GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Power Electronics Engineering

Course / Subject Code : DI01024011

Course / Subject Name : Electrical and Electronics Workshop

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

Prerequisite:	Basic knowledge of electrical and electronics engineering parameter.
Rationale:	Electrical, Electronics and allied engineering diploma holders are expected to handle various electrical and electronics tools in the workshop. They have to supervise work related to fitting of electrical components and soldering of electronic components and circuits in the workshop. This course will help to develop skills to use and test different types of electrical and electronics components, carry out simple electrical wiring, understanding basics of PCB and use of different basic electrical instruments.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Select basic electrical& electronic components for specific applications.	A
02	Fabricate staircase wiring, one room wiring and main board wiring.	A
03	Adopt precautionary steps while testing, operating and maintaining electrical system.	A
04	Design PCB for basic electronic circuit.	A
05	Select batteries for different applications.	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)	
0	2	4	4	0	0	20	30	50

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Electrical & Electronic Components.** 1.1 Passive components: 1.2 Resistors: General-purpose resistors, Power resistors, Wire-wound resistors, Thick film resistors, Surface-mount resistors, ceramic resistor, Axial resistors, Precision resistors, Variable resistors, Thermistor, resistor array, standard resistor values. 1.3 Inductors: Iron core, Ferrite core, Toroidal core inductor, Variable with slug, Air core. 1.4 Capacitors: cylindrical capacitor, disc capacitor, ceramic capacitor, capacitor array, electrolytic capacitor, tantalum capacitors 1.5 Transformer: 6-0-6, 12-0-12, 9V, 12V transformers. 1.6 Electronic components: Relay, Diode, Zener diode, LED, Photo diode, BJT, Photo transistor, LDR, Solar cell, Photocell, Opto-coupler. 1.7 Testing of Resistor, Capacitor, Diode and Transistor, Inductor using multimeter. 1.8 Electronic Workshop Tools: Bread board, Solder iron, solder-stand, solder-wire, flux, Cutter, pliers, screwdriver set, wire stripper, de-solder pump, De-solder wick, drilling machine.	8	30
2.	**Electrical Wiring & Electrical Safety Devices.** 2.1 Cable and Wire: Classification of power cables; flexible, armored and unarmored, Classification of wire as per insulation code and color code, Standard Wire Gauge, 1-core, 2-core, 3-core, and 4-core. 2.2 Electrical Safety: Fuse, MCB, ELCB, and RCCB. 2.3 Earthling: Pipe and Plate Earthing. 2.4 Domestic wiring: staircase wiring, Sample example of one room electrification. 2.5 Main Board Wiring: wiring of main board using fuse, MCB and ELCB/RCCB.	7	25
3.	**Electrical Testing Devices and Precautionary system.** 3.1 2-Pole voltage tester: Test voltage and continuity using 2-Pole voltage tester. 3.2 Megger: Test insulator resistance of 1-phase and 3-phase windings.	6	20

	3.3 Precautionary steps: 3.4 Use of Protective Equipment and tools: Insulating mate, Hand gloves, helmet, arc flash suit, electric safety shoes, arc flash boundaries, rescue hook. 3.5 Adopt safe work practices: Job Hazard Analysis for electric equipment and wiring system, SOP for electric equipment and wiring system.		
4.	**Printed Circuit Board (PCB).** 4.1 PCB layout. 4.2 PCB design software. 4.3 PCB layout - Component side and copper side. 4.4 Tracing for PCB Fabrication. 4.5 Soldering - types - selection of materials and soldering practice in connectors and general purpose PCB.	4	15
5.	**Cells and batteries.** 5.1 Classification: Primary Cells, rechargeable batteries, Reserve Batteries, Fuel Cells. 5.2 IEC standard of batteries, Battery capacity. 5.3 Battery Technology used for EVs: Ni-MH, Pb-$Pb0_2$, Na-Nicl, Ni-cd, Zn-Br_2, Li-Ion, Na-S.	5	10
	Total	**30**	**100 %**

References/Suggested Learning Resources:
(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Encyclopedia of Electronic Components Volume 1 Resistors, Capacitors, Inductors, Switches, Encoders, Relays, Transistors.	Charles Platt	O'Reilly, United States of America-2013. ISBN: 978-1-449-33389-8
2	Printed Circuit Boards: Design and Technology	Bossart	TMH, latest edition
3	Build Your Own Printed Circuit Board	Al Williams	Mc GrawHill, latest edition
4	Making Printed Circuit Boards	Jan Axelsen	Mc GrawHill, latest edition
5	Modern World Transistor Data & Its Equivalent	Lotia M.	BPB Publications, 2008, ISBN: 978-8183332477

S. No.	Title of Book	Author	Publication with place, year and ISBN
6	Everyday Electronics Data Book	Mike Tooley	BPB Publications, 2011, ISBN: 978-8176567916
7	Hobby Electronics Project Special	BPB	BPB Publications, 2011, ISBN: 978-8183332033
8	Handbook Of Batteries	David Linden & Thomas B. Reddy	McGraw-Hill, ISBN 0-07-135978-8
9	Electric Vehicle Battery Systems	Sandeep Dhameja	Newnes, ISBN 0-7506-9916-7
10	Practical Guide to Inspection, Testing and Certification of Electrical Installations	Christopher Kitcher	Newnes, ISBN: 978-0-7506-8449-1

