GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: UTILIZATION OF ELECTRICAL ENERGY (Code: 3340903)

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	4th Semester

1. RATIONALE

Electricity is used in every walk of life whether it is home, office, industry or farm. It is being used for lighting, heating, refrigeration, cooking, air conditioning, operating machines/computers, welding, traction, irrigation and so on. In this era of energy crisis it is must that electricity is consumed efficiently. Every diploma electrical engineer therefore should know to operate and maintain main electrical utilities for their efficient operations. This course will enable the students to develop skills to maintain /troubleshoot various electrical equipment / gadgets/appliances in domestic, commercial and industrial sector. The students will be able to make proper selection of equipment according to requirement to ensure economical and efficient use of electricity. Essential theoretical and practical knowledge will be achieved by this course.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Maintain different types of electrical utilities and systems**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Maintain/Troubleshoot various lamps and fittings in use.
ii. Maintain various electric heating and welding equipments used in industries.
iii. Maintain Electric Drive and elevator used in industries.
iv. Maintain Electric Traction system.
v. Maintain various domestic electrical appliances.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Illumination	1a. Define various illumination terminology and its units 1b. Explain the laws of illumination and its significance	1.1 Illumination terminology: Solid and plane angle, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Lux, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilization Factor, Maintenance Factor, Absorption Factor, Reflection Factor 1.2 Law of Inverse Squares and Lambert's Cosine Law
	1c. Describe the working and applications of the various lamps and fittings in use.	1.3 Incandescent Lamp, 1.4 Low Pressure Mercury Vapour Lamps (Fluorescent Tube) 1.5 High Pressure Mercury Vapour (HPMV) Lamps 1.6 High Pressure Sodium Vapour(HPSV) Lamps 1.7 Compact Fluorescent Lamps (C.F.L.), 1.8 Halogen Lamps 1.9 Metal Halide lamp 1.10Electronic ballasts
Unit– II Electrical Heating and Welding	2a. Explain the requirements of heating element materials 2b. Explain the principle of Resistance Heating 2c. Explain the principle of arc Heating 2d. Describe the working of salt bath furnace 2e. Describe the working of resistance oven 2f. Describe the working of arc furnaces 2g. Solve simple numerical	2.1 Requirements of heating element materials 2.2 Resistance and Arc heating 2.3 Resistance Heating : Direct(Salt Bath Furnace), Indirect Resistance Heating(Resistance Ovens) 2.4 Arc Heating and its applications 2.5 Types of Arc furnace -Direct and Indirect 2.6 Methods of Temperature Control.
	2e. Explain the principle of induction heating and their applications 2f. Describe the working of various types of induction furnaces 2g. Solve simple numerical	2.7 Induction Heating and its applications 2.8 Types of induction furnace • Core Type (Ajax Wyatt) and • Coreless type Induction Furnace
	2h. Explain the principle of dielectric heating and their	2.9 Dielectric Heating and its applications

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	applications 2i. Solve simple numerical	
	2j. State the significance of good welds 2k. Explain the principle Resistance Welding and list its types 2l. Explain the principle of electric arc Welding and its types	2.10 Quality of a good weld, welding defects 2.11 Principle of Resistance Welding 2.12 Types of Resistance welding – Spot, Seam, Butt, Projection, Percussion and flash butt welding 2.13 Principle of Electric Arc welding 2.14 Types of Arc welding Machines: a. DC Welding Machines–MG Set,AC Rectified welding unit. b. AC welding Machines–welding Transformer.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit–III Electric Drives And Elevators	3a. Explain function of major parts of an electric drive with block diagrams 3b. State the factors governing selection of electric motors in a electric drive 3c. Differentiate between: i. AC and DC Drive ii. Individual & group drive 3d. Steady state and transient characteristics of various motors	3.1 Source, Power modulator, Electric motor, Control unit and Load 3.2 Electrical characteristics, Mechanical factors, Nature of load torque, Size and cost . 3.3 Comparison of DC & AC Drive and Individual & Group Drive 3.4 Speed Torque Characteristics of the Motor
	3e. Classify various types of elevator machines and their motors. 3f. State the salient features of the latest Lift and elevator Act.	3.5 Types of electric elevator machines and their motors 3.6 Power transmission gears and braking 3.7 Safety in elevators 3.8 Lift and elevator Act; such as Gujarat Lift Act Nov 2001and others
Unit-IV Electric Traction	4a. Explain the concept of Electric Traction and the ideal conditions 4b. State the need of single phase 25 kV AC for traction	4.1 Requirements of ideal Traction System. 4.2 Traction Mechanics: Types of Services, Speed Time Curve. 4.3 Supply system: DC System, Composite System, Single Phase ac system with low and normal frequency and 3 phase system
Unit-V Domestic Electrical Appliances	5a. Explain the working of various domestic electrical appliances in use. 5b. State the energy conservation measures adopted in using various domestic gadgets.	5.1 Domestic electrical appliances: i. Electric iron. ii. Electric toaster. iii. Electric water heater. iv. Microwave oven. v. Fans (Ceiling and Table fan) vi. Washing Machine. vii. Grinder/ Mixer/ juicer. viii. Vacuum Cleaner. ix. Flour Mill etc. x. Air conditioner 5.2 Concept of Star System for energy conservation

