Course Name : Diploma in Electrical Engineering

Course Code : EE

Semester : Sixth

Subject Title : Modern Electric Traction (Elective)

Subject Code : 17640

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

In these days electric traction is used for mass transport of goods and passengers over short and long distances at faster rate. In electric traction, electric motors are used to propel different vehicles like trolley bus, tram car, electric trains and the latest vehicles that include metro trains, sky bus and mono rail.

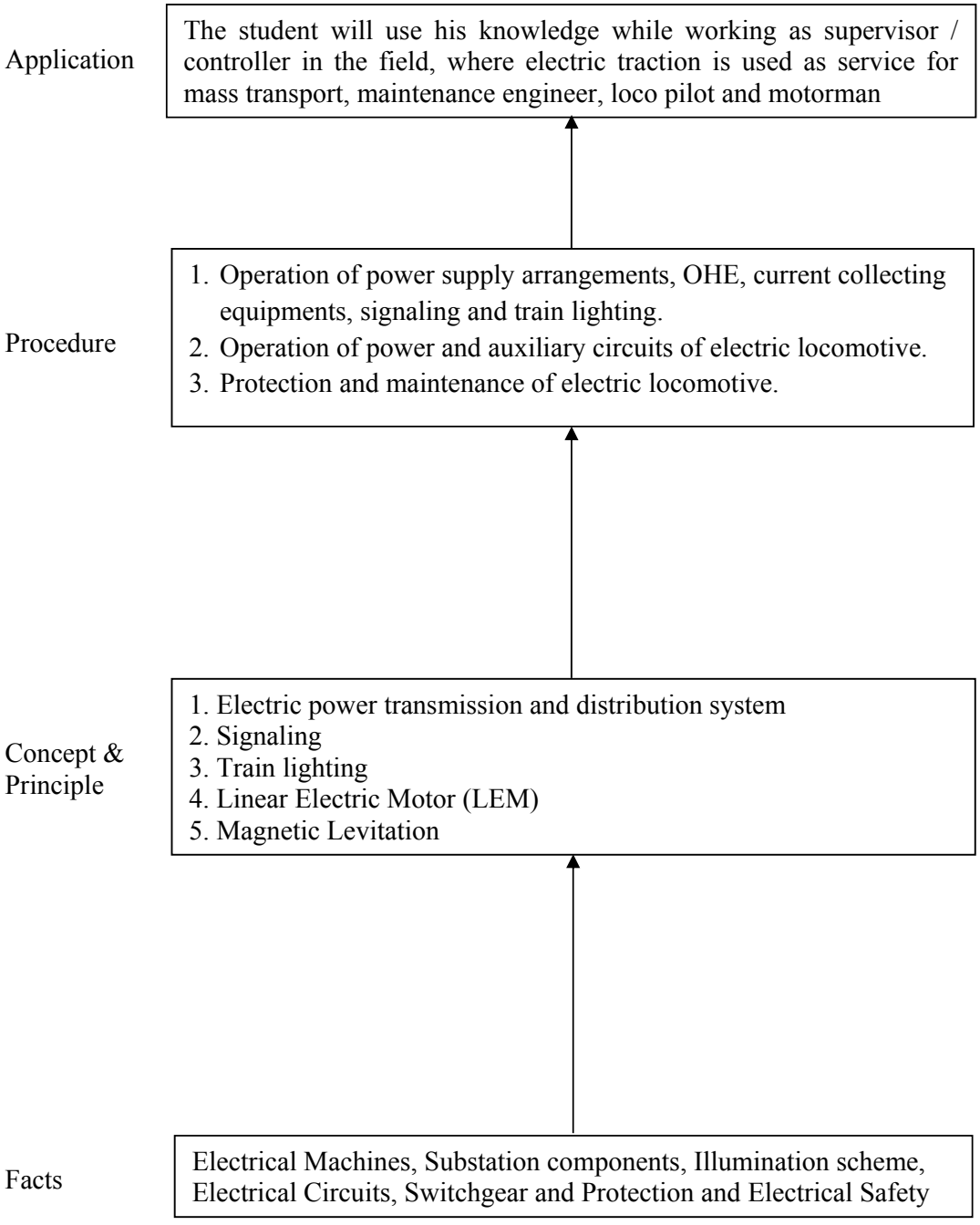
Indian Railways (IR) is the largest organization that has very large job potential and opportunities for electrical engineering diploma holders; hence they should know the recent technological developments in this area of electric traction. This has made it essential for electrical engineering diploma student to study the subject; completely dedicated to electric traction.

