

GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)**Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)**

Semester-III

Course Title: Electrical Engineering Workshop Practice

(Course Code: 4330905)

Diploma programmer in which this course is offered	Semester in which offered
Electrical Engineering	Third

1. RATIONALE

Electrical engineering diploma holders are expected to handle various electrical tools and measuring instruments in the Electrical workshop. They have to perform work related to Safety devices, Earthing, measurement of various electrical parameters and solder and de-solder the electronic components and test the circuits in the workshop. They are also expected to test the contacts of contactor and push buttons, internal wiring of fan and tube lights using appropriate tools and measuring instruments in an industry. This course helps to develop skills to select and use appropriate tools, safety devices and measuring instruments.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Identification and Use of various electrical Tools, instruments and safety devices.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

1. Use Various Electrical Tools and Measuring Instruments.
2. Select different types of wires, Cables and Switches.
3. Solder different electrical and electronics components using of appropriate tools.
4. Follow safe practices to prevent accidents/ hazards to personnel and environment.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	4	2	00	00	25	25	50

(*): For this practical only course, 25 marks under the practical CA have two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

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

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify and Use of various tools used in electrical workshop.	1	2*
2	Identify symbols used in Electrical circuit diagram.	1	2
3	Use Digital meters like Multimeter, Clamp on meter and Digital tachometer for measuring various parameters.	1	2
4	Use Analogy meters like Ammeter, Voltmeter, and Wattmeter for measuring various electrical parameters.	1	2
5	Measure output voltage of the given single phase auto transformer.	1	2
6	Demonstrate different types of switches, plugs and sockets.	2	2*
7	Test the tube light wiring appropriate tools.	2	2
8	Test the fan wiring using appropriate tools.	2	2*
9	Test NO and NC contacts of contactor and push button. Operation of three phase contactor with Auxiliary Contact.	2	2*
10	Demonstrate installation of lugs and gland on the cable.	2	2
11	Identify different type of faults in a cable using Meggar and Test lamp.	2	2*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
12	Identify various types of resistors, inductors and capacitors, diodes and LEDs.	3	2
13	Measure the size of different wires using standard wire gauge and micrometer.	3	2
14	Demonstrate breadboard utilization for making electronics circuits.	3	2
15	Solder various electrical and electronics components on PCB.	3	2*
16	Find out value of Resistance using color code and verify it with Multimeter.	3	2
17	Demonstrate the different types of earthing including chemical earthing.	4	2
18	Study of electrical hazard and its effect, Precaution, and cure.	4	2
19	Study of Artificial respiration and first aid exercise to learn about safety procedures.	4	2
20	Study about IE safety rules.	4	2*
21	Demonstrate the protective devices like Fuse, MCB and ELCB.	4	2*
22	Study about recycle cables and electrical/electronic waste.	2	2
Minimum 14 Practical Exercises			28

Note

- i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. Care must be taken in assigning and assessing study report as it is a first year study report. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their market survey.

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr.No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Diagrams/Sketches/Tables	20
2	Experimental procedure and conduction by following safety practices.	30

Sr.No.	Sample Performance Indicators for the PrOs	Weightage in %
3	conceptual clarity	30
4	Time bound completion, team work & ethical values	20
Total		100

6. EQUIPMENT/ INSTRUMENTS REQUIRED :

These equipments with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name
1	Various Electrical Tools like pliers, wire stripper, cramping tools, etc.
2	Various electrical measuring instruments such as Digital and analog Multimeter, Ammeter, Voltmeter, Wattmeter, Clamp on Meter, Megger, Digital Tachometer, tong tester etc.
3	Various Domestic appliances like fan, tube light, electrical iron etc.
4.	Electrical wires and Cables, Lugs, Gland, tags, switches, socket, Contactor, Push button, etc.
5.	Electrical safety devices for Protection such as Fuse, MCB, ELCB, earthing rods.
6.	Electrical and electronics Component like Resistor, Inductor, Capacitor, LEDs etc.
7.	Soldering Kit.
8.	Various safety devices used for first aid and electrical hazards.
9.	Various electrical powers supplying equipment like variac, dc power supply.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-I Electrical Tools & Measuring Instruments	1a. Use of Various electrical tools. 1b. Measure electrical parameters using measuring instruments.	Pliers, Nose Plier, Cutter, Screw Driver, Test Lamp, Series Lamp etc. Voltmeter, Ammeter, Wattmeter, multimeter, Digital Tachometer, Clamp on Meter, Meggar.
Unit- II Switches and Cable	2a. Identify different type of cables, switches, plugs, sockets. 2b. Test NO-NC contacts of contactor and Push buttons. 2c. Trouble shooting of internal wiring of fan and tube light.	Different types of Cables, Lugs, Glands, Cable Joint, Tags, Recycle of Cables, Different Types of Switches, Plugs and Sockets, Basics of Contactor and Push Button, Internal circuit connection of Fan and Tube light, Recycle of cables.
Unit- III Resistor, Inductor and Capacitor	3a. Identify different type Resistors, Inductors and Capacitors 3b. Test different types of LED. 3c. Soldering electrical and electronics components on PCB	Different types of Resistor, Inductor capacitors and LED, Color Coding of Resistors, Soldering Practices, Recycle of Electronics components
Unit- IV Earthing and Electrical safety devices	4a. Select safety devices for various types of protections. 4b. Aware about the safety Rules to prevent accidents and hazards.	Need Of Earthing, Basics of Pipe Earthing, Plate earthing and Chemical Earthing, Safety devices Like Fuse, MCB, MCCB, ELCB etc. Electrical safety Rules, I.E. Rules for Electrical Safety and Hazards

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit	Unit Title	Teaching	Distribution of Theory Marks
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No.		Hours	R Level	U Level	A Level	Total Marks
I	Electrical tools and Measuring Instruments.		Not Applicable			
II	Switches and Cables.					
III	Resistor, Inductor and Capacitor					
IV	Earthing and Electrical Safety devices.					