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Illumination	12	4	4	6	14
II	Electrical Heating And Welding	10	4	5	5	14
III	Electric Drives and Elevators	10	5	4	3	12
IV	Electric Traction	12	4	4	6	14
V	Domestic Electrical Appliances	12	4	4	8	16
	Total	**56**	**21**	**21**	**28**	**70**

Legends: R = Remember; U = Understand; A = Apply 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

7. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(outcomes in psychomotor and affective domain)** so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

***Note**: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hrs. Required
1	I	Measure Illumination at different places in college by luxmeter.	2
2	I	Prepare a survey report after collecting technical information of various lamps available in the local market.	2
3	I	Prepare an industrial visit report after visiting nearby lamp manufacturing industry (otherwise from internet)	2
4	I	Prepare a report on different luminaries available in the market & collect the technical data	2
5	I	Identify the different lighting accessories required for various types of lamps.	2
6	II	Prepare a technical report after visiting an industry, manufacturing electrical heating furnaces. (otherwise from internet)	2
7	II	Prepare a report of specification of various heating furnaces used in industries.	2
8	II	Prepare a report of specification of various electrical welding machines available in college workshop.	2
9	III	Prepare a report on various elevators after visiting nearby elevators	2

S. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hrs. Required
		manufacturing/repairing industry.	
10	III	Compare various Electric Drives for Traction	2
11	IV	Select the appropriate motors and justify selection for given different load situations (at least 5)	2
12	IV	Given a specific load condition determine the rating of a motor (motor for a pump, motor for a lift).	2
13	V	Prepare a report after visiting nearby electric-traction substation. (otherwise from Internet)	2
14	V	Prepare a report /chart on various types traction systems.	2
15	V	Prepare a report/chart on speed time curves.	2
16	V	Demonstration of different components of domestic appliances and their functions with study of their energy consumption and procedures for basic testing and maintenance. Also study of their specification and costs. (Any two of following) a) Electric toaster. b) Electric Oven c) Electric water heater. d) Microwave oven. e) Fans (ceiling and table fan) f) Washing Machine. g) Grinder / mixer / juicer. h) Vacuum cleaner. i) Flour Mill. j) Air conditioner	2 hr for each appliances
17	V	Write the procedure of servicing of any two domestic appliances after visiting nearby servicing centers of electrical domestic appliances,	2
18	V	Prepare a report on manufacturing of a domestic appliance by visiting a manufacturing unit of electrical domestic appliances (or from internet).	2
19	V	Prepare a comparative chart of two different manufacturing company in India for any two electrical domestic appliances.	2
20	V	Prepare test reports & bills for servicing of electrical domestic appliances.	2
Total Hours (perform any practical worth 28 hours from above depending upon the availability of resources so that most units are covered)			40

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

i. Preparing reports based on tutorial practices
ii. Assignments for solving numerical
iii. Identify different types of illumination schemes in the Institute.
iv. Note the ratings of various types of welding machines in the Institute workshop.
v. Prepare chart of various electrical equipment used for heating.
vi. Seminar on elevators.
vii. Seminar on latest electric traction in world.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Industrial visit
ii. Visit to railway loco shed

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Art & Science of Utilization of Electrical Energy	H. Partab	Dhanpat Rai & Sons , New Delhi, Latest edition
2.	Utilization of Electric Power & Electric Traction.	J. B. Gupta	S. K. Kataria & Sons, New Delhi, Latest edition
3.	Utilization of Electric Power & Electric Traction	G. C. Garg	Khanna Publishers, New Delhi, Latest edition
4.	Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publisher Ltd., New Delhi, Latest edition
5.	Fundamentals of Electrical Drives	G. K. Dubey	Narosa Publishing House. New Delhi, Latest edition
6.	Electrical Power system	V.K.Mehta	S.Chand, New Delhi, Latest edition

B) List of Major Equipment/ Instrument with Broad Specifications

i. Three phase transformer : 2kVA, 415V / 415 V, 50 Hz, 2.8A
ii. Three phase induction motor: 5 HP, 440 Volts, 1460 rpm, 8.0A, 50Hz, Squirrel cage.
iii. Three phase induction motor: 2 HP, 440 Volts, 1460 rpm, 50Hz, 4.2 A Slip ring cage.
iv. DOL starter, star delta starter, auto transformer starter.
v. Synchronous motor : 5HP, 3-Φ, 415 V, 50 Hz, 6.0 A, 1500 RPM, Excitation-120V DC
vi. Single phase induction motor: 1 HP, 220 V, 50Hz, 1440 RPM .
vii. Ceiling fan and other domestic appliances as given in list of practical above
viii. Various types of cables

C) List of Software/Learning Websites

i. www.nptel.iitm.ac.in
ii. www.howstuffworks.com/
iii. www.vlab.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. H. C. Chawda**, Lecturer in Electrical Engineering RCTI, Ahmedabad
- **Prof. Alpa. A. Amin**, Lecturer in Electrical Engineering GP, Vadnagar
- **Prof. R. D. Panchal**, Lecturer in Electrical Engineering RCTI, Ahmedabad
- **Prof. V. S. Tejwani**, Lecturer in Electrical Engineering G.P. Rajkot.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) C S Rajeshwari**, Head of Department of Electrical and Electronics Engineering.
- **Prof. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering.