GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch: Computer Engineering/
Computer Science and Engineering
Course / Subject Code : DI01000151
Course / Subject Name : Basics of Electronics

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

Prerequisite:	--
Rationale:	Engineering technologists, such as those holding engineering diplomas, often work with a variety of electronically operated and controlled equipment. To use and maintain such equipment effectively, they need to apply fundamental principles of electronics and electrical engineering to solve the various problems they will encounter throughout their careers. A solid understanding of the functions of basic electronic devices and circuits, coupled with practical skills acquired in the laboratory, is essential for these technologists. This knowledge will aid them when working with electronically controlled or operated equipment and electronic circuits. Therefore, this course is designed to ensure that students can effectively use and apply the principles of basic electronics whenever required.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply fundamental principles to analyze and solve problems in electronics engineering.	U
02	Describe the different types of semiconducting materials and their functionalities in electronic devices.	U
03	Demonstrate the characteristics and functions of various semiconductor diodes and rectifiers, including their applications in electronic circuits.	U
04	Utilize transistors in the design and implementation of electronic circuits.	A
05	Apply the 555 timer IC in various electronic circuit 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)	
2	0	2	3	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Basics of electronic circuits.	06	20
2.	Fundamentals of different types of Semiconductors.	06	15
3.	Introduction to Diodes and Rectifiers with their types.	08	30
4.	Introduction to Transistors.	06	20
5.	Timer circuits and application.	04	15
	Total	**30**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	40	30	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze, E: Evaluate and C: Create (as per Revised Bloom's Taxonomy)

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	Major Learning Outcomes	Topics and sub-topics
Unit – I Electronic Components	1a Define active and passive components. 1b Explain the calculation of color coding technique for resistance Calculation. 1c Compare specifications of capacitors. 1d Differentiate between resistors, capacitors and inductors. 1e Block diagram of DC power supply and compare with AC power supply	1.1 Introduction to electronics, brief history of electronic components, active and passive components 1.2 Resistors: Concept of resistors, specification of resistor, classification of resistors, fixed type and variable type resistors with applications, color coding of resistors. 1.3 Capacitors: Concept of capacitor, Classification of capacitors, capacitors specifications, fixed and variable capacitor. 1.4 Inductors: Faraday's laws of electromagnetic induction self-inductance, mutual inductance, and inductor specifications. 1.5 DC & AC Power supply analysis
Unit – II Fundamentals of Semiconductor	2a Explain atomic structure and conductivity 2b Describe Semiconductors and conductivity	2.1 Structure of atom of trivalent, tetravalent pentavalent materials, valence electron, free electrons, energy levels 2.2 Doping, Intrinsic semiconductor, extrinsic semiconductor 2.3 P-type and N-type semiconductor, majority - minority charge carrier and conductivity.

Unit– III Diodes and Rectifiers	3a Describe the working, characteristics and applications of P-N junction diode. 3b Describe the working, characteristics and applications of Zener diode. 3c Describe applications of various Diodes. 3d Compare performance of various types of rectifiers	3.1 P-N junction, Depletion layer, knee voltage 3.2 P-N junction diode forward bias, reverse bias working 3.3 P-N junction diode voltage-current characteristics 3.4 Zener diode: Working, characteristics and applications 3.5 Symbol, construction, characteristics and working of Varactor diode, Photodiode, Light Emitting Diode(LED) and Multi color LED 3.6 Rectifier: Need of rectifier, definition, types of rectifiers - half wave and full wave
Unit– IV Transistors	4a Distinguish the specification of the given type of transistors. 4b Differentiate the performance of the specified transistor with sketches. 4c Explain the operation of transistor Configuration with current gain, voltage gain and power gain. 4d Explain application of transistor as switch.	4.1 Types of transistors: PNP, NPN. 4.2 Working of transistors. 4.3 Transistor Configuration and input output characteristics of NPN transistors in Common base (CB), Common emitter (CE) and Common collector (CC) configuration 4.4 Transistor voltage gain and current gain 4.5 Transistor as switch
Unit– V Introduction to 555 timer IC and its application	5a Overview of 555 timer IC 5b Pin configuration and functions 5c Applications of 555 timer IC	5.1 IC 555 5.2 Description of the 8 pins: Vcc, GND, Trigger, Output, Reset, Control Voltage, Threshold, Discharge. 5.3 Functional block diagram. 5.4 List Applications - pulse generators, oscillators, timers and frequency Counters.

