GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130907
Semester – III
Subject Name: Analog and Digital Electronics

Type of course:

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Differential, multi-stage and operational amplifiers** Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)	**10**
2	**Linear applications of op-amp** Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.	**10**
3	**Nonlinear applications of op-amp** Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.	**8**
4	**Combinational Digital Circuits** Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization	**10**
5	**Sequential circuits and systems** A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using	**10**

	flip flops, special counter IC's, asynchronous sequential counters, applications of counters.	
6	**A/D and D/A Converters** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs	**8**

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**40**	**10**	**10**	**00**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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.

Reference Books:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
6. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India
7. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
8. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
9. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Describe the functioning and selection of OP-AMP as per application.	25

CO-2	Design and testing of OP-AMP based circuits.	25
CO-3	Design and implement Combinational and Sequential logic circuits.	25
CO-4	Describe the process of Analog to Digital conversion and Digital to Analog conversion.	25

List of Experiments:

1. Study the different parameter of op-amp.
2. Frequency response of inverting amplifier and non-inverting amplifier.
3. Study of op-amp as inverting amplifier and non-inverting amplifier.
4. OPAMP circuits –integrator, differentiator, and comparator.
5. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
6. Waveform generation – Square, triangular and saw tooth wave form generation using OPAMPs.
7. Application of op-amp as low pass filter, high pass filter and band-pass filter.
8. Verification of function of Half/Full adder circuits.
9. Verification of function of Binary to Grey code conversion.
10. Verification of function of Latch and flip-flop.
11 Verification of counter circuit like binary up/down counter, decimal counter, ring counter, Johnson counter etc.
12. Verification of Specification and Performance indices of D/A and A/D converters

Major Equipment:

- ✓ Trainer kits related to Analog and Digital electronics.

List of Open Source Software/learning website:

1. Courses available through NPTEL.
   - website : nptel.ac.in