GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: **Electronic Practice**
(Course Code: 4312001)

Diploma programme in which this course is offered	Semester in which offered
Mechatronics Engineering	First

1. RATIONALE

Electronic practice is the backbone of the real industrial work situation, which helps in development and enhancement of relevant skill required by the technician working in engineering industries and workshops. The main objective of this course is to impart knowledge of different electronic components and develop the ability to understand datasheets. This course is designed to develop the skills to use the basics electronic components for different applications and will be useful in the project designs in the courses of later semesters. The course is also aimed at providing knowledge and skills related with working of simple circuits and fabrication of PCBs, drilling and soldering technique.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competency:

- **Test various electronic components and circuits.**

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:

a) Operate basic test and measuring instruments.
b) Use basic active and passive electronic components.
c) Perform soldering and de-soldering using soldering tools.
d) Test developed and simulated simple electronic circuit.
e) Dispose electronic waste safely.

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 has 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

The following practical outcomes (PrOs) are the sub-components of the COs. T*hey are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the features and use of the front panel controls of AC/DC voltage sources.	I	2
2	Identify the features and use of the front panel controls of Digital Multi Meter (DMM).	I	2
3	Identify the features and use of the front panel controls of CRO.	I	2
4	Identify the features and use of the Function Generator.	I	2
5	Measure voltage and periodic time of different waves using CRO.	I	2
6	Measure values of resistors using colour code and DMM.	II	2
7	Measure values of capacitors using DMM.	II	2
8	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	II	2
9	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter.	II	2
10	Measure values of voltages of transformer using DMM.	II	2
11	Measure component values using LCR Q-meter.	II	2
12	Test different types of diodes.	II	2
13	Test different types of Zener diode and LED.	III	2
14	Test 7-segment display using multimeter.	III	2
15	Identify three terminals of a transistor using digital multimeter.	III	2
16	Test different types of transistor configurations.	III	2

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
17	Identify and test different types of ICs.	III	2
18	Identify different types of switches and relays.	III	2
19	Construct various electronic circuits on breadboard.	IV	2
20	Test outputs of various electronic circuits on breadboard.	IV	2
21	Get familiar with PCB design process.	IV	2
22	Perform soldering on general purpose board.	IV	2
23	De-solder the components using de-soldering tools.	IV	2
24	Design a basic electronic circuit and simulate using open source tool/ available application software.	V	8
25	Prepare and test circuit on general purpose PCB.	IV	2
26	Make a simple electronic circuit by soldering on designed PCB.	IV	2
27	Build and test a simple circuit using relay and other electronics components.	IV	2
28	Perform market and internet survey of different methods used for disposal of electronic waste.	V	4
	Minimum Practical Hours	**56**	

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. *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..*

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

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. 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	Almost all
2.	Cathode Ray Oscilloscope Dual Trace 20MHz, 1MegaΩ Input Impedance	3,5,10-13
3.	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	4,5,10-13
4.	Digital Multimeter : 3 1/2-digit display, 9999 counts digital multimeter measures: V_{ac}, V_{dc} (1000 V max) , A_{dc}, A_{ac} (10 amp max) , Resistance (0 - 100 MW) , Capacitance measurement	Almost all
5.	LCR meter bench top or hand-held type, 3 1/2-digit display 1999 and resistance 0-20M	9
6.	Electronic Workbench: Bread Board 840 -1000 contact points: Positive and Negative DC power rails on opposite sides of the board with , 0-30 V, 2 Amp Variable DC power supply, Function Generator 0-2MHz, CRO 0-30MHz , Digital Multimeter	Almost all
7.	Educational Trainer Kits	16
8.	Soldering Gun: 40 Watts, Holding stand, Temperature Control, Power cord	22, 23, 26, 27
9.	De-soldering Gun: 80 Watts, output voltage 24 V	22, 23, 26, 27
10.	Wire Cutter	22, 23, 26, 27
11.	Wire Stripper	22, 23, 26, 27
12.	Consumable components: Resisters, capacitors, Diodes, Transistors, ICs, IC Sockets, General Purpose PCBs, LEDs, Relays, Switches, Connectors, Connecting Wires, Soldering metal, Soldering Flux, De-soldering mesh.	Almost 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 fulfil the development of this course competency.

a) Work as a leader/a team member.
b) Follow safety practices while using instruments and tools.
c) Follow ethical practices.
d) Practice environmentally friendly methods and processes.

