>- Aiding Drivers and Maintenance Depot Through On Board Computers</li> <li>- History of Locomotive and OHE Equipment.</li> <li>- Failure Analysis.</li> <li>- Monitoring Execution of Trip Inspection Schedules of Locomotives.</li> <li>- Inventory Control.</li> </ul> </li> </ul> </li> <li>- Possible Other Areas for Computer Controlled Monitoring.</li> <li>- Advantages of Use of Computers for Management of Electric Traction System.</li> </ul>	06	10
	Total	48	70

Text /Reference Books:		
Titles of the Book	Name of Authors	Name of the Publisher
Modern Electric Traction	H. Partab	Dhanpat Rai & Sons
Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd.
Viddut Engine Parichay (In Hindi)	Om Prakash Kesari	S. P. Graphics, Nashik. Phone No. (0253) 2580882
Electric Traction-II	Deepak Kumar	Foundation Publishing

**ELECTIVE - (ANY ONE)-(ii) MAINTENANCE AND REPAIRS OF ELECTRICAL EQUIPMENT**

<b>Subject Code EE405T</b>	<b>Theory</b>						<b>Credits 03</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>				
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>100</b>		
	<b>03</b>	<b>—</b>	<b>—</b>	<b>TA</b>	<b>:</b>	<b>10</b>		
				<b>CT</b>	<b>:</b>	<b>20</b>		

**CONTENTS: THEORY**

Chapter	Name of the Topic	Hours	Marks
Unit-1	Introduction Principle different effects of electric currents, materials used in electrical equipments, tools / instruments necessary for repair works, jointing methods, soldering, testing of instruments, Interpretation, location & identification of faults, recording / estimation of materials / components required & their cost, approximate costing of repair of equipment.	08	12
Unit-2	Domestic electrical equipment, Principle, types, construction, operation, testing, fault finding, dismantling, assembly & testing after repairs of following equipments electric Iron all types, electric ovens, electric fans & regulators, water heaters, geysers mixers, food processors, toasters.	16	22
Unit-3	Circuits used for control & regulation of electronic circuits like rectifiers amplifier timer, oscillator, identification of component, component testing, with multimeters replacement of components, microwave & use microwave for heating, laser & laser equipment	08	12
Unit-4	Advanced equipments principle, types, construction, operation, Testing, fault finding, dismantling, assembly & testing after repairs of following equipments- UPS / Inverters, battery chargers, microwaves ovens, air coolers, Washing machines – semi automatic / fully automatic, remote controllers of different equipments, VCD / DVD / ACD players.	16	24
	Total	48	70

Text /Reference Books:

Titles of the Book	Name of Authors	Name of the Publisher
Maintenance and Repairs of Electrical Equipment	Rajiv Kumar	Foundation Publishing

## PCB DESIGNING LAB

<b>Subject Code EE406P</b>	<b>Practical</b>						<b>Credits 01</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>		
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>		
	—	—	<b>02</b>	<b>Internal</b>	<b>:</b>	<b>15</b>		
	—	—	—	<b>External</b>	<b>:</b>	<b>35</b>		

### CONTENTS : PRACTICAL

	Name of the Topic	Hrs/Week
Unit-01	PCB designing concepts:- Introduction, Difference between PWB and PCB, Types of PCBs ,Single Sided (Single Layer),Multi-Layer (Double Layer), PCB Materials .	04
Unit-02	Trends in PCB designing:- Older PCB Method, PCB Designing Using Graph Paper , Making a hand drawn PCB ,Using Computer for EDA, Introduction to electronic design Automation, Latest Trends in Market, Different EDA tools, Introduction to SPICE and PSpice Environment, Introduction and Working of PROTEUS.	04
Unit-03	<p>Component introduction and their categories:- Types of components, Active Components</p> <ul style="list-style-type: none"> <li>○ Diode</li> <li>○ Transistor</li> <li>○ MOSFET</li> <li>○ LED</li> <li>○ SCR</li> <li>○ Integrated Circuits (Ics)</li> </ul> <ul style="list-style-type: none"> <li>● Passive Components <ul style="list-style-type: none"> <li>○ Resistor</li> <li>○ Capacitor</li> <li>○ Inductor</li> <li>○ Transformer</li> <li>○ Speaker/Buzze</li> </ul> </li> </ul>	04
Unit-04	<p>Detailed description and practicals of PCB designing:-</p> <ul style="list-style-type: none"> <li>● PCB designing flow charts, Schematic Entry</li> <li>● Netlisting</li> <li>● PCB Layout Designing</li> <li>● Prototype Designing <ul style="list-style-type: none"> <li>○ Design Rule Check(DRC)</li> <li>○ Design For Manufacturing(DFM)</li> </ul> </li> <li>● PCB Making <ul style="list-style-type: none"> <li>○ Printing</li> <li>○ Etching</li> <li>○ Drilling</li> </ul> </li> <li>● Assembly of components</li> <li>●</li> </ul>	04

