GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Fundamentals of Electronics
(Course Code: 4330904)

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

1. RATIONALE

Electrical engineer must have knowledge about electronics devices because now a days in industry many electronics components are used, So to meet industrial demands this course discuss about fundamental concepts and principles of basic electronics and aims at providing construction, working and applications of various types of semiconductor and optoelectronic devices, working of transistor in various configuration; which are used in electronics circuits. This course is developed in such a way that, students will be able to apply the knowledge to solve broad electronic engineering problems.

2. COMPETENCY

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

- **Maintain electronic circuits comprising of distinct electronic components.**

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) Use P-N junction diode for various rectifier circuits.
b) Apply knowledge of transistor in amplifier circuits.
c) Use the different types of oscillator.
d) Identify the behavior of semiconductor and opto electronic devices.
e) Test the performance of regulated power supply.

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	
4	0	2	5	30*	70	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: 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 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	Test characteristics of PN junction diode.	I	2*
2	Test characteristics of Half wave rectifier using CRO	I	2
3	Test characteristics of full wave centre tapped & bridge rectifier using CRO	I	2*
4	Compare output waveform of different Filters using CRO	I	2
5	Test the performance characteristics of CB transistor amplifier.	II	2*
6	Test the performance characteristics of CE transistor amplifier.	II	2*
7	To Test/Build transistor as a switch.	II	2
8	Testing of transistor using multi meter.	II	2
9	Test Hartley oscillator using CRO.	III	2*
10	Test Colpitts oscillator using CRO.	III	2
11	Test characteristic of zener diode.	IV	2
12	Test MOSFET amplifier.	IV	2
13	Derive characteristics of SCR.	IV	2*
14	Derive characteristics of UJT.	IV	2*
15	Display various alphanumeric characters on Seven segment LED Display.	IV	2
16	Test characteristics of LDR.	IV	2
17	Test Zener diode as voltage regulator.	V	2*
18	Build voltage regulator using 78xx and 79xx and measure the dropout voltage for the given voltage regulator.	V	2
19	Test the performance of SMPS.	V	2
20	Trouble shoot given DC regulated power supply.	V	2

	Minimum 14 Practical Exercises		28

Note

*f) 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.*

*g) 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	Prepare experimental setup	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

This major equipment 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 with Broad Specifications	PrO. No.
1	Regulated power supply: Dual DC , 0-30V/1A & 5V /1A with resolution of 10mV , 2mA	1-18
2	Digital Storage Oscilloscope : 300 MHZ Bandwidth , 2GSa/s maximum real time sampling rate refresh rate upto 2000 wfams/s , RS232 & USB connectivity	2,3,4,9,10
3	C.R.O.: 30 MHz Bandwidth, 2 channels, 20 ns sampling time.	2,3,4,9,10
4	Function generator: 10 HZ to 10MHZ , 10 Vpp , rise & fall time =20ns, manual / external triggering	2,3,4,9
5	Digital Multimeter: 51/2 digits resolutions with all basics measurement facility like DC Voltage: 200 mV ~ 1000 V, DC Current: 200 µA ~ 10 A, AC Voltage: True-RMS, 200 mV ~ 750 V, AC Current: True-RMS, 20 mA ~ 10 A, 2-Wire, 4-Wire	1-18

	Resistance: 200 Ω ~ 100 MΩ, Capacitance Measurement: 2 nF ~ 10000µF, Frequency Measurement: 20 Hz ~ 1 MHz etc., 0.015% DC Voltage Accuracy.	
6	DC Ammeter(0-50mA, 0-500 µA)	1-18
7	DC Voltmeter (0-30V, 0-10V)	1-18

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 course competency.

a) Work as a leader/a team member(while doing a micro-project)
b) Follow ethical practices.
c) Work as a group member (while performing experiments and taking readings)
d) Practice environmental friendly methods and processes. (Environment related)

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 **Basics of semiconductor and its applications**	**1a.** Explain properties of Semiconductor **1b**.Distinguish between intrinsic and extrinsic semiconductor materials **1c**. Describe working of PN junction diodes. **1d.**Describethe working of half and full wave bridge rectifier along with sketches. **1e.**Justify the need for different types of filters.	**1.1** Semiconductor properties and bonds in semiconductor **1.2** Intrinsic and extrinsic semiconductor materials: P type, N type semiconductors. **1.3** P-N junction diode. **1.4** Applications - Diode as rectifier, half wave, full wave and bridge wave rectifier. **1.5** Need of Filters **1.6** C, L, LC, π filters.