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.

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) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I **Electronic Test Equipment**	1a. Describe the features associated with front panel controls of Power supply, CRO, Function generator, and Multi meters. 1b. Operate test and measuring instruments	1.1 Power Supply: DC power supply, concept of dual power supply 1.2 CRO: CRO probe, Front panel controls, AC/DC voltage measurement, frequency measurement 1.3 Function Generator: Front panel controls, Functions: sine wave, square wave, triangular wave and Amplitude measurement 1.4 Digital Multi meter: Front panel controls of DMM 1.5 AC and DC Waveforms
Unit – II **Passive Electronic Components**	2a. Identify various types of resistors, capacitors, inductors and transformer. 2b. Use various types of resistors, capacitors and inductors & their usage. 2c. Test various components.	2.1 Resistors: Concept of Resistors, Colour Coding, Tolerance, Maximum power rating, Application of LDR 2.2 Capacitors: Classification of capacitors, Coding of capacitors-using numerals, directly Printed values on capacitors, Ceramic capacitor and Electrolytic capacitor 2.3 Inductors: Concept of Inductors 2.4 Transformer: Concept of Transformer, Types: step-up and step-down 2.5 Testing of components using Multi meter/LCR Q-meter
Unit– III **Active Electronic Components**	3a. Identify Diodes, Transistors, IC, Switches, Relay. 3b. Describe applications of various components 3c. Test various diodes, transistors, IC, switches, relay, SMD, HWR, FWR	3.1 Diodes: Concept of Diode, PN junction diode, Zener diode, LED, 7 segment display, Photo diode, Solar cell, Optocoupler : Terminal identification and characteristic 3.2 Transistors: Types of transistor: NPN and PNP,

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
		terminal identification and testing and characteristic. 3.3 ICs: Pin diagram, Integrated Circuits (ICs) like 7905, 7805, 555, 741,LM 317 3.4 Switches: Concept of switches, Application of Toggle, Rotary, push to on & push to off 3.5 Relay: Concept of relays, Application of General-purpose relay, NO,NC contact, reed relays, solid state relays. 3.6 Surface Mount devices(SMD) 3.7 Half Wave Rectifier (HWR), Full Wave Rectifier (FWR)
Unit – IV **Circuit Connections and PCB designing**	4a. Connect various circuits on breadboard. 4b. Test output of various circuits. 4c. Describe PCB design process. 4d. Design a PCB. 4e. Test prepared PCB.	4.1 Breadboard- Study of breadboard connections 4.2 Circuits- Construction of various electronic circuits on breadboard Circuits like: rectifiers, filter circuits, clipper, clamper, transistor amplifiers, logic gates, LED driver circuit, power supply, etc. 4.3 Testing of outputs of various electronic circuits using test Equipment 4.4 PCB-Study of printed circuit board, layout design, artwork, etching 4.5 Soldering Practice- Soldering practice on general purpose PCB 4.6 Designing a PCB-Select a basic electronic circuit as a mini project and prepare its PCB 4.7 Mounting-Mounting of the component on the prepared PCB 4.8 Testing-Testing of the complete project (do not prepare project report) 4.9 Desolder pump, desolder wick & drilling machine

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit– V **Use of Simulation Software and Handling Electronic Waste**	5a. Use simulation software. 5b. Justify the need of understanding electronic waste 5c. Establish the relationship of sustainability and electronic waste. 5d. Suggest methods of handling electronic waste with examples. 5e. Suggest methods to dispose electronic waste	5.1 Simulation basics and to do simulation of 2-3 basic circuits (Any open source tool like PSpice ,ORCAD, , MultiSIM can be used) 5.2 Concept of electronic waste. 5.3 Sustainability and electronic waste 5.4 Methods to handle electronic waste 5.5 Disposal of electronic waste

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Not Applicable					

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 and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Collect various electronic components and make a show case component wise.
b) Collect specifications, pictures of electronic components from internet and present in classroom.
c) Visit nearby industry which manufacture any electronic component covered in this course

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) Guide students on how to address issues on environment and sustainability.
g) Guide students for finding proper active and passive components using datasheet manuals and websites for electronic application.