Unit-05	<p>Description of PCB layers:-</p> <p>Electrical Layers</p> <ul style="list-style-type: none"> <li>○ Top Layer</li> <li>○ Mid Layer</li> <li>○ Bottom Layer</li> </ul> <ul style="list-style-type: none"> <li>● Mechanical Layers <ul style="list-style-type: none"> <li>○ Board Outlines and Cutouts</li> <li>○ Drill Details</li> </ul> </li> <li>● Documentation Layers <ul style="list-style-type: none"> <li>○ Components Outlines</li> <li>○ Reference Designation</li> <li>○ Text</li> </ul> </li> </ul>	04
<b>Total</b>		20

List of Assignments:-

1. PCB Designing of Basic and Analog Electronic Circuits.
2. PCB Designing of Power Supplies.
3. PCB Designing of Different Sensor modules.
4. PCB Designing of Electronics Projects.
5. PCB Designing of Embedded Projects.
6. Soldering and Desoldering of componets as per Design.
7. Testing and Troubleshooting of PCB Designing.

# **POWER ELECTRONICS AND DRIVES LAB**

<b>Subject Code</b>	<b>Practical</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	<b>01</b>
<b>EE407P</b>	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>02</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	—	—	—	<b>External</b>	<b>:</b>	<b>35</b>	
	—	—	—				

## **CONTENTS: PRACTICAL**

Skills to be developed:

Intellectual skills:

1. Select appropriate devices and instruments
2. Testing & troubleshooting

Motor Skills:

1. Accuracy of Measurement
2. Proper connections
3. Draw characteristics

List of Practical's:

- (1) To identify the terminals and plot V-I Characteristics of Thyristor.
- (2) To study Full Wave Rectifier Using SCR and UJT.
- (3) To study Parallel Inverter Using SCR.
- (4) To study Bridge Rectifier Using SCR and UJT.
- (5) To study series Inverter Using SCR.
- (6) To study Chopper Using SCR.
- (7) To study Circuit Breaker Using SCR.
- (8) To study Battery Charger Using SCR.
- (9) TO Perform Speed control of DC series motor by static armature voltage control using single phase half/full controlled converter.
- (10) TO Perform speed control of three phase Induction motor using PWM/CSI Inverter. Interpret the speed – torque characteristics. Use the circuit as Variable Voltage Variable Frequency (V. V. V. F.) drive.



## CONTROL SYSTEM LAB

<b>Subject Code EE408P</b>	<b>Practical</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>50</b>	<b>01</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>ESE</b>	<b>:</b>	<b>50</b>	
	—	—	<b>02</b>	<b>Internal</b>	<b>:</b>	<b>15</b>	
	—	—	—	<b>External</b>	<b>:</b>	<b>35</b>	

### CONTENTS : PRACTICAL

	Name of the Topic	Hrs/Week	Marks
Unit-01	Study of D.C. position control servomechanism system.		
Unit-02	Study of Control System Components.		
Unit-03	Transient Response of First Order System.		
Unit-04	Transient Response of Second Order System.		
Unit-05	Frequency Response of Second Order System.		
Unit-06	ON-OFF temperature Control.		
Unit-07	Analogue Computer, Solution of different equation.		
<b>Total</b>			

