GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-II

Course Title: Electronic and Computer Workshop Practice
(Course Code: 4320701)

Diploma programme in which this course is offered	Semester in which offered
Computer	Second

1.   RATIONALE

The engineering technologists (i.e. engineering diploma holders) have to use/maintain various types of equipment which are electronically operated and controlled. For using/maintaining such equipment, the fundamental principles of electronics and electrical are to be applied in many situations to arrive at the probable solutions to many of the broadly defined problems which they will face during their career as technologists. Therefore, the knowledge about the functions of various basic electronics devices and the associated circuits including the associated practical skills acquired through the laboratory will help the student when she/he will be working with electronically controlled/operated equipment or electronic circuits. This course is therefore so designed that the students will be able to use/apply the knowledge of various electronic hardware and measuring equipment and they will be also able to develop mini projects using certain electronics boards like Arduino.

2.   COMPETENCY

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

- **Use practical knowledge of electronics in various engineering applications.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

CO1 Demonstrates various active and passive components used in circuit.
CO2 Categorize various types of cable based on their characteristics and applications.
CO3 Categorize various types of connectors based on their characteristics and applications.
CO4 Operate Digital Multimeter for various measurements
CO5 Build any mini project on Arduino/Raspberry pi/PCB / Breadboard which enforces
     Project based Learning

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
CI	T	P	C	CA	ESE	CA	ESE	
-	-	2	1	-	-	25	25	50

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: CI*-Class Room Instructions;* **T** *– Tutorial/Teacher Guided Theory Practice;* **P** *-Practical;* **C** *– Credit,* **CA** *- Continuous Assessment;* **ESE** *-End Semester Examination.*

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs.*Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identification/Measurement of various electronic hardware components	I	06
2	Identification of various types of cables.	II	02
3	Identification of various connectors/Interfaces.	III	04
4	Hands on practice on Digital Multimeter	IV	04
5	Miniproject based on PCB(Group Activity*)	I to IV	06
6	Miniproject based on Arduino/Raspberry Pi based board(Group Activity*)	V	06
	Total		**28**

<u>***Note***</u>

 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. *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..*

iii. *Maximum number of students in one group is 4.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Prepare of experimental setup	20
2	Operate the equipment setup or circuit	20
3	Follow safe practices measures	10
4	Record observations correctly	20
5	Interpret the result and conclude	30
Total		**100**

6.   MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical skills in all institutions across the state in a proper way so that the desired skills are developed in students.

S. No.	Suggested Components and Equipment List (Consumables)	PrO. No.
1	Various types of Resistors,capacitors,Inductors,ICs,PCBs	All
2	Various types of Diodes,Transistors,LEDs, 9 Volt batteries	All
3	Soldering Iron, Soldering core ,Flexible Wire, Blank PCB, 2-pin plug, Soldering flux, Breadbord	All
4	Digital Multimeter : 3 1/2 digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000V max) , A_{dc}, A_{ac} (10 amp max) , Resistance (0 - 100 MΛ) , Capacitance and Temperature measurement, Screwdriver Set	All
5	Various types of Cables and connectors,ICs, Switches, Jumpers	All
6	Arduino boards/Kit,Raspberry Pi boards/Kit/Sensors/Required cables as well as per recent trends/technology need	All

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfill the development of this competency.
   a) Work as a leader/a team member.
   b) Follow ethical practices.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
   i.   'Valuing Level' in 1st year
   ii. 'Organization Level' in 2nd year.
   iii. 'Characterization Level' in 3rd year.

9.   UNDERPINNING THEORY

The major Underpinning Theory is formulated as given below and only higher level UOs of *Revised Bloom's taxonomy* are mentioned for development of the COs and competency in the

students by the teachers. (Higher level UOs automatically include lower level UOs in them). If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at Application level)	Topics and Sub-topics
Unit-I Basic of Electrical and Electronic Components	1a. Identify various electronic hardware components. 1b. Soldering - desoldering process	1.1 Resistor, Capacitor, Inductor, transformer 1.2 Voltage Source(AC 230 Volt)/Current Source, Battery 1.3 Various types of Diodes including LEDs 1.4 Transistors 1.5 IC, PCB, Breadboard, jumpers, switch ,knob. 1.6 Soldering, Desoldering Process
Unit – II Identification of Cables	2a. Identify various types of Cables	1.1 Twisted Pair Cable (UTP/STP) 1.2 Fiber Optic Cable 1.3 Coaxial Cable 1.4 Ribbon Cable