General Objectives:

Students will be able to

1) Identify and describe the use of components of power supply arrangements for electric traction
2) Know different overhead equipment's
3) Compare the different type of current collecting systems and current collecting gears
4) Explain various types of signals and track circuits
5) Describe supervisory control used in electric traction
6) Know special requirements of train lighting system
7) Understand the importance of electric locomotive maintenance and protective system
8) Describe the recent trends in electric traction- LEM propelled traction, Metro Rail System, Mono Rail System

Learning Structures:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Power Supply Arrangements Specific Objectives: ➢ Interpret the layout of traction power supply arrangement, ➢ Draw layout of traction power supply arrangement, and ➢ Explain the functions of various constituents of traction power supply arrangement Contents: (Scope – To be restricted as per allotted time and marks) 1.1 Introduction to Traction Supply System 1.2 Constituents of Supply System. • Substations • Feeding Posts. • Feeding and Sectioning Arrangements. • Sectioning and Paralleling Post. • Sub Sectioning and Paralleling Post. • Sub Sectioning Post • Elementary Section. 1.3 Miscellaneous Equipments at Control Post or Switching Stations. 1.4 Major Equipments at Substation • Transformer. • Circuit Breaker. • Interrupter. 1.5 Protective System for AC Traction • Transformer • 25 kV Catenary	12	20
Topic 2: Overhead and Current Collecting Equipments Specific Objectives: ➢ Comprehend the importance of Overhead and Current Collecting Equipments in traction power supply, ➢ Identify Overhead Equipments in traction power supply and state its function, ➢ Describe the functions of Current Collecting Equipments in traction power supply ➢ Select current collecting equipment as per the requirements Contents: (Scope – To be restricted as per allotted time and marks) 2.1 Overhead Equipments (OHE) • Principles of Design of OHE - Composition of OHE - Height of Contact Wire - Contact Wire Gradient - Encumbrances - Span Length • Automatic Weight Tension and Temperature Compensation • Un-insulated and Insulated Overlaps, Neutral Section, Section Insulator and Isolator • Polygonal OHE - Single Catenary Construction - Compound Catenary Construction - Stitched Catenary Construction	10	20

- Modified Y Compound Catenary • Effect of Speed on OHE • OHE Supporting Structure • Different types of signal boards of OHE 2.2 Current Collecting Equipments • Systems of Supplying Power in Electric Traction - Third Rail or Conductor Rail System - Overhead System • Current Collectors for Overhead System - Trolley Collector or Pole Collector - Bow Collector - Pantograph Collector • Types of Pantographs - Diamond Pantograph - Faiveley Type • Methods of Raising and Lowering of Pantograph		
Topic 3: Signaling and Train Lighting Specific Objectives: ➢ Appreciate the importance of signaling and train lighting, ➢ State different types of signals and their meanings, and ➢ State and explain different methods of train lighting Contents: (Scope - To be restricted as per allotted time and marks) 3.1 Signaling • Requirements of Signaling System • Types of Signals • Colour Light Signals • Three and Four Aspects of Colour Light Signals. • Track Circuits. - DC Track Circuit - AC Track Circuit 3.2 Supervisory Control • Advantages of Remote Control • Systems of Remote Control - DC versus Voice Frequency (VF) Signaling - Remote Control System Equipment and Network • Mimic Diagram • Control Desk for TPC 3.3 Train Lighting • Systems of Train Lighting • Special Requirements of Train Lighting • Method of obtaining Unidirectional Polarity • Method of obtaining Constant Output • Single Battery System. • Double Battery Parallel Block System. • Failure of under frame Generating Equipments. • End on Generation.	14	20
Topic 4: Electric Locomotives Specific Objectives: ➢ Draw power circuit of Electric Locomotive and state the functions of various constituents of it, ➢ State the various Equipments in Auxiliary Circuit and their functions,	10	16

