GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

BASIC ELECTRONICS
(Code: 3330301)

Diploma Programmes in which this course is offered	Semester in which offered
Biomedical Engineering	Third Sem

1. RATIONALE

All biomedical instruments are made up of electronic circuits. Acquiring the practical skills and cognitive skills of basic electronics will go a long way in maintaining many of the biomedical equipment. Hence the construction and working of the basic electronic components such as the diodes, transistors and their applications are included in this course. By undertaking this course, the student will be able to maintain the basic electronic circuits of biomedical equipment.

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

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

- **Maintain the electrical and electronic circuits of biomedical equipment.**

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**	
4	0	4	8	70	30	40	60	200

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **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 Basics of Electricity	1a. State Ohm's Law, Faraday's laws, Lenzs Laws. 1b. Differentiate between cycle, frequency, periodic time, amplitude, angular velocity and frequency of AC circuits 1c. Distinguish between dynamically and statically induced emf. 1d. Discriminate between self, mutual inductance and coefficient of coupling. 1e. Describe the working principle of transformer with sketches.	2.1 DC Fundamentals, Ohm's Law, Faraday's laws, Lenz' Laws. 2.2 Dynamically and statically induced emf 2.3 Self and mutual inductance and coefficient of coupling 2.4 Cycle, Frequency, Periodic time, Amplitude, Angular velocity or frequency with reference to alternating emf and current 2.5 Voltage and current in series and parallel circuits 2.6 Single phase transformer
Unit – II Semiconductor Diode and its Applications	2a. Distinguish between intrinsic and extrinsic semiconductor materials 2b. Describe working of PN junction diodes 2c. Differentiate the working of half and full wave bridge rectifier along with sketches	2.1 Intrinsic and extrinsic ssemiconductor materials: P type, N type semiconductors 2.2 P-N junction diode: 2.3 Series and parallel diode configuration 2.4 half-wave, full-wave, bridge rectifier and PIV 3.1 average D.C. current, voltage, ratio of rectification and ripple factor
	2d. Justify the need for different types of filters. 2e. Differentiate between C, L, LC and π filters 2f. Distinguish between voltage doublers and multipliers	2.5 Need of Filters 2.6 C, L, LC, π filters 2.7 Simple capacitor filter and induction filter 2.8 Clamper and clipper circuits 2.9 Voltage doublers and multipliers
Unit– III Other Semiconductor Devices	3a. Explain working principle and applications of zener diode, 3b. Differentiate between LDR, photo diode, photo transistor, LED, 3c. Discriminate the working of the optocoupler and opto-isolator 3d. Explain working principle of the seven segment display.	3.2 Zener diode performance 3.3 Photo diode, photovoltaic cell, phototransistor, LDR, LED 3.4 Optocoupler, opto- isolator 3.5 Seven Segment display
Unit – IV Transistor	4a. Discriminate between PNP and NPN transistors	5.1 PNP and NPN transistors, conduction through transistor 5.2 Leakage current, relationship between α and β
	4b. Compare the working of CB, CE and CC transistors. 4c. Describe the load line and biasing methods of the transistor	5.3 Transistor configuration & characteristics for CB,CE,CC 5.4 Load line and biasing methods of transistor

Unit	Major Learning Outcomes ('Course Outcomes' in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – V Voltage and power amplifiers	5a. Justify the need of voltage amplifier 5b. Select the voltage amplifier for a particular application	5.1 Transistor as an amplifier : CE amplifier 5.2 Cascade amplifiers
	5c. Explain the need of power amplifier 5d. Select the power amplifier for a particular application	5.3 Power amplifier: Class A amplifier: Series fed and transformer-coupled amplifier 5.4 Class B push-pull Amplifier Operation 5.5 Amplifier Distortion
Unit – VI Regulated Power Supply	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	6.4 Switch mode power supply(SMPS)
	6c. Differentiate the working principle of the online and offline UPS	6.5 Uninterruptible power supply(UPS): online and offline

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	Basics of Electricity	08	4	8	0	12
II	Semiconductor Diodes and its applications	08	6	6	0	12
III	Other semiconductor Devices	10	6	4	4	14
IV	Transistor	10	2	6	0	08
V	Transistor Amplifier	12	2	8	4	14
VI	Regulated Power Supply	08	4	4	2	10
	Total	**56**	**24**	**36**	**10**	**70**

