22EEHO110	TRACTION ENGINEERING		SEMESTER			
PREREQUISITES		CATEGORY	PEC	Credit		3
Power Electronics, Electrical Machines		Hours/Week	L	T	P	TH
			3	0	0	3

Course Objectives:

1.	To learn the fundamentals of electric traction, power substation, distribution system and overhead contact system design, construction and operation
2.	To learn the traction mechanics, power supply systems and role of battery banks and maintenance
3.	To learn the traction motor drives and control
4.	To learn about traction power supply and protection
5.	To learn about railway signalling

UNIT I	INTRODUCTION TO ELECTRIC TRACTION	9	0	0	9

Requirements of Ideal Traction Systems, the Indian Scenario of Electric traction, Present day State of art Electric traction as a Viable Transport Strategy, Advantages of Electric Traction over other systems of traction, Ideal choice of traction system, Power supply systems for Electric Traction, DC systems, Single phase ac system and three phase ac systems, Kando systems, Latest Developments in 3phase with special reference to locomotives, EMUs and Metro stock, Role of Battery banks in Traction, types and maintenance.

UNIT II	TRACTION MECHANICS	9	0	0	9

Requirements of Ideal Traction Systems, the Indian Scenario of Electric traction, Present day State of art Electric traction as a Viable Transport Strategy, Advantages of Electric Traction over other systems of traction, Ideal choice of traction system, Power supply systems for Electric Traction, DC systems, Single phase ac system and three phase ac systems, Kando systems, Latest Developments in 3phase with special reference to locomotives, EMUs and Metro stock, Role of Battery banks in Traction, types and maintenance.

UNIT III	TRACTION MOTOR AND DRIVES	9	0	0	9

Type of traction motor best suited for traction duties, Available motor characteristics and their suitability for traction duties, speed control methods, Braking methods, special Emphasis and techniques of regenerative braking, Optimization of design and construction features for improved power to weight ratio, Power Factor and Harmonics, Tractive Effort and Drive Ratings, Important Features of Traction Drives, conventional DC and AC Traction drives, Semiconductor/IGBT based Converter Controlled Drives, DC Traction using Chopper Controlled Drives, AC Traction employing Poly-phase motors, Traction control of DC locomotives and EMU's, Traction control system of AC locomotives, Control gear, PWM control of induction motors, Power & amp; Auxiliary circuit equipment (Other than traction motors), Linear Induction motors, introduction to Maglev Technology.

UNIT IV	POWER SUPPLY AND PROTECTION	9	0	0	9

Traction substation, spacing and location of Traction substations, Major equipment at traction substation, selection and sizing of major equipment like transformer and Switchgear, Types of protection provided for Transformer and overhead lines, surge protection, maximum demand and load sharing between substations, sectionalizing paralleling post and feeder posts, Booster transformers, Return Conductor, 2X25KV AC system, controlling/monitoring, Railway SCADA systems, Train lighting and Air-conditioning.

Design requirement of catenary wire, contact wire, Dropper, Height, span length, Automatic weight tensioning, section insulator, overlap, Different techniques of current collection (overhead and underground systems), neutral section, overhead crossing of power lines, Protection

UNIT V	RAILWAY SIGNALING	9	0	0	9

Block Section Concept, AC/DC Track Circuits, Interlocking Principle, Train speed and signaling, Solid state Interlocking, Automatic Warning Systems, CAB signaling, Signaling level crossing. Permissible limit of EMI and EMC, Permissible capacitively-coupled current, Coupling between circuits, conductive coupling, Electrostatic induction.

Total (45L+0T) = 45 Periods

Reference Books:

1.	E. A. Binney, "Electric Traction Engineering: An Introduction", Cleaver-Hume Press, 1955, 1 Oct 2007
2.	Douglas W. Hinde, M. Hinde, "Electric Traction Systems and Equipment", Elsevier Science & Technology, 1968

3.	Samuel Sheldon, Erich Hausmann, "Electric Traction and Transmission Engineering", Van Nostrand, 1911
4.	Frederick William Carter, "Railway Electric Traction", E. Arnold & Company, 1922
5.	Edward Parris Burch, "Electric traction for railway trains; a book for students, electrical and mechanical engineers, superintendents of motive power and others", New York, McGraw-Hill Book Company
6.	Edward Trevert, "Electric Railway Engineering", Lynn, Mass. : Bubier Pub. Co.
7.	Burch Edward Parris, "Electric Traction for Railway Trains; a Book for Students, Electrical and Mechanical Engineers, Superintendents of Motive Power and Others", Arkose Press, ISBN: 9781345582376, 9781345582376

Course Outcomes: Upon completion of this course, the students will be able to:			**Bloom's Taxonomy Mapped**
CO1	:	To understand the basics of traction and supply systems.	L2: Understanding
CO2	:	To understand the traction mechanics and ideal choice of supply systems.	L4: Analyzing
CO3	:	To describe the concepts of traction motors and applying the solid state drive control.	L3: Applying
CO4	:	To design the protection system for the traction power supply system	L5: Evaluating
CO5	:	To understand the concepts of railway signaling	L2: Understanding

COURSE ARTICULATION MATRIX

COs/ POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	3	2	3	2	2	3	2	1				1	3	2	3
CO2	3	2	3	2	2	3	2	1				1	3	2	3
CO3	3	2	3	2	2	3	2	1				1	3	2	3
CO4	3	2	3	2	2	3	2	2	1	1	2	1	3	2	3
CO5	3	2	3	2	2	3	2	3	1	1	2	1	3	3	3
Avg	3	2	3	2	2	3	2	1.6	1	1	2	1	3	2.2	3

3/2/1-indicates strength of correlation (3- High, 2-Medium, 1- Low)