➢ List Different Type of Relays in Electric Locomotive and state their functions, ➢ List Different Type of Contactors in Electric Locomotive and state their functions, and ➢ Explain the fundamentals of three phase Locomotive Contents: (Scope – To be restricted as per allotted time and marks) 4.1 Classification of Locomotives and EMU 4.2 Power Circuit • Power Circuit Diagram of AC Locomotive • Equipments in Power Circuit and their Functions - Circuit breaker and Earthing Switch - Tap Changer - Traction Transformer - Rectifier: Rectifier Connections - Smoothing Reactor • Equipments in Auxiliary Circuit & their Functions - Head Light - Flasher Light - Horn - Marker Light - Batteries - Arno Converter - Blowers - Exhausters - Compressors - Selsyn transformer. • List and Function of Different Type of Relays • List and Purpose of Different Type of Contactors • Three Phase Locomotive - Power Circuit of Three Phase Locomotive - Power Supply Arrangement for Auxiliary - Machines in Three Phase Locomotive		
Topic 5: Protection and Maintenance of Electric Locomotive Specific Objectives: ➢ Appreciate the importance of protection and maintenance of Electric Locomotive, ➢ Explain various types of protections provided to Electric Locomotive, and ➢ Describe the maintenance policies of Electric Locomotives and state them Contents: (Scope - To be restricted as per allotted time and marks) 5.1 Protection of Electric Locomotive • Broad Strategy For Protection • Surge Protection: - Direct Lightening Strokes - Switching Surges: External and Internal • Overload Protection of Main Power Circuit • Earth Fault Protection of Power and Auxiliary Circuit • Protection from Over Voltage and Under Voltage • Differential Current Protection of Traction Circuits. • Protection against High and Low Air Pressure in the Air Circuit	10	14

• Temperature Monitoring 5.2 Maintenance of Locomotive • Need of Maintenance and Policy of Obsolescence • Defects • Ideal Maintenance • Means to Improve the Reliability of Locomotive • Means to Improve Availability of Locomotive • Means to Reduce Maintenance Cost • Maintenance Record. • Characteristics of Efficient Maintenance • Electrical Faults and Their Causes.		
Topic 6: Modern Trends in Electric Traction Specific Objectives: ➢ State new Developments in the Area of Electric Traction, ➢ Explain the working of Linear Electric Motor (LEM) Traction System, and ➢ State the Levitation Schemes used in Wheel less Traction System Contents: (Scope – To be restricted as per allotted time and marks) 6.1 LEM Propelled Traction • Linear Electric Motor (LEM) • Linear Induction Based Traction System - Moving Primary Fixed Secondary Single Sided LIM - Moving Secondary Fixed Primary Single Sided LIM - Moving Primary Fixed Secondary Double Sided LIM • Strengths/Weaknesses of LIM Propelled Railway Traction - Strengths of LIM Propelled Railway Traction System - Weaknesses of LIM Propelled Railway Traction System • Practical Possibilities of LIM Propelled Transportation	08	10
Total	**64**	**100**

List of Drawing Assignments:

Five Drawing Sheets (Half Imperial Size) and Report on each Sheet

1. Traction Substation and Feeding Post Layout
2. Overhead Equipments (OHE) and Current Collecting Equipments (at least 6 equipments on 2 sheets)
3. Signaling and Train Lighting,
4. Power Circuit in Electric Locomotive and Auxiliary Circuit Equipments

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
1	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
2	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publishers Ltd.
3	Om Prakash Kesari	Viddut Engine Parichay (In Hindi)	S. P. Graphics, Nashik.
4	J. B. Gupta	Utilisation of Electric Energy (Including Electric Traction)	Kataria and Sons

4. Websites:

1) http://www.railway-technical.com/etracp.shtml
2) http://www.irfca.org/faq/faq-elec.html
3) http://en.wikipedia.org/wiki/Railway_electrification_system
4) http://en.wikipedia.org/wiki/Traction_substation
5) http://www.irfca.org/faq/faq-elec2.html
6) http://en.wikipedia.org/wiki/Electric_locomotive
7) http://www.irfca.org/faq/faq-loco2e.html
8) http://www.irfca.org/faq/faq-shed.html
9) http://www.irfca.org/docs/ac-auxiliaries.html
10) http://www.railway-technical.com/elec-loco-bloc.shtml