GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

ADVANCED ELECTRONIC DEVICES AND CIRCUITS (Code: 3332403)

Diploma Programme in which this course is offered	Semester in which offered
Power Electronics	3rd semester

1. RATIONALE

Electronics and power electronics always go together and are generally are inseparable. Therefore, the skills required to use advanced electronic devices in various power electronic circuits becomes essential. Through the study of this course the students will acquire the skills to maintain different types of amplifiers, pulse circuits, photo electric devices, and FETs used in the industry.

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 transistorized electronic 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
4	0	2	6	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 Feedback in Transistors Amplifier and Oscillators	1a. Define the term feedback 1b. Classify feedback systems	1.1 Feedback: classification, definition
	1c. Describe effect and the merits of negative voltage feedback. 1d. Describe effect of negative current feedback	1.2 Negative voltage feedback: Principle, Gain, Advantages 1.3 Negative current feedback: Principle, Gain, effect on impedance
	1e. Explain working of the Darlington pair amplifier	1.4 Darlington amplifier: operation, characteristics, application
	1f. Justify the need for oscillators. 1g. Explain the working of various types of oscillators. 1h. State the steps to undertake preventive maintenance of electronic circuits comprising of amplifiers and oscillators	1.5 Oscillator: Requirements for oscillation, classification, Operation; LC oscillator -Hartley and Colpitts oscillator, RC oscillator-RC phase shift and Wein-bridge, Crystal oscillator
Unit – II Frequency Response of Small Signal Transistor Amplifiers	2a. Establish the relationship between gain, frequency response and decibel gain.	2.1. Single stage amplifier: low frequency response: 2.2. Multi stage transistor amplifier: frequency response, decibel gain, advantages and applications.
	2b. Describe working of RC coupled amplifier.	2.3. Two stage RC coupled amplifier: operation, frequency response, merits, demerits, applications
	2c. Explain the working of transformer coupled amplifier.	2.4. Transformer coupled amplifier: operation, frequency response, merits, demerits and applications
	2d. Explain the working of direct coupled amplifier.	2.5. Direct coupled amplifier: operation, frequency response, merits, demerits and applications
	2e. State the differentiating features of various types of multistage amplifiers	2.6. Comparison: RC coupled, transformer coupled, Direct coupled.
Unit – III Transistor Power Amplifiers	3a. Compare voltage and current amplifier	3.1. Comparison: voltage amplifier, power amplifier
	3b. Explain working of power amplifiers 1i. State the steps to undertake preventive maintenance of electronic circuits comprising of power amplifiers.	3.2. Power amplifier: classification, definition, efficiency and operation; class-A, class-B, class AB, class B push-pull
Unit – IV Pulse Circuits	4a. Define the terms, time constant, rise time, fall time, duty cycle 4b. Explain operation of RC differentiator circuit	4.1. Time constant, rise time, fall time, duty cycle. 4.2. RC Differentiator: operation, response to pulse input
	4c. Explain operation of RC	4.3. RC Integrator: operation, response to

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	integrator circuit	pulse input
	4d. Explain the working of different types of switching circuits	4.4. Multivibrators using transistors: Astable, Monostable , Bistable, Schmitt trigger circuit
	4e. Explain operational mode of IC555	4.5. Timer IC-555: block diagram, basic operation, pin description, Astable mode, Monostable mode.
Unit – V Photo Electric Devices	5a. Explain the working of photo devices with sketches 5b. Explain the working of opto-coupler with sketches 5c. Choose the specifications of a opto-coupler for any given condition	5.1. Photo electric effect: Photo transistor: construction, working, applications 5.2. Solar PV cell: construction, working, applications 5.3. Opto-coupler: construction, working, applications
Unit – VI Field Effect Transistors	6a. Classify different types of FET 6b. Distinguish between N channel JFET and P channel JFET 6c. Describe the construction of JFET with sketches 6d. Explain the working of JFET	6.1. Types of FET 6.2. Construction, symbol, characteristics; N channel JFET, P channel JFET
	6a. Describe the construction and working of MOSFET with sketches 6b. Choose the specifications of a MOSFET for any given condition	6.3. Construction, symbol, characteristics; Enhancement mode MOSFET, depletion mode MOSFET