	1f. Differentiate between C, L, LC and π filters	
Unit– II **Transistor and amplifiers**	**2a**.Describe PNP and NPN transistors **2b**. Compare the working of CB, CE and CC transistors. **2c.**Describe the load line and biasing methods of the transistor. **2d.** Justify the need of voltage amplifier. **2e.** Select the voltage amplifier for a particular application. **2f.**Transistor as a switch	2.1 PNP and NPN transistors, conduction through transistor Leakage current, relationship between α and β. 2.2 Transistor configuration & Characteristics for CB, CE, CC. 2.3 Load line and biasing methods of Transistor. 2.4 Transistor as an amplifier : CE Amplifier. 2.5 Cascade amplifiers. 2.6 Transistor as a Switch: Working and application.
Unit– III **Oscillators**	**3a.** Explain the working of different types of oscillators with relevant sketches **3b.** Select oscillator for different frequency generation	3.1Working principle of oscillators 3.2 Different types of oscillators: Hartley oscillator, Colpitts oscillator, Phase-Shift Oscillator, Wien Bridge Oscillator, Crystal Oscillator
Unit– IV semiconductor and optoelectronic devices	**4a.** Describe working of the Zener diode, FET,MOSFET, DIAC , TRIAC ,UJT,TRIAC and SCR **4b.** Describe working of the Photo diode, photo transistor, LDR, Photovoltaic Cell, LCD, Light Emitting Diode (LED) and opto coupler, with symbols. **4c.**Explain seven segment LED display	4.1 Zener diode, FET,MOSFET, DIAC , TRIAC ,UJT and SCR 4.2 Photo diode, photo transistor, LDR, Photovoltaic Cell, LCD, LED and opto coupler. 4.3 Seven Segment LED display
Unit– V **Regulated Power supply**	**5a.** Justify the need of IC **5b.** Explain the need of Power Supply. **5c.** Explain parameters of the regulator and the need of regulated DC power supply. **5d.**Explain the working of different types of voltage regulator circuits **5e.** Explain working of SMPS. **5f.**Explain the working of UPS.	5.1 Need of IC 5.2 Difficulties with unregulated power supply. Need to have Regulated Power Supply. 5.3 Regulated power supply (module level), Shunt voltage regulator (module level). 5.4 Transistorized series voltage regulator(basic and with feedback, without derivation) 5.5 3-Terminal Fixed/variable voltage regulator IC: 78xx, 79xx, LM317

		5.6 Switch mode power supply (SMPS). 5.7 Uninterruptible Power Supply (UPS) types and application for critical load.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of semiconductor and its applications	12	4	7	5	16
II	Transistor and amplifiers	14	5	6	7	18
III	Oscillators	08	4	3	3	10
IV	Semiconductor and opto electronic devices	12	6	4	4	14
V	Regulated Power Supply	10	4	4	4	12
Total		56	23	24	23	70

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to 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 slightly vary from above table.*

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 (or individual) 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) Present seminar on various topics from course content
b) Test different semiconductor devices using multimeter.
c) Prepare a chart on different configuration of transistor.
d) Undertake micro-projects in teams.

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) Show animation/ video related to course content.
e) Some of the topics/sub-topics which are relatively simpler or descriptive are to be given to the students for self-learning but to be assessed using different assessment methods.
f) Many electronics projects can be made using semiconductor and optoelectronic devices which are covered in syllabus, so encourage students to make such projects.
g) Guide students on how to address issues on environment and sustainability

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 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 micro project 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) Build circuit of half wave rectifier without filter on bread board/General purpose PCB.
b) Build circuit of half wave rectifier with filter on bread board/General purpose PCB.
c) Build circuit of Full wave rectifier without filter on bread board/General purpose PCB.
d) Build circuit of Full wave rectifier with filter on bread board/General purpose PCB.
e) Prepare chart of comparison of CB, CE and CC transistors.
f) Prepare chart of different methods of cascading amplifiers.
g) Prepare chart of amplifier with positive feedback as oscillator and explain "Barkhausen criterion"

h) Make a flasher circuit using diac and triac.
i) Make a circuit of Burglar alarm using LDR.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Electronics Fundamental and application	Chattopadhyay ,D.	New Age International Publishers 2011
2	Electronics Principles	Malvino, Albert	TMH, New Delhi 2012
3	Principle of Electronics	Mehta, V.K.	S.Chand, New Delhi 2012
4	Basic Electronics and linear circuits	Bhargava, N.N.	TMH, New Delhi 2012
5	Basic Electronics and linear circuits	Kulshreshtha,D.C . Gupta, S.C.	TTTI, Chandigarh 2007
6	Fundamentals of Electronics	Thomas F. Schubert	I K International Publishing House, 2017
7	Electronic devices and circuit	Robert Boylestad	PHI, New Delhi 2012
8	Electronics devices and circuits	J.B.Gupta	S.K.kataria& Sons, 2013
9	Electrical and ElectronicsEngineering	SK Bhattacharya	Pearson Education, New Delhi, 2011
10	Electronic Principles	SK Sahdev	DhanpatRai & Co., New Delhi, 2022
11	Semi conductor opto electronic devices	Pallab bhattacharya	Prentice-Hall of India Pvt.Ltd 2017

14. SOFTWARE/LEARNING WEBSITES

WEBSITES

- https://circuitmaker.com/
- https://www.pspice.com/
- https://www.electronics-tutorials.ws/
- Electronics work bench
- https://www.allaboutcircuits.com/
- Electronicsclub.info

15. PO-COMPETENCY-CO MAPPING:

Semester III	Fundamental Of Electronics(Course Code:4330904)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solution	PO4 Engineerig Tools, Experimen-tation&Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Manage-ment	PO 7 Life-long learning
Competency	**Apply the basic concepts of distinct electronic components to build and trouble shoots various electronic circuits.**						
Course Outcomes CO1 Use P-N junction diode for various rectifier circuits	3	3	2	3	-	1	1
CO2 Apply knowledge of transistor in amplifier circuits.	3	3	3	3	-	1	2
CO3 Use the different types of oscillator.	3	1	1	-	-	-	-
CO4 Identify the behavior of semiconductor and opto electronic devices.	3	2	2	2	1	-	-

CO5 Test the performance of regulated power supply.	3	3	3	2	-	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

S. No.	Name and Designation	Institute	Contact No.	Email
1.	Nimish R. Suchak Lecturer Electrical Engg.	GP, Jamnagar	9228526725	suchak.nimish@rediffmail.com
2.	Dhara V. Sodha	GP, Junagadh	9429215260	dharasodha18@yahoo.com