## **ELECTIVE - (ANY ONE)-(i) ELECTRIC TRACTION LAB –II**

Subject Code	Practical			Credits		
	No. of Periods Per Week			Full Marks	:	50
EE409P	L	T	P/S	ESE	:	50
	—	—	02	Internal	:	15
	—	—	—	External	:	35

### **CONTENTS: PRACTICAL**

List of Laboratory Experiments :	
1	Study of Electric AC Locomotives.
2	Study of Relays, Contactors
3	Individual Equipment Testing
4	Overload Protection, Earth Fault Protection of Power and Auxiliary Circuit.
5	Differential Current Protection of Traction Circuits
6	Linear Induction Based Traction System:
7	Computer Aided Locomotive Designs
8	Monitoring Execution of Trip Inspection
9	Use of Computers for Management of Electric Traction

#### List of Assignments :-

1 Drawing Sheets:

- (i) Drawing (on half Imperial sheet) for Power Circuit of any type of Electric Locomotive
  - (ii) Drawing (on half Imperial sheet) for Protection of Electric Locomotive.
- ( Note: Students should be able to identify, explain the functions of various equipments used in Electric locomotive).

Mini Project:

Collection of information using Internet on any two topics in the contents and submission of printouts

2 Mini Project:

Collection of information using Internet on any two topics in the contents and submission of printouts

**ELECTIVE - (ANY ONE)-(ii) MAINTENANCE AND REPAIRS OF ELECTRICAL EQUIPMENT LAB**

Subject Code	Practical			Credits		
	No. of Periods Per Week			Full Marks	:	50
EE409P	L	T	P/S	ESE	:	50
	—	—	02	Internal	:	15
	—	—	—	External	:	35
				01		

**CONTENTS: PRACTICAL**

Skills to be developed:

Intellectual Skills:

1. Analytical Skills
2. Identification Skills
3. Fault finding Skills

Motor Skills:

1. Measuring Skill
2. Connecting instruments
3. Proper use of instruments, tools for repairs

A) Laboratory Experiences:

Dismantling, assembly, testing, preparation of list of components, parts and their cost for:

- 1) Electric iron all types
- 2) Electric oven
- 3) Electric toasters
- 4) Electric fan (CF, TF, PF, & EF & regulators)
- 5) Water heaters & geysers
- 6) Mixer & food processors
- 7) UPS / Inverters / battery chargers
- 8) Air coolers ( portable / desert type)
- 9) Semi automatic & fully automatic washing machine
- 10) VCD / DVD / AVD players
- 11) Microwave Ovens
- 12) All types remote controllers

B) Field work:

- 13) Visit servicing centers of manufacturing companies , write the procedure of servicing of any one of them
- 14) Visit a manufacturing unit & prepare a report based on it.

C) Mini project:

- 15) For given specific application of any two equipments collect literature of different manufacturing company & prepare a comparative chart
- 16) Prepare test reports & bills for servicing of above any two equipments.

Learning Resources:

1. Service Manuals of manufacturers



# INDUSTRIAL PROJECTS

<b>Subject Code</b>  <b>EE410P</b>	<b>Term Work</b>						<b>Credits</b>
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>	<b>25</b>	<b>03</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>	<b>07</b>	
	—	—	<b>05</b>	<b>External</b>	<b>:</b>	<b>18</b>	

