GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Information & Communication Technology/ Electronics & Communication Engineering

Course / Subject Code : DI01000051

Course / Subject Name: F u n d a m e n t a l s of Electronics

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

Prerequisite:	Basic of power supply & electronics components
Rationale:	The engineering diploma holders are required to use and maintain various types of electronically controlled equipment. The fundamental principles of electronics are to be applied in most of the situations to arrive at the probable solutions which is faced in the world of work, therefore the knowledge of the functions of various basic electronic devices and components and practical skills acquired through the laboratory experiments will help them, when they work with electronic equipment and its sub-circuits. This course is designed to develop the skills to use the basics electronic components and apply the knowledge to maintain the various types of electronic circuits.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Use passive electronic components and it's measurement.	R, U, A
2	Develop different types of rectifiers using PN junction diode.	R, U, A
3	Use special purpose diodes for different applications.	R, U, A
4	Analyze various transistor configurations.	R, U, A
5	Design various IC 555 Timer circuits	R, U, 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)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage marks
1.	Electronic Components & its measurements	10	14
2.	Introduction of Rectifiers & operation	10	26
3.	Special Purpose Diodes applications	10	20
4.	Introduction to Transistors	10	20
5.	Timer circuits and application	5	20
	Total	**45**	**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 and E: Evaluate 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 passivecomponents. 1b. Explain the calculation of colorcoding technique for resistance calculation. 1c. Compare specifications of varioustypes of capacitors. 1d. Differentiate various types of resistors, capacitors and Inductors onthe basis of construction and workingprinciple. 1e. Describe the applications of giventype of passive component. 1f. Block diagram of DC power supply and compare with AC power supply	1.1 Introduction to electronics, Brief History of electronic components, activeand passive components 1.2 Resistors: Concept of resistors, specification of resistor, classification of resistors, fixed type and variable type resistors with applications, color coding ofresistors, Light dependent resistor (LDR) -symbol and working. 1.3 Capacitors: Concept of capacitor, Classification of capacitors, capacitors specifications, fixed capacitor, specification and application of ceramic disk capacitor, polyester capacitor , mica capacitor ,aluminum electrolytic capacitor, Inductors: Faraday's laws of electromagnetic induction self- inductance, mutual inductance, inductorspecifications, introduction to air core, iron core and ferrite core inductor, DC & AC Power supply analysis.
Unit – II Applications ofDiodes and Rectifiers	2a. Explain clipper and clamper circuits2b. Compare performance of various types of rectifiers. 2c. Calculate ripple factor, ripple frequency, PIV and efficiency of thegiven type of rectifier. 2d. Justify the selection of specific typeof rectifier for the given application. 2e. Discuss function of shunt capacitorand Pi – filter	2.1 Different types of Clipper Clamper circuits, 2.2 Rectifier: Need of rectifier, definition,types of rectifiers 2.3 half wave rectifier, full wave center tap and bridge rectifier, output voltage, current, ripple voltage, ripple factor, ripple frequency, PIV of a diode, transformer utilization factor, efficiencyof half wave and full wave rectifiers 2.4 Filters: Need and applications of rectifier filters, types of filters: shuntcapacitor & Pie filter

Unit– III Special PurposeDiodes	3a. Draw and describe symbol, construction, characteristics andworking of the various Diodes. 3b. Describe applications of variousDiodes.	3.1 Zener diode: -Symbol, construction,characteristics and working and application as a voltage regulator 3.2 symbol, construction, characteristics and working of Varactor diode, Photodiode, Light Emitting Diode(LED) and Multi color LED 3.3 Application of Varactor diode, Photodiode, Light Emitting Diode(LED)and Multi color LED
Unit– IV Introduction toTransistors	4a. Draw and describe symbol, construction, characteristics and working of NPN and PNP Transistor	4.1 Transistor NPN and PNP symbol, construction, working, characteristics andimportant specifications of transistor
	with sketch. 4b. Explain the operation of transistor Configuration with current gain ,voltagegain and power gain 4d. Explain application of transistor asswitch and amplifier.	4.2 Transistor Configuration and input output characteristics of NPN transistorsin Common base (CB), Common emitter(CE) and Common collector (CC) configuration 4.3 Transistor voltage gain and currentgain. 4.4 Transistor as switch 4.5 Transistor as single stage Commonemitter amplifier
Unit– V Timer circuits and application	5a. Explain block diagram, Pin diagramand working of IC 555 timer 5b. Draw and explain Astablemultivibrator 5c. Draw and explain mono stablemultivibrator 5d. Draw and explain Bistablemultivibrator	5.1 IC 555: block diagram, working , Pindiagram 5.2 Astable Multivibrator using 555 timerIC. 5.3Mono stable Multivibrator using 555timer IC. 5.4 Bistable Multivibrator using 555 timerIC. .

