GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL (09) / POWER ELECTRONICS (24)

ANALOG ELECTRONICS

SUBJECT CODE: 2130902

B.E. 3rd Semester

Type of Course: Engineering Science**(ELECTRICAL)**

Prerequisite: N.A.

Rationale: N.A.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Module 1. Diode and transistor: Common Emitter and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers- Class B and Class AB - Power amplifiers using BJTFET: Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers. Frequency response of BJT amplifiers. Concepts of negative and positive feedback – loop gain- advantages of negative feedback -Feedback Connection Types - Practical Feedback Circuits	6	10
2.	Module 2. Op amp basics and linear applications: Introduction Block diagram representation of a typical op-amp, Analysis op-amp ICC circuits, types, designations, packages, pin configurations and power supplies. Ideal op-amp, equivalent circuit, open loop op amp configurations of differential, inverting and non-inverting amplifiers, op amp feedback amplifier analysis, differential amplifier with one, two and three op amps.Op amp parameters - offset voltages and currents, bias current, drift, PSRR, CMRR, offset nulling methods.	12	30
3	Module 3. AC performance of O-amp: Bandwidth, slew rate and frequency response. Op-amp applications: DC and AC amplifiers, peaking, summing scaling and averaging amplifiers, instrumentation amplifier, differential input and differential, output amplifier, V to I and I to V converters, integrator, differentiator comparator, non-linear amplifier, phase shift oscillator, Wien bridge oscillator, square, triangular and sawtooth wave generator,	12	30

	voltage controlled oscillator, zero crossing detector, window detector, introduction to analog simulation.		
4	Module 4. Non linear IC applications using Opamp: Signal Generators: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation- monostable circuits- Principles of VCO circuits. Comparator Circuits: Zero Crossing Detector- Regenerative comparator circuits Active filters –Types- Characteristics- Frequency Response of different types of filters- Order and cut off frequency -Butterworth low pass filter – First order and second order filter design - Sallen and Key second order LP filter - - Butterworth high pass filters - Second order wide band and narrow band filters. Timer IC 555: Functional diagram- astable and monostable modes Phase locked loops: Principles – Building blocks of PLL-Lock and Capture ranges - Capture process - Study of NE565 - Applications of PLL - Frequency multiplication - FSK demodulator - FM demodulation. Three terminal regulator ICs: basic block schematic - 78 x x& 79 x x series - Adjustable output voltage regulator LM 317, LM 340 and LM 337 series power supply ICs. their use and basic design considerations for designing regulated power supplies.	12	30

Reference Books:

1. Robert T. Paynter, Introductory Electronic Devices and Circuits, Pearson Education
2. A. V. Boylestad and Nashelsky, Electronic Devices and Circuits, Prentice Hall of India
3. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India
4. Schilling and Belove, Electronic Circuits, McGraw Hill
5. Theodore F. Bogart Jr., Electronic Devices and Circuits,
6. K. R. Botkar, Integrated Circuits, Khanna Publishers
7. Floyd, Fundamentals of Analog Circuits 2e, Pearson Education.

Course Outcomes:

After learning the course the students should be able to:

- Understand the different configurations of transistor and amplifiers.
- To test and design the circuits with op-amps and other electronics components for different applications.
- To test and design circuit using different ICs.

List of Practical including Open Ended Problems:

1. Study the different parameter of op-amp.
2. Comparison between different transistor configurations.
3. Frequency response of inverting amplifier and non-inverting amplifier.
4. Study of op-amp as inverting amplifier and non-inverting amplifier.
5. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator, differentiator, and comparator.
6. OPAMP circuits –integrator, differentiator, and comparator.
7. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
8. Waveform generation – Square, triangular and saw tooth wave form generation using OPAMPs.
9. Application of op-amp as low pass filter, high pass filter and band-pass filter.

10. IC 555 Applications as timer.
11. IC 555 Applications as bistable, monostable and astablemulti-vibrator.
12. PLL IC 565/566 Frequency multiplying, FSK demodulation

* The course coordinator has **to define at least 3 open ended problems** related to the courses.

Major Equipments:
The necessary no. of Kits, breadboard, equipment, accessories and instruments etc… to be provided to conduct the above practical in a group of max. 4 students.

List of Open Source Software/learning website:

Open Source Sfteware:

- LTSpice for circuit simulation,
- KiCAD for CAD application

Web-base tools for design:

- http://www.fairchildsemi.com/support/design-tools/power-supply-webdesigner/
- http://www.ti.com/lsds/ti/analog/webench/overview.page

Circuit Lab:

- https://www.circuitlab.com/editor/

Open source for Math Tools:

- http://maxima.sourceforge.net/
- http://www.sagemath.org/
- http://www.scilab.org/
- http://www.gnu.org/software/octave/

Learning website

- http://www.electrical-engineering-portal.com/
- http://nptel.iitm.ac.in/courses.php

Active learning Assignments (AL) : Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.