GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

ELECTRONIC COMPONENTS AND CIRCUITS (Code: 3330905)

Diploma Programme in which this course is offered	Semester in which offered
Electrical Engineering	3rd semester

1. RATIONALE

Electronics is becoming a part and parcel of electrical systems in the industry/power system. And hence it has become essential for an electrical diploma engineer to have fundamental understanding of the use of various electronic devices and circuits. This course therefore discusses about the construction, working, and applications of various types of semiconductor components such as diodes and transistors, which are basic building block of amplifier, oscillator, switching circuit, wave shaping circuit and power supply. The skills developed in this course are also essential for comprehending the advanced courses in the later semesters.

2. COMPETENCY (Programme Outcome according to NBA Terminology):

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency

- **Use discrete electronic devices and components in various circuits**

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	150
04	00	02	06	70	30	20	30	

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

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Semiconductor Diode and its Applications	1a. Distinguish between intrinsic and extrinsic semiconductor materials 1b. Describe working of PN junction diodes 1c. Differentiate the working of half and full wave bridge rectifier along with sketches	1.1 Intrinsic and extrinsic ssemiconductor materials: P type, N type semiconductors 1.2 P-N junction diode: 1.3 Applications - Diode as rectifier, half wave, full wave and bridge wave rectifier
	1d. Justify the need for different types of filters. 1e. Differentiate between C, L, LC and π filters	1.4 Need of Filters 1.5 C,L,LC, π filters
Unit – II Transistors, voltage & power amplifiers	2a. Discriminate between PNP and NPN transistors	2.1 PNP and NPN transistors, conduction through transistor leakage current, relationship between α and β
	2b. Compare the working of CB, CE and CC transistors. 2c. Describe the load line and biasing methods of the transistor	2.2 Transistor configuration & characteristics for CB,CE,CC 2.3 Load line and biasing methods of transistor
	2d. Justify the need of voltage amplifier 2e. Select the voltage amplifier for a particular application	2.4 Transistor as an amplifier : CE amplifier 2.5 Cascade amplifiers
	2f. Explain the need of power amplifier 2g. Select the power amplifier for a particular application	2.6 Power amplifier: Class A amplifier: Series fed and transformer-coupled amplifier 2.7 Class B push-pull Amplifier Operation 2.8 Amplifier Distortion
Unit – III Oscillators and Other Semiconductor Devices	3a. Explain the working of different types of oscillators with relevant sketches 3b. Select oscillator for different frequency generation 3c. Describe working of the Zener diode, Photo diode, LDR, Photovoltaic Cell, LED with symbols 3d. Describe working of the FET, MOSFET, DIAC ,UJT, TRIAC and SCR	3.1 Working principle of oscillators 3.2 Different types of oscillators: Hartley oscillator, Colpitts oscillator, Phase-Shift Oscillator, Wien Bridge Oscillator, Crystal Oscillator 4.1 Zener diode, Photo diode, LDR, Photovoltaic Cell, Light Emitting Diode 3.3 FET, MOSFET, DIAC, UJT, TRIAC and SCR
Unit – IV Simple circuit using IC	5a. Justify the need of ICs 5b. Describe the working of an OPAMP 5c. Select OPAMP IC 741 for a particular application	5.1 Need of I.C. 5.2 Operational amplifier (OPAMP). 5.3 Characteristic and specification of OPAMP- IC 741

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
	5d. Justify the need of IC 555 Timer 5e. Explain the working of a IC555 using the block diagram 5f. Select IC 555 timer for a particular application	5.4 IC 555 timer and applications 5.5 Block diagram of IC555 timer
Unit – V Regulated power supplies	6a. Justify the need of regulated DC power supply	6.1 Regulated power supply (module level), Shunt voltage regulator (module level)
	6a. Explain the working of different types of voltage regulator circuits	6.2 Transistorized series voltage regulator (basic and with feedback, without derivation) 6.3 3- Terminal Fixed/variable voltage regulator: 78xx, 79xx, LM317
	6b. Explain working of SMPS and UPS	6.4 Switch mode power supply(SMPS) 6.5 Uninterruptible power supply(UPS)

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Semiconductor diode and its applications	10	4	5	6	15
II	Transistors: voltage and power amplifiers	14	7	7	4	18
III	Oscillators and semiconductor devices	18	8	7	7	22
IV	Simple circuit using IC	06	2	2	3	07
V	Regulated power supplies	08	2	2	4	08
Total		**56**	**23**	**23**	**24**	**70**