Contents : Term Work				Hrs/week	
<ul style="list-style-type: none"> <li>Two hours should be allotted for giving the Instructions for preparing a Project Report. (Refer Guideline Document for Format of Project Report)</li> </ul>					
Project					
<ol style="list-style-type: none"> <li>Design of Illumination Scheme (Up to 20 KW) for Hospital / Shopping Mall/Cinema Theatre/Commercial Complex/Educational Institute/Industrial Complex.</li> <li>Design of Rural Electrification Scheme for small Village, Colony.</li> <li>Case Studies Related to Industries – Operation / Maintenance / Repair and Fault Finding. (Refer Guideline Document).</li> <li>Energy Conservation and Audit.</li> <li>Substation Model (Scaled)</li> <li>Wind Turbine Model (Scaled)</li> <li>Pole Mounted Substation Model (Scaled)</li> <li>Rewinding of Three Phase/Single Phase Induction Motor.</li> <li>Rewinding of Single Phase Transformer.</li> <li>Fabrication of Inverter up to 1000 VA.</li> <li>Fabrication of Battery Charger.</li> <li>Fabrication of Small Wind Energy System for Battery Charging.</li> <li>Fabrication of Solar Panel System for Battery Charging.</li> <li>Microprocessor/ Micro controller Based Projects.</li> <li>PC Based Projects.</li> <li>Simulation Projects.</li> </ol>					
<p><b>Seminar</b> Seminar on any relevant latest technical topic based on latest research, recent trends, new methods and developments in the field of Electrical Engineering / Power Electronics.</p>					
<p>Note: (1) One Project                      (2) Seminar will be held under Professional Practices.</p>					
Text Books:					
Name of Authors		Titles of the Book	Edition	Name of the Publisher	
IEEE Transactions/Journals					
Electrical India					
IEEMA Journal					
Elecrama					
Technorama					
Urja					
Industrial Automation					
Electronics for You					
Electronics Projects					
Computer World					
Chip					
Any Journal Related to Electrical Engg./ Electronics/ Computer/Information Technology					
<p>2. Website: Using any search engine, such as <a href="http://www.google.co.in/">http://www.google.co.in/</a> the relevant information can be searched on the Internet.</p>					

## PROFESSIONAL PRACTICES

<b>Subject Code EE411P</b>	<b>Term Work</b>					<b>Credits 02</b>	
	<b>No. of Periods Per Week</b>			<b>Full Marks</b>	<b>:</b>		<b>25</b>
	<b>L</b>	<b>T</b>	<b>P/S</b>	<b>Internal</b>	<b>:</b>		<b>07</b>
	—	—	<b>05</b>	<b>External</b>	<b>:</b>		<b>18</b>

### CONTENTS :TERM WORK

Sr. No.	Activity	Hours
Unit-01	<p>Structured industrial visits shall be arranged and report of the same should be submitted by the individual student, to form a part of the term work. (minimum 3 visits)</p> <p>Following are the suggested type of Industries/ Fields -</p> <ul style="list-style-type: none"> <li>i) Visit to Load Dispatch Center.</li> <li>ii) Visit to Transformer Repair Workshop.</li> <li>iii) Visit to Electrical Machine Manufacturing Unit.</li> <li>iv) Visit to Industry of Power Electronics Devices.</li> <li>v) Visit to Maintenance Department of Large Industry.</li> <li>vi) Visit to Multi Storied Building.</li> <li>vii) Visit to Loco Shade.</li> </ul>	19
Unit-02	<p><i>The Guest Lecture/s at least two of two hours duration each from field/industry experts, professionals are to be arranged from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work</i></p> <ul style="list-style-type: none"> <li>a) New Trends in Power Electronics Devices</li> <li>b) Eco friendly Air Conditioning/Refrigeration</li> <li>c) TQM</li> <li>d) Recent Modifications in IE Rules</li> <li>e) Functioning of Electricity Regulatory Commission</li> <li>f) Fourth Stage of Koyana Hydro Station</li> <li>g) Recent trends in Power Generation</li> </ul>	12
Unit-03	<p>Information Search ,data collection and writing a report on the topic</p> <ul style="list-style-type: none"> <li>a) Collection of data for comparison of Transformer Companies</li> <li>b) Latest trend in Classification of Insulating materials</li> <li>c) Design Considerations for Manufacture of Dry Type Transformers</li> <li>d) State and National Statistics for Power Generation</li> <li>e) Comparison of Cost per unit generated by various methods of Power Generation</li> <li>f) Safety considerations for Generation</li> </ul>	13
Unit-04	<p>The students should discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are -</p> <ul style="list-style-type: none"> <li>a) Role of Electrical Engineer in disaster management.</li> <li>b) Scope of out sourcing of Electrical Engineering services.</li> <li>c) Pollution control.</li> </ul>	12
Unit-05	<p>Seminar Presentation</p> <p>The students should select a topic for Seminar based on recent developments in Electrical engineering field, emerging technology etc.</p>	14
	Total	70