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's 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 and affective 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 Exercises ('Course Outcomes' in Psychomotor Domain according to NBA terminology)	Hrs. required
1	I	Measure amplitude and frequency of sinusoidal wave using the C.R.O.	02
2	I	Measure AC and DC voltage and current.	02
3	I	Identify phase, neutral and earthing terminals.	½
4	I	Identify different types of capacitors and inductors	02
5	I	Generate and observe various signals of function generator and measure the frequency and amplitude.	01
6	I	Check the continuity using Multi-meter.	½
7	I	Identify various active and passive components.	02
8	II	Test the performance of the PN diode.	02
9	II	Build /Test the positive and negative clipping using CRO.	02
10	II	Build/ Test the positive and negative clamping using CRO.	02
11	III	Test the performance of the zener diode.	02
12	III	Test the performance of the LED.	02
13	III	Test the performance of the photodiode.	02
14	III	Build/Test Half-wave rectifier.	04
15	III	Build /Test full-wave rectifier with capacitor filter.	04
16	III	Build /Test Bridge rectifier with choke filter.	04
17	III	Test the performance of the LDR	02
18	IV	Test the performance of the CB configuration.	02
19	IV	Test the performance of the CE configuration.	02
20	IV	Test CE amplifier and obtain the frequency response.	02
21	V	Build/test CB amplifier	02
22	V	Build/test CE amplifier	02
23	V	Build/test CC amplifier	02
24	IV	Test Darlington pair.	02
25	VI	Build /Test Bridge voltage regulator circuits	02
26	VI	Determine the values of the given resistors and capacitors using color coding and verify by multi-meter.	02
27	VI	Test the performance of the SMPS.	02
Total			**56**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Collect various electronics components and make a show case component wise.
ii. Collect specifications, Picture of electronics components from internet and present in class room.
iii. Build DC power supply.
iv. Visit nearby industry which manufactures any electronics component covered in this course.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

A. Class Test
B. Assignment
C. Seminar/Symposium
D. Mini Project
E. Progressive Assessment of lab activity on regular basis (i.e. along with the practical)

9. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Book	Author	Publication
1.	Electronic devices and Circuits	Mehta, V. K.	S.Chand, New Delhi latest edition
2.	Electronic devices and Circuits theory	Boylestand, Robert and Louis Nashelsky	PHI Learning New Delhi latest edition
3.	Electrical Technology vol1	Thereja, B.L.	S.Chand New Delhi latest edition
4.	Electronics Principles	Malvino, A.P.	TMH, New Delhi latest edition
5.	Electronic devices and Circuits	Halkias, Millman	MGH, New Delhi latest edition

B) List of Major Equipment/ Instrument with Broad Specifications

i. Function Generator
ii. Multi-meter
iii. Cathode Ray Oscilloscope
iv. Variable D.C. Power supplies (0- 30V)
v. Electronics Trainer Kits
vi. Diode Trainer Kits
vii. Clipping-Clamping Trainer Kits
viii. Transistor Trainer Kits
ix. Amplifier Trainer Kits
x. SMPS Trainer Kits
xi. UPS Trainer Kits
xii. A.C. and D.C. Power supply Trainer Kits
xiii. Three terminal Regulated Power supply Trainer Kits

C) List of Software/Learning Websites

i. Electronic Work Bench/MultiSIM
ii. http://www.efymag.com/
iii. http://www.electronicsforu.com
iv. http://www.kpsec.freeuk.com
v. http://www.electronics- tutorials.com//symbol.html
vi. http:// www.nptel.com
vii. http:// www.ocw.mit.edu
viii. www.gpgbiomedical.hpage.com

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. A. K. Bula**, Lecturer, Dept. of Instrumentation Engineering, G.P. Gandhinagar
- **Prof. N. D. Makwana**, Lecturer, Dept. of Biomedical Engineering, G.P. Gandhinagar
- **Prof. M. H. Dave,** Lecturer, Dept. of Biomedical Engineering, G.P. Gandhinagar
- **Prof. S. S. Malkan**, Lecturer, Dept. of Biomedical Engineering, G.G.P. Ahmedabad

Coordinator and Faculty Members from NITTTR, Bhopal

- **Prof. (Mrs.) Susan S. Mathew,** Associate Professor Department of Electrical and Electronics Engineering
- **Dr. Joshua Earnest**, Professor Department of Electrical and Electronics Engineering