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

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

6. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills **(Course Outcomes in psychomotor domain)** so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx. Hrs. Required
1.	I	Test PN junction diode.	02
2.	I	Test Half wave rectifier using CRO	02
3.	I	Test full wave centre tapped & bridge rectifier using CRO	02
4.	I	Compare output waveform of different Filters using CRO	02
5.	II	Test the performance of CB transistor amplifier	02
6.	II	Test the performance of CE transistor amplifier	02
7.	II	Testing of transistor using multi meter	02
8.	II	Test the performance class – B push pull amplifier	02
9.	III	Test Hartley oscillator using CRO	02
10.	III	Test Colpitts oscillator using CRO	02
11.	IV	Test LED and LDR	02
12.	IV	Test J-FET amplifier	02
13.	IV	Test MOSFET amplifier	02
14.	IV	Test SCR and UJT	02
15.	V	Identify the pins of IC 741 and IC-555	02
16.	V	Test the performance of IC 555 timer	02
17.	VI	Test Zener diode as voltage regulator	02
18.	VI	Build voltage regulator using 78xx and 79xx and measure the dropout voltage for the given voltage regulator.	02
19.	VI	Test the performance of SMPS	02
20.	VI	Test the performance of UPS	02
		Total	**40**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

The student can perform the following activities such as:

i. Prepare mini project
ii. Testing of electronic components like diode, transistor, SCR, IC etc.
iii. Prepare chart for characteristic of various electronics components.
iv. Survey to collect data sheets for various electronics components used in different circuits.

8. SUGGESTED INSTRUCTION STRATEGIES (If Any)

i. Students should be shown animations/video films to explain the working concept of different types of diodes, transistors, ICs, amplifiers, oscillators, regulated power supply etc.
ii. Samples of the electronic components and devices should be brought in the class for demonstration while teaching those components and devices.

9. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Basic Electronics and linear circuits	Bhargava, N.N.	TMH, New Delhi 2012
2	Electronic devices and circuit	Robert Boylestad	PHI, New Delhi 2012
3	Principle of Electronics	Mehta, V.K.	S.Chand, New Delhi 2012

S. No.	Title of Books	Author	Publication
4	Electronics Principles	Malvino, Albert	TMH, New Delhi 2012
5	Basic Electronics and linear circuits	Kulshreshtha,D.C. Gupta, S.C.	TTTI, Chandigarh 2007
6	Opamp and Linear integrated circuits	Gayakwad, Ramakant	PHI, New Delhi 2010
7	Electronics Fundamental and application	Chattopadhyay , D.	New Age International Publishers 2011

B) List of Major Equipment/Materials with Broad Specification

i. Regulated power supply: Dual DC , 0-30V/1A & 5V /1A with resolution of 10mV , 2mA
ii. Digital Storage Oscilloscope : 300 MHZ Bandwidth , 2GSa/s maximum real time sampling rate refresh rate upto 2000 wfams/s , RS232 & USB connectivity
iii. C.R.O. : 30 MHz Bandwidth, 2 channel, 20 ns sampling time.
iv. Function generator: 10 HZ to 10MHZ , 10 Vpp , rise & fall time =20ns, manual / external triggering
v. Different trainer kits of Electronics.
vi. Digital Multimeter : $5^{1/2}$ 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 Resistance: 200 Ω ~ 100 MΩ, Capacitance Measurement: 2 nF ~ 10000µF, Frequency Measurement: 20 Hz ~ 1 MHz etc., 0.015% DC Voltage Accuracy.

C) List of Software/Learning Websites

i. Electronics work bench
ii. Circuit maker
iii. pSpice
iv. www.howstuffwork
v. www.allaboutcircuits.com/vol_1/chpt_1/1.html
vi. http://openbookproject.net/electricCircuits/DC/DC_5.html
vii. www.kpsec.freeuk.com
viii. www.electical-electronics.org

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A.A. Parmar**, Sr. Lecturer, Electrical Engg.
- **Prof. N. R. Suchak**, Sr. Lecturer, Electrical Engg. Dept, Government Polytechnic, Rajkot
- **Prof. J.K. Rathod**, HOD, Electrical Engg. Dept., Tolani F.G. Polytechnic, Adipur

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. (Mrs.) C.S. Rajeshwari**, Professor & Head, Department of Electrical and Electronics Engineering
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering