GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

Course Title: Basic Electronic Circuits
(Code: 3322401)

Diploma Programmes in which this course is offered	Semester in which offered
Power Electronics	Second Semester

1. RATIONALE

This course will enable students to develop the skills required to use basic electronic devices in various electronic circuits. Through the study of this course the students will get the knowledge of construction, working principle, characteristics and application of various types of semiconductor diodes and transistors. This course will develop skills to identify and test active electronic components and simple circuits such as filters and power supply used for various applications.

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:

- **Analyze electronic circuits consisting of active electronic components.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
4	0	4	8	70	30	40	60	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

Note: It is the responsibility of the institute heads that marks for **PA of theory** & **ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

4. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes	Topics and Sub-topics
Unit – I **Semiconductor Material, Junction Diode and Applications**	1a. Describe semiconductor material characteristics.	1.1 Semiconductor material: Germanium, silicon, atomic structure and characteristics of semiconductor material
	1b. Explain the working of P-N junction diode.	1.2 Forward and reverse biased characteristics 1.3 Diode approximation: First, second and third approximation
	1c. Explain the working of diode rectifier circuits.	1.4 Rectifiers: half wave and full wave rectifier - centre tapped and bridge rectifier
	1d. Compare the parameters of half wave, center-tapped and bridge rectifiers.	1.5 Parameters: PIV, peak current, DC output current, DC output voltage, RMS current and voltage, ripple factor and efficiencies of rectifier circuits
	1e. Analyze diode clipper circuits.	1.6 Diode clipper: Biased and unbiased clipper, positive and negative and combination clippers
	1f. Analyze diode clamper circuits.	1.7 Diode clamper: Positive and negative clamper, voltage doublers and multiplier
Unit– II **Special Purpose Devices**	2a. Differentiate the working of various types of special purpose diodes.	2.1 Zener diode, tunnel diode, varactor diode and schottky diode
	2b. Distinguish the working of various types of photo devices.	2.2 Photo diode, LDR, photovoltaic cell and photo transistor, light emitting diode, opto-coupler, 7-segment display
Unit– III **Bipolar Junction Transistor**	3a.Explain construction and working of bipolar transistor.	3.1 NPN, PNP; working as an amplifier
	3b.Compare various transistors configurations.	3.2 CB, CE and CC: Current gain: β and α, relation between β and α, voltage gain and power gain
	3c. Describe h-Parameters for transistor.	3.3 h-parameters and its equivalent circuit
Unit – IV **Transistor Biasing Circuits, Transistor Amplifiers and Thermal Stability**	4a.Explain different types of biasing circuits.	4.1 Importance of biasing, fixed bias, collector to base bias, emitter bias and voltage divider bias
	4b.Explain working principle of transistor amplifiers.	4.2 CB, CE, CC Amplifiers
	4c. Compare various configurations of amplifier.	4.3 Comparisons of CB, CE and CC amplifier, basic concepts of CB and CC amplifier, Darlington pair
	4d. Draw the DC load line and Q point for calculating various operating parameters.	4.4 Load line consideration, operating point for CE amplifier, DC load line, Q point, operating parameters: A_v, A_i, A_p, R_o, $R_{i.}$

Unit	Major Learning Outcomes	Topics and Sub-topics
	4e.Distinguish between thermal instability, thermal runaway, stability factor and thermal resistance.	4.5 Thermal instability, thermal runaway and stability factor, thermal resistance
	4f. Compare different types of heat sinks.	4.6 Types of heat sinks
Unit – V **Filter and Regulated Power Supply**	5a. Justify the need for filters. 5b. Compare the different types of filter.	5.1 Filters: Types of filters- series L filter, shunt C filter, chock input filter, π filter
	5c. Explain need for regulators in electronic circuits.	5.2 Zener as voltage regulator
	5d. Describe the use of zener in voltage regulator circuit.	5.3 Series voltage regulator, shunt regulator using transistor
	5e. Select relevant regulator for specific applications.	5.4 Three terminal IC voltage regulator ICs i.e. 7805, 7812, 7905, 7912

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor Material, Junction Diode and Applications	10	04	04	02	10
II	Special purpose Devices	12	04	08	04	16
III	Bipolar Junction Transistor	08	04	06	02	12
IV	Transistor Biasing Circuits, Transistor Amplifiers and Thermal Stability	16	06	06	08	20
V	Filter and Regulated Power Supply	10	04	04	04	12
	Total	**56**	**22**	**28**	**20**	**70**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