5. SUGGESTED SPECIFICATION TABLE (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Feedback in Amplifiers and Oscillators	12	6	4	4	14
II	Frequency Response of Small Signal Transistor Amplifiers	11	2	8	4	14
III	Transistor Power Amplifiers	7	2	5	2	9
IV	Pulse Circuits	12	2	8	5	15
V	Photo Electric Devices	8	4	6	0	10
VI	Field Effect Transistors	6	2	6	0	8
	Total	**56**	**18**	**37**	**15**	**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/PRACTICAL

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/Exercise ('Course Outcomes' in Psychomotor Domain according to NBA terminology)	Approx. Hrs. Required
1	I	Test Hartley- Colpitts oscillator for variable frequency.	2
2	I	Test RC phase shift oscillator for variable frequency.	2
3	I	Test Wein-bridge oscillator for variable frequency.	2
4	I	Test Crystal oscillator.	2
5	II	Test Frequency response of Signal stage transistor amplifier	2
6	II	Test Frequency response of two stage transistor amplifier	2
7	II	Test Frequency response of transformer coupled transistor amplifier	2
8	II	Test Frequency response of direct coupled transistor amplifier	2
9	III	Build/test Class A, B amplifier and calculate its efficiency.	2
10	III	Test Push pull amplifier and calculate its efficiency.	2
11	IV	Interpret the response of R-C differentiating and integrating circuit for pulse input.	2
12	IV	Test Astable mutivibrator using transistor and observe output waveform.	2
13	IV	Test Mono stable mutivibrator using transistor and observe output waveform.	2
14	IV	Test Bistable mutivibrator using transistor and observe output waveform.	2
15	IV	Test Schmitt trigger circuit using transistor and observe output waveform.	2
16	IV	Configure IC 555 in Astable mode and observe output waveform.	2
17	IV	Configure IC 555 in Mono stable mode and observe output waveform.	2
18	V	Test the performance of opto-electro devices like photo diode and transistor.	4
19	VI	Test the performance of FET.	2
20	VI	Test the performance of MOSFET	2
	Total		**42**

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Prepare oscillator circuit for specified frequency range.
ii. Practically identify photo electric effects using different photo electric devices.
iii. Observe output signals of different pulse circuits.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Show video/animation films on working of different electronic components and circuits.
ii. Give assignment/mini projects based on application of different electronic components and circuits.

9. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1.	Principle of electronics	Mehta, V. K., Mehta Rohit	S. Chand (2010), 11th edition or latest
2.	Electronic Devices and Circuit Theory	Boylestad, Robert L Nashelsky, Louis	Pearson (2009), 10th edition or latest
3.	Electronic Principles	Malvino A.P.	Tata McGraw-Hill Education , 7th edition or latest
4.	Analog Electronics	André, Pittet, Kandaswamy, A.	PHI Learing, New Delhi, latest edition
5.	Basic electronics and linear circuits	Bhargava N. N., Kulshreshtha D.C., Gupta S.C.	Tata McGraw-Hill Education, New Delhi, latest edition
6.	Electronic devices and circuits	Gupta J. B.	S. K. Kataria and Sons (2012),3rd edition or latest

B) List of Major Equipment/Materials with Broad Specifications

i. Digital multimeter (31/2 digit)
ii. Oscilloscope (dual channel channel, preferably digital)
iii. Function Generator
iv. DC power supply (-30V-0-30V)
v. AC power supply (-30V-0-30V)
vi. Circuit boards/Educational Kits
vii. Bread boards.

C) List of Software/Learning Websites

i. PSIM
ii. CASPOC
iii. OrCAD
iv. http://educypedia.karadimov.info/electronics/electronicaopening.htm
v. http://www.electronics-tutorials.ws/
vi. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv052-Page1.htm
vii. http://www.indiabix.com/electronics/questions-and-answers/

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

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

Coordinator and Faculty Members from NITTTR Bhopal

- **A.S. Walkey**, Associate Professor, Department of Electrical and Electronics Engineering.
- **Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering.