GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Electronics & Communication Engineering / Power Electronics

Course / Subject Code: DI01000101

Course / Subject Name: Fundamentals of Electrical Engineering

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	ESC

Prerequisite:	The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Use principles of electrical engineering in solving branch specific engineering problems.
Rationale:	In the era of globalization, it has become essential to possess the knowledge of various engineering disciplines. The aim of introducing this course is to impart knowledge of basic concepts of electrical engineering to the students of other branches.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply fundamentals of electric and magnetic circuits for electromagnetic induction	R, U, A
02	Apply AC Fundamentals to solve Electrical Engineering problem	R, U, A
03	Application of AC circuits in Electrical Engineering field.	R, U, A
04	Apply single phase transformer and D.C. motor for different industrial purpose.	U, A
05	Use of Protection devices for Electrical safety	R, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
02	00	02	03	70	30	20	30	150

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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**BASIC OF ELECTRIC, MAGNETIC CIRCUITS AND ELECTRO MAGNETIC INDUCTION** 1.1 Definitions of EMF, Current, Potential Difference, Power and Energy. 1.2 Ohm's Law, Kirchoff's Current Law, Kirchoff's voltage Law 1.3 Study of terms: - M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor etc. 1.4 Comparison of magnetic and electric circuit. 1.5 State Faraday's laws of electromagnetic induction. 1.6 Dynamically induced emf. 1.7 Statically induced emf. (a) Self-induced emf (b) Mutually induced emf. 1.8 Definitions & equations of self & mutual inductance.	04	20%
2.	**A.C. FUNDAMENTALS** 2.1 Define cycle, frequency, periodic time, amplitude, angular velocity or Frequency with reference to alternating emf & current. 2.2 Definitions of RMS value, average value, form factor & peak factor. 2.3 Vector representation of an alternating emf and current.	04	15%
3.	**A.C. CIRCUITS** 3.1 A.C. through pure a) resistors, b) inductors and c) capacitors. 3.2 A.C. through R-L series, R-C series, and R-L-C series circuit and simple problems of series R-L circuit. 3.3 Definitions of impedance, phase angle, and power factor. 3.4 Power in A. C. Circuits. Concept of power triangle. 3.5 Voltage and Current relationship in Star and Delta connections.	06	15%
4.	**SINGLE PHASE TRANSFORMER AND D.C. MOTOR** 4.1 General construction and principle of transformers. 4.2 Emf equation and transformation ratio of transformers. 4.3 List various losses in transformers and equation of efficiency. 4.4 Applications of Transformers. 4.5 Construction and uses of auto transformers. 4.6 Construction, working principle, types and applications of D.C. motor. 4.7 Back EMF and torque equation of D.C. Motor (without derivation) 4.8 Speed Control of D.C. shunt motor.	12	40%
5.	**PROTECTION AND UTILIZATION OF ELECTRICAL POWER** 5.1 Domestic wiring (a) Lamp Control from one place (b) Staircase Wiring	04	10%

	5.2 Different protective devices such as fuse, M.C.B. and ELCB. 5.3 Electrical safety and earthing. 8.4 Causes of low power factor and advantages of power factor improvement.		
	Total	**30**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
24 %	**56 %**	**20 %**	**00**	**00**	**00**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. A text book of Electrical Technology vol.1 by B. L. Theraja
2. A text book of Electrical Technology vol.2 by B. L. Theraja
3. Principles of Electrical Machine by V.K. Mehta
4. Principles of Power System by V.K. Mehta

(b) Open source software and website:

1. Electric circuit studio
2. Multisim for analog and digital circuit
3. Electronics work bench

(c) Sources of Virtual Laboratory to perform practicals:

1. www.nptel.iitm.ac.in
2. www.electricals4u.com
3. www.vlab.co.in
4. https://ndl.iitkgp.ac.in

Suggested Course Practical List:

Sr. No.	Practical Outcome (PrOs)	Unit No.	Approx. Hours Required
1	Verify Ohm's Law.	1	02
2	Verify Kirchhoff's current law.	1	02
3	Verify Kirchhoff's voltage law.	1	02
4	Find equivalent resistance for series connection and parallel connection.	1	02
5	To measure voltage, current & power in 1-phase circuit. (with resistive load)	3	02
6	To measure voltage, current & power in R-L series circuit.	3	02

7	Verify relation between line & phase values in Star & Delta connection.	3	02
8	Measurement of transformation ratio K of 1-phase transformer.	4	02
9	Perform Open circuit Test and Short circuit Test on single phase transformer.	4	02
10	Perform direct loading test to find efficiency and voltage regulation of transformer.	4	02
11	Perform speed control of D.C. Shunt motor.	4	02
12	Use of Digital Multi-meter for the measurement of voltage, current, & resistance.	5	03
13	Wiring Diagram of (a) Lamp Control from one place (b) Lamp Control from two places	5	03
14	Measurement of Power factor in pure resistive, pure inductive and pure capacitive circuit.	2	02
Total Approx. Hours Required			**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Variable DC power supply: 0- 30 V, 2 A, SC protection, display for voltage and current	1 to 4
2	Resistance load bank (5 KW)	1 to 10
3	Choke coil (Inductor)	6 to 7 and 14
4	Capacitor (2KVAr)	6 to 7 and 14
5	Single Phase Transformer (1 KVA)	8 to 10
6	D.C. Shunt Motor (220 Volts, 03 to 05 KW)	11
7	Digital Multimeter: 3 1/2 digit display, 9999 counts digital multimeter measures: Vac, Vdc (1000 V max) , Adc, Aac (10 amp max) , Resistance (0 - 100 MΩ) , Capacitance and Temperature measurement	1 to 14
8	Single phase variac (0-260 Volts, 5 Amp.)	1 to 14
9	Lamps, Single pole one way Switches, Single pole two way switches, connection wires, patch chords etc.	1 to 14
10	Simulator to perform practicals (1) www.vlab.co.in (2) https://ndl.iitkgp.ac.in (3) www.nptel.iitm.ac.in	1 to 14

Suggested Project List:

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Demonstration kit: Prepare demonstration kit for various electrical laws that has been part of the course.

b) Components: Prepare a chart for commonly used resistors, inductors and capacitors used in different domestic appliances (name of appliances with type and ratings)

c) LED tube light: Build and test the LED lamp circuit for its proper working.

d) Power Factor Improvement: Visit a nearby sub-station and observe the use of power capacitors for power factor improvement and prepare a report.

Suggested Activities for Students:

Other than the classroom and laboratory learning, following are the suggested studentrelated co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews: a) Prepare specification of resistor/inductor/capacitor.

b) Calculate total installed electrical load of any premises

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