S. No.	Unit No.	Practical Exercise/Experiment	Approx. Hrs. Required
1.	I	Measure voltage and frequency of any given signal using oscilloscope.	01
2.	I	Measure different voltage and frequency from function generator using oscilloscope and multimeter.	02
3.	I	Test performance of P-N junction diode.	01
4.	I	Test performance of half wave rectifier.	02
5.	I	Test performance of centre tap and bridge rectifier.	02
6.	I	Build/test positive and negative clipper circuit using diode.	02
7.	I	Build/test positive and negative clamper circuit using diode.	02
8.	II	Test performance of zener diode.	02
9.	II	Test performance of photo diode.	01
10.	II	Test performance of tunnel diode.	01
11.	II	Test performance of varactor diode.	01
12.	II	Test performance of schottky diode.	01
13.	II	Test performance of LED.	01
14.	II	Test performance of LDR.	02
15.	II	Test performance of photovoltaic cell.	02
16.	II	Test performance of photo transistor.	02
17.	II	Test performance of 7-segment display.	02
18.	III	Build/test performance of CB configuration.	02
19.	III	Build/test performance of CE configuration.	02
20.	III	Build/test performance of fixed biased amplifier.	02
21.	III	Calculate h-parameters of the given transistor.	02
22.	IV	Measure voltage at different points of voltage divider biased amplifier.	02
23.	IV	Build/test performance of CE amplifier circuit.	04
24.	IV	Build/test performance of CB amplifier circuit.	02
25.	IV	Test the performance of CB amplifier using Darlington pair.	02
26.	IV	Test performance of CC amplifier using Darlington pair.	02
27.	IV	Measure parameters for CE transistor amplifier.	02
28.	IV	Test performance of transistor for thermal stability.	02
29.	V	Build/test zener diode as voltage regulator.	02
30.	V	Build/test series voltage regulator.	02
31.	V	Build/test shunt voltage regulator.	02
32.	V	Build/test three pin voltage regulators using 7805.	02
33.	V	Build/test three pin voltage regulators using 7812.	01
34.	V	Build/test three pin voltage regulators using 7905.	02
35.	V	Build/test three pin voltage regulators using 7912.	01
		Total	**63**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

- Students may be given exercises based on diode and transistor to calculate important parameter related with above topic.
- Student may be asked to collect photographs from internet which is related to field application of various topics and have to prepare learning material using it.
- Teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.
- Student activities like: course/topic based seminars, internet based assignments.

8. SUGGESTED LEARNING ACTIVITIES

A. List of Books

S. No.	Title of Book	Author	Publication
1.	Principle of Electronics	Mehta V.K.	S. Chand, 2010 or latest
2.	Electronic Devices and Circuit Theory	Boylestad L. Robert	Pearson, 2009 or latest
3.	Basic Electronics and Linear Circuits	Kulshrestha, Gupta and Bhargava	TMH, 2011 or latest
4.	Electronic Principles with simulation CD	Malvino A.P.	TMH, 2006 or latest
5.	Electronic Devices and Circuits	Mottershead Allen	PHI, 2011 or latest
6.	Electronic Devices and Circuits	Bell David A.	Oxford, 2008 or latest

B. List of Major Equipment/ Instrument

i. Function Generator
ii. Multimeter
iii. Cathode ray Oscilloscope/Digital Oscilloscope
iv. D.C. Power supplies
v. Circuit boards/Educational Kits

C. List of Software/Learning Websites

i. Electronic Work Bench/Multi-SIM/PSIM
ii. www.nptel.iitm.ac.in
iii. www.ocw.mit.edu

9. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof (Smt.) J. M. Patel**, ALPE, Dept. of Power Electronics, Dr. S. & S. S. Ghandhy College of Engg. and Technology, Surat
- **Prof. S. A. Patel**, LPE, Dept. of Power Electronics, Dr. S. & S. S. Ghandhy College of Engg. and Technology, Surat

Coordinator & Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Susan S. Mathew**, Associate Professor, Dept. of Electrical and Electronics Engg.

- **Dr. (Mrs.) Anjali Potnis**, Assistant Professor, Dept. of Electrical and Electronics Engg.