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group (max.3-4 students) and prepare reports for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews.

- a) Undertake a market survey of different Switches and cables.
- b) Conduct Mock drill of Electric shock and respiration.
- c) Arrange group discussion on
- d) Seminar/Presentation on following topics:
 - i. Electrical I.E. Safety rules.
 - ii. Electrical Protective devices.
 - iii. Electrical tools
 - iv. Different types of wires and cables.
 - v. Different types of earthing etc.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a) Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.
- b) Guide student(s) in undertaking micro-projects.
- c) '**L' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.
- d) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
- e) With respect to **section No.10**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- f) Introduce E-waste recycling technology among the students.
- g) Guide students for reading data sheets.

12. SUGGESTED MICRO-PROJECTS :

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 4). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission.. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

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:

- 1) Prepare Extension board using few sockets and switches.
- 2) Prepare a board of different types of wires or cables.
- 3) Prepare a board of different types of Switches and sockets.
- 4) Make a PCB circuit using electronic components.
- 5) Prepare a board of different types of lugs and glands.
- 6) Prepare board of different protective devices with specification.
- 7) Make a simple control circuit using contactor and push button.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Electronic Components and Materials	Joshi Madhuri	Shroff Publishers & Distributors private ltd.
2	Electrical Wiring, Estimating and Costing	S. L. Uppal & G. C. Garg	Khanna Publication
3	Electrical Measurements And Measuring Instruments.	Rajput R.K.	S Chand
4	Electrical Workshop	R. P. Singh	I.K. International Publishing House Pvt. Ltd.,
5	Handbook of Electrical Engineering	S.L. Bhatia	Khanna Publication
6	Electrical Engineering	Singh, S. K. Surjit	Kataria & Sons

Sr. No.	Title of Book	Author	Publication
	Drawing I & II		
7	Handbook of Electrical Design Details	Neil Sclater, John E. Traister	Mc Graw hill
8	Text book of Applied Electronics	Sedha R.S	S. Chand
9	Electrical engineering materials & semiconductor devices	Gupta, J.B. ,& Gupta, Renu	S.K. Kataria& sons
10	Electrical Engineering Materials	G. K. Mithal	Khanna Publication

14. SOFTWARE/LEARNING WEBSITES

- https://www.electronics-tutorials.ws/resistor/res_1.html (for Resistor)
- <https://nptel.ac.in> (for online courses and video of all engineering branches)
- <https://www.electricaltechnology.org/2019/07/mcb-mccb-elcb-rcb-rcd-rccb-rcbo.html> (for MCB, ELCB,RCCB)
- <https://uk.rs-online.com/web/generalDisplay.html?id=ideas-and-advice/cable-glands-guide> (for cable Gland installation guideline)
- www.electrical4u.net/basic-accessories/electrical-cable-lugs-crimping-procedure-for-beginner/ (For cable lug)
- <https://electrialstandards.blogspot.com/2015/11/circuit-diagram-of-ceiling-fan-fault.html> (For Trouble shoot of fan)
- <https://www.electrical4u.com/wiring-diagram-for-a-single-tube-light-circuit/> (for trouble shoot of tube light)
- <https://electricalgang.com/chemical-earthing> (For Chemical earthing)
- https://cpcb.nic.in/uploads/Projects/E-Waste/e-waste_amendment_notification_06.04.2018.pdf(For E-waste Recycle guidelines)
- <https://cpcb.nic.in/displaypdf.php?id=RS1XYXN0ZS9FLVdhc3RITV9SdWxlcl8yMDE2LnBkZg==>(For E-waste Recycle guidelines)
- https://www.meity.gov.in/writereaddata/files/1035e_eng.pdf(For E-waste Recycle guidelines)
- <https://www.meity.gov.in/content/gazettes>(For E-waste Recycle guidelines)

Semester 2	Electrical Engineering Workshop and Practice (Course Code: 4320902)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analyses	PO3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
<u>Competency</u>	Identification and Use of basic electrical instruments and devices.						
CO 1 Use Various Electrical Tools and Measuring Instruments.	3	-	-	3	-	2	2
CO 2 Select different types of wires, Cables and Switches.	3	2	2	2	2	-	2
CO 3 Solder different electrical and electronics components using of appropriate tools.	3	-	-	2	-	-	-
CO 4 Follow safe practices to prevent accidents/hazards to personnel and environment.	3		-		3	2	2

Legend: '3' for high, '2' for medium, '1' for low and '-' for no correlation of each CO with PO.

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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