



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3152411

Semester– IV (Power Electronics)

Subject Name: Electrical Power Utilization & Traction

Type of course: Professional Elective 1

Prerequisite: 1) 3110016 Basic Electronics

2) 3132407 Electrical Machine and Application

Rationale: This subject involves importance in view of the fact that a engineer has to work in a wide spectrum of activities wherein he has to make collections from alternative schemes from technical and economic considerations i.e. to plan and design using basic principles and handbooks, to select equipment, processes and components in different situations. The curriculum has been designed keeping the above objectives in view.

Besides giving him basic knowledge in the topics concerned, attempts have been made to ensure that the knowledge acquired is applied in various fields. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize the students with the new developments in different areas.

Teaching & Examination scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		PracticalMarks		
				ESE(E)	PA(M)	ESE(V)	PA(I)	
3	1	0	4	70	30	0	0	100

Sr. No.	Content	Total Hrs	% Weight age
1	ELECTRIC HEATING AND WELDING: Induction Heating: High frequency power source for induction heating, requirements, merits & applications Dielectric heating: Theory and principle, Properties of dielectric material, electrodes and its coupling methods, thermal losses, applications. Electric Welding: Classification, Sequence of operations, interval triggering and gating circuit, interval time counter, weld power circuit; resistance , spot , arc type welding, Energy storage welding system ,Switch-Mode welding.	10	20
2	ELECTROLYTIC PROCESS: Need of electro-deposition, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing equipment, accessories for electroplating, Factors affecting electrode position ,Principle of galvanizing & its applications, Principle of anodizing and its applications. Electroplating on non-conducting materials. Manufacture of chemicals by electrolytic process and electrolysis process	06	15



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3152411

3	ILLUMINATION: Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light. Laws of illumination, lighting calculation, factory lighting, flood lighting, street lighting, different types of lamps-incandescent, fluorescent, vapor, CFL and LED lamps and their working, comparison.	06	10
4	ELECTRIC TRACTION-I: Electric Drives: Advantages, Types of motors used in electric drive, Electric braking, Plugging, Rheostat braking, Regenerative braking. Electric Traction :Introduction, Advantages of electric traction, requirements of an ideal traction, speed time curve, Types & selection of traction motors, Various systems of electric traction - DC & AC systems, method of speed control, energy saving by series parallel control, AC traction equipments. AC series motor, characteristics, linear induction motor & its use.	08	20
5	ELECTRIC TRACTION-II: Factors affecting scheduled speed, diesel electric equipment, trains lighting system, specific energy, factors affecting specific energy consumption. Block diagram of an electric locomotive with description of various equipment and accessories, Starting and braking of traction motors. EMU and metro railways.	06	20
6	Electric - Hybrid Vehicles : Electric Vehicles: Introduction, configuration and performance of electrical vehicles- Traction Motor Characteristics, Tractive Effort and Transmission Requirement, Vehicle Performance; Tractive Effort in Normal Driving Hybrid Electric Vehicles: Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains- Torque-Coupling, Speed-Coupling, Torque-Coupling and Speed-Coupling.	08	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
RLevel	ULevel	Alevel	NLevel	E Level	CLevel
10	25	20	5	5	5

Legends: R:Remembrance;U: Understanding; A:Application, N:Analyze and E:Evaluate C:Create and above Levels(Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Electrical Drives By N.K.De, PHI Publications
2. Art and Science of Utilization of Electrical Energy by H. Partap, Dhanpat Rai & Sons



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3152411

3. Utilization of Electrical Energy by J. B. Gupta, Kataria Publications
4. Modern Electric Traction by H. Partap, Dhanpat Rai & Sons
5. Industrial Electronics And Control by Biswanath Paul PHI Publications
6. Industrial and Power Electronics by G. K. Mithal, Maneesha Gupta , Khanna Publications
7. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design by Mehrdad Ehsani et.al. by CRC Press.

Course Outcomes: After Learning the Course Student should be able to

Sr. No.	CO statement	Co-topic Mapping	Marks % weightage
CO-1	understand the power electronics technology for efficient utilization in electric heating and welding process.	1	25
CO-2	understand the illumination and electrolytic process.	2 ,3	25
CO-3	apply knowledge for effective utilization of Electric Power in Electrical Traction System	4,5	30
CO-4	explore the performance of electrical - Hybrid vehicles	6	20

Learning Resources: <https://nptel.ac.in/>