Unit – III
Identification of Connectors
	2a. Identify various types of connectors	2.1. HDMI Port
		2.2. RS-232 Interface
		2.3. RJ-45 Connectors
		2.4. USB Connectors
		2.5. Audio-Video Jack
		2.6. Mobile Connectors
		    -Type C connector
		    -Micro USB connector

Unit– IV Measuring Instrument	4a. Operate measuring instruments	4.1 Digital Multimeter
Unit– V Internet of things	5a. Develop application based on PCB/Breadboard/Arduino/Raspberry pi electronic board	5.1 Mini Project based on PCB /Breadboard 5.2 Mini Project based on Arduino /Raspberry pi electronic board

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Practical Hours	Distribution of Practical Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Electrical and Electronic components	06	1	1	1	3
II	Identification of Cables	02	1	1	1	3
III	Identification of Connectors	04	1	1	1	3
IV	Measuring Equipments	04	2	2	4	8
V	Internet of things	12	2	2	4	8
	Total	28	**7**	**7**	**11**	**25**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

11.   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 conduct following activities in groups and prepare small reports (of 1 to 5 page for each activity). For micro project reports should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare specifications of some electronic devices.
b) Undertake micro-projects in groups(Max.Limit-4)
c) Give seminars on any relevant topic.
d) Undertake a market survey of different semiconductor components.
e) Prepare showcase portfolios.

12.   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) **'CI" 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.11**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
f) Guide students on how to address issues on environment and sustainability using the knowledge of this course
g) Guide students for using data manuals.

13.   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-project are group-based (group of 3 to 5). 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 a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before submission. The total work load on each student due to the micro-project should be about **16 (sixteen) student engagement hours** (i.e. about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

1   Make an LED blinking using Arduino.
2   Controlling an LED with a button using Arduino.
3   Make an active buzzer sound using Arduino.
4   Connect 8 LEDs showing the result of flowing using Arduino.
5   Interface LCD display using Arduino.

14.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	Goodyear Publishing Co. ,New Delhi, ISBN : 9780876202654
2	Principles of Electronics	V. K. Mehta (Text book)	S. Chand
3	Electronic Principles	A .P. Malvino(Text book)	TMH Edition
4	The Art of Electronics	Horowitz, Paul; Hill, Winfield	Cambridge University Press, New Delhi 2015 ISBN : 9780521689175
5	Basic Electronic Engineering	Baru, V.; Kaduskar, R.; Gaikwad S.T.	Dreamtech Press, New Delhi,2015 ISBN: 9789350040126
6	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press New Delhi, 2015, ISBN : 9780195425239
7	Electronic Devices and Circuit	Maini, Anil K.	Wiley India, New Delhi, ISBN : 9788126518951
8	Transistor Selector Handbook	-	Tower's International Foulsham, London, 1974, ISBN: 9780572008888

15.   SUGGESTED LEARNING WEBSITES

a)   www.datasheetcafe.com

b)   www.williamson-labs.com
c)   www.learnerstv.com
d)   www.cadsoft.io
e)   www.nptel.iitm.ac.in
f)   www.khanacademy
g)   www.vlab.co.in

16.   PO-COMPETENCY-CO MAPPING

Semester II	Basic Electronics (Course Code: ………………)									
	POs and PSOs									
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/develo pment of solutions	PO 4 Engineering Tools, Experiment ation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Managem ent	PO 7 Life-long learning	PSO 1	PSO 2	PSO 3 (If needed)
Competency *Use principles of basic electronics in various engineering applications*										
CO1 Demonstrate various active and passive components used in circuit.	2	-	-	1	-	-	1			
CO2 Categorize various types of cable based on their characteristic and applications.	2	-	-	1	1	-	1			
CO3 Categorize various types of connectors based on their characteristic and applications.	2	-	-	1	1	-	1			
CO4 Operate Digital Multi meter for various measurements	1	-	-	2	-	-	-			
CO5 Build any mini project on Arduino/Raspberry pi/PCB / Breadboard which enforces Project based Learning	2	2	2	2	1	2	1			

Legend: '**3**' for high, '**2**' for medium, '**1**' for low or '**-**' for the relevant correlation of each competency, CO, with PO/ PSO

17. COURSE CURRICULUM DEVELOPMENT COMMITTEE
   GTU Resource Persons

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