(b) Open source software and website:

1. https://www.electrical4u.com/types-of-resistor (for Resistor)
2. https://www.electronics-tutorials.ws/resistor/res_1.html (for Resistor)
3. https://www.electrical4u.com/electrical-engineering-articles/batteries (for Batteries)
4. https://www.electronicshub.org/types-of-diodes/ (for Diodes)
5. https://nptel.ac.in (for online courses and video of all engineering branches)
6. www.electronicsforu.com (for basic electronic projects and technical videos)
7. https://www.vlab.co.in(Virtual Lab for all engineering branches)
8. Fritzing – PCB Designing Open Source Software.
9. KiCAD – PCB Designing Open Source Software.
10. https://www.electricaltechnology.org/2019/07/mcb-mccb-elcb-rcb-rcd-rccb-rcbo.html (for MCB, ELCB,RCCB)

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
1	Identify various symbols of electrical and electronic component.	I	02
2	Identify and test various electrical and electronic component.	I	04
3	Test Capacitor, Diode, Transistor and JFET using multimeter.	I	02
4	Use multimeter for measurement of voltage and current in basic electrical and electronic circuits.	I	02
5	Measure the voltage, current and power of 6-0-6 and 12-0-12 transformer.	I	02
6	Use different types of relay for basic switching circuits.	I	04
7	Use different types of electrical and electronics workshop tools.	I	04
8	Make a chart of different electronic component by reading their datasheet.	I	04
9	Carryout staircase wiring.	II	02
10	Carryout one room wiring.	II	04
11	Carry out main board wiring: wiring with fuse, MCB and ELCB/RCCB.	II	04
12	Make a Pipe and Plate Earthling in your college building.	II	02
13	Demonstrate the Pipe and Plate Earthling Schemes using Charts/Site Visit.	II	02
14	Use 2-pole voltage tester for connectivity of 1 phase and 3 phase wiring.	III	02
15	Use Megger to measure insulation resistance for 1 phase and 3 phase wiring.	III	02
16	Demonstrate precautionary steps to adopt Safe work practices.	III	04
17	Prepare PCB layout manually.	IV	02
18	Prepare PCB layout using computer software.	IV	04
19	Trace electronic circuit from the given PCB layout of an electronic circuit.	IV	02
20	Make a simple electronic mini project by soldering on designed PCB.	IV	04
21	Test different types of batteries using multimeter.	V	02
	Total		**60**

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications
1.	Variable DC power supply 0- 30V, 2A, Short Circuit protection, display for voltage and current.
2.	Discrete Component Trainer/ Analog component Trainer: 2mm patch cords in interconnecting components, Collection of utilities like fixed and variable D.C. supplies, electrical Components like, LDR, Transistor, Photo diode, IC 78XX, IC 79XX resistors, capacitors, inductors,LED's, Built in variable DC supply dual ± 0 to 15V/ 500mA, fixed DC power supply, ± 12V / 500 mA, fixed DC power supply +5V/500mA, Built in AC supply.
3.	Digital Multimeter: 3 ½ digit display, 9999 counts digital multimeter measures: Vac, Vdc (1000V max), Adc, Aac (10 amp max) ,Resistance (0 – 100 MΩ) , Capacitance.
4.	Demonstration Board for staircase wiring.
5.	Demonstration Board for different wires & cables.
6.	Demonstration Board for operation of fuse, MCB and ELCB.
7.	Copper Plate for earthing: Size: 300 mm to 1200 mm, 25mm diameter GI pipe with 2meter length.13mm to 19mm GI pipe for watering, Bolt, Nut, wire, lugs, 30cm2 cast iron cover and frame, charcoal, cement, salt.
8.	2-Pole Voltage Tester: Voltage Measuring Range AC 12 Volt to 600 Volt. Operating Temperature range: -5 to 40 Degree Celsius.
9.	Megger- Digital Insulation Tester, Up-to 5 Kv 200 G-Ohm with Calibration Certificate
10.	Insulating mate, Hand gloves, electrical safety helmet, arc flash shoot, electric safety shoes, rescue hook.
11.	Primary Cells, Rechargeable batteries, Reserve batteries and Fuel Cells.
12.	Battery tester- for 12.8V/13.2V (Lithium), 12V (Lead Acid).
13.	PCB designing software

Suggested Micro Project List:

1. Prepare a board consist of different types of wires & cables.
2. Staircase wiring: Prepare a board that consist Staircase wiring.
3. Extension board: Prepare Extension board with fuse, few sockets and switches.
4. Electronic Circuit on PCB: Make basic electronic circuit on PCB.

Suggested Activities for Students:

1. Prepare specification of electrical and electronic components.
2. Prepare presentation on reading a datasheet of electronic components.
3. Undertake a market survey of different semiconductor components.
4. Prepare Job Hazard Analysis report for installing electrical motor.
5. Prepare chart that classify electric battery used for electric vehicle.

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