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-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 dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the microproject should be about **14-16 (fourteen to sixteen) student engagement hours** during the course. 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:

a) Design and assemble half wave and full wave rectifier using diodes.
b) Build and test DC power supply or any simple circuit on PCB.
c) Solder components on PCB and check the continuity.
d) Test the active and passive components connected in the given electronic equipment.
e) **Electronic Waste**: Prepare a report of strategies regarding handling of electronic waste with figures, tables and comparative charts.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Electronic Components and Materials	Madhuri Joshi	Shroff Publishers & Distributors Private Ltd., 9788173669002
2	Electronics Engineering Materials	K.B. Raina and S.K. Bhattacharya	S.K. Kataria & Sons, 2021 9789350144176
3	Electronic Components Handbook	Thomas H.Jones	Reston Publishing,1978 9780879092221
4	Handbook of components for electronics	Charles A. Harper	McGraw-Hill, 1988 9780070266827

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
5	Electronic Components and Materials	Naresh Grover, Kuldeep Singh Jamwal	Dhanpat Rai & Co (P) Ltd, 2007
6	Principles of Electronics	V. K. Mehta	S. Chand Publishers, 2020 978-9352838363
7	Electrical and Electronics Engineering Materials and Components	S. K. Bhattacharya	Khanna Publishers, 1996 9789387394247

Other Learning Resources

i. Practical Semiconductor Data manuals: BPB Publications; New Delhi
ii. Hobby Electronics Project Special: BPB Publications; New Delhi
iii. Some electronics engineering magazines like Electronics for You.

14. SOFTWARE/LEARNING WEBSITES

- http://www.efymag.com/
- http://www.electronicsforu.com
- http://www.kpsec.freeuk.com/symbol.htm
- http://en.wikipedia.org/wiki/Electronic_component
- https://mightyohm.com/files/soldercomic/FullSolderComic_EN.pdf
- www.nptel.iitm.ac.in
- www.khanacademy.com

15. PO-COMPETENCY-CO MAPPING

Semester I	Electronic Practice (Course Code: 4312001)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimen-tation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency	**Test various electronic components and circuits.**						
Course Outcomes CO a) Operate basic test and measuring instruments.	3	1	1	3	1	1	1
CO b) Use basic active and passive electronic components.	3	2	2	3	-	1	2
CO c) Perform soldering and de-soldering using soldering tools.	3	2	1	3	-	1	1
CO d) Test developed and simulated simple electronic circuit.	3	2	2	3	-	1	2
CO e) Dispose electronic waste safely.	2	1	1	-	3	1	1

*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

S. No.	Name and Designation	Institute	Contact No.	Email
1	U. V. Buch, Sr. Lecturer (EC)	G.P. Ahmedabad	9825346922	uvbuch@gmail.com
2	Hitesh J. Soni, Lecturer	B & B Institute of Technology, V.V.Nagar	9924177967	soni.hitesh21@yahoo.in
3	Bhavesh V. Patel, Lecturer	B & B Institute of Technology, V.V.Nagar	9925232822	bhaveshpatel1908@gmail.com
4	Muktesh P. Shah, Lecturer (EC)	B & B Institute of Technology, V.V.Nagar	9428437704	mpshah@bbit.ac.in

NITTTR Resource Person

S. No.	Name and Designation	Department	Contact No.	Email
1	Prof. (Mrs.) Susan S. Mathew, Associate Professor	Electrical & Electronics Engineering Education	0755-2661600 *363	ssmathew@nitttrbpl.ac.in
2	Dr. (Mrs.) Vandana Somkuwar, Associate Professor	Mechanical Engineering Education	0755-2661600 *356	vsomkuwar@nitttrbpl.ac.in