References/Suggested Learning Resources:

(a)Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Basic Electronics and Linear Circuits	N.N. Bhargava , D.C. Kulshreshtha , S.C. Gupta	McGraw Hill Education, ISBN: 9781259006463
	Electronic Devices and	Mottershead,	Goodyear Publishing Co., New Delhi,

2	Circuit: An Introduction	Allen	ISBN : 9780876202654
3	The Art of Electronics	Horowitz, Paul; Hill, Winfield	Cambridge University Press, New Delhi, 2015, ISBN : 9780521689175
4	Basic Electronic Engineering	Baru, V., Kaduskar, R., Gaikwad S.T.	Dreamtech Press, New Delhi, 2015 ISBN: 9789350040126
5	Fundamentals of Electronic Devices and Circuits	Bell, David	Oxford University Press New Delhi, 2015, ISBN : 9780195425239
6	Electronic Devices and Circuit	Maini, Anil K.	Wiley India, New Delhi, ISBN : 9788126518951
7	Transistor Selector Handbook	TAB books	Tower's International Foulsham, London, 1974, ISBN: 9780572008888
8	Principles of Electronics	V.K.Metha, Rohit Mehta	S. Chand, New Delhi, 2014, ISBN: 978-8121924504
9	Electronic Principles	Albert Malvino, David J. Bates	McGraw Hill Education ISBN - 978-0070634244

(b) Open source software and website:

1. www.datasheetcafe.com
2. www.williamson-labs.com
3. www.learnerstv.com
4. www.cadsoft.io
5. www.nptel.iitm.ac.in
6. www.khanacademy
7. www.vlab.co.in

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Use digital multimeter to measure basic electrical parameters like current, voltage and resistance.	I	02
2	Measure resistance, capacitances and inductances of different type of resistors, capacitors and inductors using LCR meter and verify it through color code and numerical code.	I	02
3	To construct and analyze the behavior of P-type and N-type semiconductors and identify the majority and minority charge	II	02

	carriers.		
4	To study the V-I characteristics of a P-N junction diode in forward and reverse bias.	III	02
5	To analyze the V-I characteristics of a zener diode and explore its application as a voltage regulator.	III	02
6	Build and test the half wave rectifier on a breadboard.	III	04
7	Build and test the full wave rectifier (center tapping) on a breadboard.	III	04
8	To construct and study the input and output characteristics of a transistor in Common Emitter (CE) configuration. Identify the cutoff, active, and saturation regions.	IV	04
9	Perform application of transistor as a switch	IV	04
10	To study and understand the IC 555 timer, its pin configuration, and its internal functional block diagram.	V	04
	TOTAL		**30**

List of Laboratory/Learning Resources Required:

(a) Software and Simulation Tools:

1. MATLAB
2. Multisim
3. PSpice
4. Lab VIEW
5. Proteus

(b) List of Equipment's

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Dual variable DC power supply ,0- 30V, 2A, With Short circuit protection, separate display for voltage and current	6,7, 8,9
2	Cathode Ray Oscilloscope ,Dual Trace 20Mhz, 1MegaΩ Input Impedance	6,7, 8,9
3	Digital MultiMate : 3 1/2 digit display, 1999 count digital multimeter measures: Vac, Vdc (600V max) , Adc, Aac(10 amp max) , Resistance (0 – 2 Mega Ohm) , with diode and transistor tester	1,6,7, 8,9
4	LCR meter bench top or hand-held type, 3 1/2 digit LCD /LED display , 1999 count , Resistance 0-20 Mega Ohm , Capacitance 0-200 micro Farad , Inductance 0 – 20 Henry	2
5	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	1 to 10

Suggested Project List:

Each student will work on one micro-project assigned at the beginning of the semester. In the first four semesters, these projects will be group-based, with 3 to 5 students per group. In the fifth and sixth semesters, groups will be limited to a maximum of three students.

The micro-projects can be based on industry applications, internet research, workshops, laboratory work, or field studies. Each project should cover two or more Course Outcomes (COs) and integrating Practical Outcomes (PrOs).Students must keep a dated work diary documenting their individual contributions and present a seminar on their project before submission. The workload for each student should be around 16 hours (approximately one hour per week) throughout the course. Projects should be submitted by the end of the semester to help students develop industry-relevant skills.

Here is a suggestive list of micro-projects, which should align closely with the course's competencies and COs. Similar projects may be added by the course teacher:

Using fundamental knowledge of electronics, students can develop mini or micro-projects based on team or individual work. These projects should strengthen their understanding of electronics hardware and serve as prototype models for various societal applications.

Suggested Activities for Students:

In addition to classroom and laboratory learning, the following student-related co-curricular activities are suggested to help achieve the various course outcomes:

1. **Group Activities and Reports**: Students should conduct the following activities in groups and prepare small reports (1 to 5 pages each). For micro-project reports, follow the suggested format. For other activities, students and teachers can decide on the format together. Students should also collect and record physical evidence, such as photographs or videos, for their portfolios, which will be useful during placement interviews:

   a. Prepare charts or display boards of some electronic devices with their specifications.
   b. Undertake mini or micro-projects in teams or individually.
   c. Give a seminar on any relevant topic.
   d. Conduct a market survey of various types of hardware components.
   e. Prepare showcase portfolios.

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