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
2	Electronic Devices and Circuit: An Introduction	Mottershead, Allen	Goodyear Publishing Co., New Delhi, 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	E-Waste: Management and Procurement of Environment	Suresh Kumar, Jatindra Kumar Pradhan	Authors press 2021, ASIN : B095PR6MVS
10	Solid and Liquid Waste Management Waste to Wealth	Rajaram Vasudevan, Siddiqui Faisal Zia , Agrawal Sanjeev	PHI Learning Pvt. Ltd. New Delhi ISBN: 9788120352452
11	Power Electronics	M.H. Rashid	PHI

(b) Open source software and website:

Software:

1. Electric Circuit Studio
2. Multisim for Analog and Electronics Circuit design and simulation.
3. Electronics Work bench
4. Power Simulator
5. Scilab

Websites:

1. https://www.multisim.com/
2. https://www.vlab.co.in/broad-area-electronics-and-communications
3. http://202.12.103.135/vlab/interface/index.html
4. www.nptel.iitm.ac.in
5. www.datasheetcafe.com
6. www.williamson-labs.com
7. www.learnerstv.com
8. www.cadsoft.io
9. https://lectures.gtu.ac.in/listview.aspx?br=11&course=DI
10. www.nptel.iitm.ac.in
11. www.khanacademy
12. www.youtube.com
13. www.alldatasheet.com
14. www.electronics-tutorials.ws
15. www.instructables.com/Basic-Electronics
16. www.makerspaces.com/basic-electronics
17. https://robu.in/product-category/electronic-components/
18. https://in.rsdelivers.com/campaigns/microsites/electronics?cm_mmc=IN-PPC-DS3A-_-google-_- 0_IN_EN_Brand_RS+Components|Pure_BMM-_-RS_Components-_-%2Brs+%2Bcomponents&matchtype=b&kwd-296158955919&s_kwcid=AL!7457!3!360038397031!b!!g!!%2Brs%20%2Bcomponents&gclid=EAIaIQobChMIq9DAjuqb8gIVwRErCh2QaQvYEAAYASACEgKUgPD_BwE&gclsrc=aw.ds
19. https://www.digikey.in/?utm_adgroup=General&utm_source=google&utm_medium=cpc&utm_ca mpaign=EN_Competitor_Mouser_E&utm_term=mouser&productid=&gclid=EAIaIQobChMIg8Kt qeqb8gIV7xxyCh2cUwbYEAAYAiAAEgKsovD_Bw
20. https://electronicscoach.com/category/basic-electronics

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	Use CRO to measure electrical parameters of different types of signals obtain from Function generator.	I	02*
3	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*
4	Test the performance of LDR and measure the variation in resistancewith the change in light intensity.	I	02
5	Build and test different types of clipper circuits.	II	02*
6	Build and test the half wave rectifier on a breadboard.	II	02*
7	Build and test the full wave rectifier (center tapping) on a breadboard.	II	02
8	Build and test the full wave bridge rectifier on a breadboard.	II	02*
9	Test the performance of half and full wave rectifier with shunt capacitorfilter.	II	02*
10	Test the performance of the zener diode and obtain the Zener breakdown (Reverse) voltage and current.	III	02
11	Build and test zener voltage regulator for the given regulated voltage.	III	01*
12	Test the performance of LED in series and shunt connection and measure the current and voltage in both the connections.	III	02
13	Test common emitter transistor configuration and obtain the value ofcurrent gain and input impedance.	IV	02
14	Perform application of transistor as a switch	IV	01*
15	Build and test common emitter amplifier and obtain the value of voltagegain for given input signal.	IV	01*
16	Build and test mono stable multi vibrator using IC 555	V	01*
17	Build and test b is table multi vibrator using IC 555	V	01
18	Build and test as table multi vibrator using IC 555	V	01*
	Minimum 15 Practical Exercises	**30 Hrs.**	**Minimum 15 Practical Exercises**

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	Prepare of experimental setup	20
2	Operate the equipment setup or circuit	20
3	Follow safety measures and practices	10
4	Record and plot observations correctly	20
5	Interpret the result and conclude	30

List of Laboratory/Learning Resources Required:

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

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	4,5,6,7,8,9,10, 11,12,13,14, 15,16,17, 18
2	Cathode Ray Oscilloscope ,Dual Trace 20Mhz, 1MegaΩ Input Impedance	2,5,6,7,8,9,13, 14,15,16, 17,18
3	Function Generator 0-2 MHz with Sine, square and triangular output withvariable frequency and amplitude.	2

4	Digital Multimeter : 3 1/2 digit display, 1999 count digital multimeter measures: Vac, Vdc (600V max) , Adc, Aac(10 amp max) , Resistance (0 – 2Mega Ohm) , with diode and transistor tester	1,4,5,6,7,8,9, 10,11,12,13, 14,15,16,17,18
5	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 microFarad , Inductance 0 – 20 Henry	3
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 AmpVariable DC power supply, Function Generator 0-2MHz, CRO 0-30MHz , Digital Multimeter	1 to 17 & 18

Suggested Project List:

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 to5). 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) **Diode:** Build a circuit on general purpose PCB or breadboard to obtain +12V unregulated DC powersupply using full wave bridge rectifier and filter (Duration: 8- 10 hours)

b) **Photodiode**: Build a interruption detector circuit to blink an LED using LDR, and prepare a mini projectreport. ((Duration: 6-8 hours)

c) **Transistor Amplifier**: a common emitter amplifier using transistor and prepare a mini project report.(Duration: 6-8 hours)

d) **Transistor Application:** Build a transistorized water level indicator and prepare a mini project report.(Duration: 6-8 hours)

e) **Special Purpose Diodes:** Build basic applications using any one or combination of special purposediodes , and prepare a mini project report. (Duration: 6-8 hours)

f) **555 Timer**: Build a circuit on a breadboad using 555 timer to generator square with variable duty cycleand frequency. (Duration: 6-8 hours)

Suggested Activities for Students:

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) Prepare a table and interpret the technical specification of various diodes and transistors using data sheet.
b) Prepare specifications of some electronic components.
c) Collect information and seminar on any relevant topic related with the course.
d) Undertake a market survey of different semiconductor components.
e) Identify various types of transistor
f) Analysis of 555 Times circuits

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