SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B.Tech. - I Year Semester II

Subject Name: **Analog and Digital Circuit** **Subject Code: BTEL13283**

Type of course: **Professional Core Course**

Prerequisite: Basic knowledge of electronic active and passive components and low and high frequency circuit analysis techniques etc

Rationale: This course aims to familiarize students with various oscillators, differential amplifier, op-amp and its applications including active filter circuits, voltage regulators and specialized ICs

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks		Practical Marks		Total
L	T	P	C	TEE	CAT	TEP	CAP	
4	0	0	5	60	40	30	20	150

CAT: Continuous Assessment (assignments/projects/open book tests/closed book tests **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CAP:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	**Introduction to Operational Amplifiers:** Block diagram representation of a typical op-amp, its equivalent circuit, Differential Amplifier, Open loop op-Amp ZCD-PLD-NLD, Closed loop inverting and non-inverting Op-Amp **Parameters of Practical op-amp:** Input offset voltage, Input bias current, Input offset current, SVRR, CMRR, Slew Rate, Offset voltage adjustment range, Input Resistance, Input capacitance, Characteristics of Ideal op amp	6	20
2.	**Linear Applications:** Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Virtual ground and Differential voltage tends to Zero concept, Voltage Buffer, Summing, Scaling and Averaging amplifiers, Differential amplifier using one and two op-amps, Integrator, Differentiator, P-PI-PID controllers using Op-Amp.	10	15
3.	**Converters, Oscillators and Generators** Current to voltage converter, Voltage to current converter for floating and grounded loads, Half and Full Wave rectifier, Requirements for oscillations, Wein Bridge Oscillator and Phase Shift Oscillator. Square, Triangular and Saw tooth Wave Generator	8	15

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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, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, Q-M method of function realization	12	20
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, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops , asynchronous sequential counters, applications of counters.	12	15
6.	**A/D and D/A :** **Digital to Analog Converters:** weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, 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	12	10

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	10	25	20	20	10

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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

Reference Text Books:

Sr. No.	**Title of book /article**	**Author(s)**	**Publisher and details like ISBN**	**Year of publication**	**Publication Edition**
1.	Op-Amps and Linear integrated circuits	Ramakant A. Gayakwad,	Pearson ISBN: 9332549913	2015	4th Edition

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2.	Operational Amplifier and linear Integrated circuit	Coughlin & Driscoll	Pearson ISBN:0130149916	2000	6th Edition
3.	Design With Operational Amplifiers and Analog Integrated Circuits	Sergio Franco	MGH ISBN:9352601943	2016	4th Edition
4.	Modern Digital Electronics	R. P. Jain	McGraw Hill Education	2009	Latest
5.	Digital logic and Computer design	M. M. Mano	Pearson Education India	2016	Latest
6.	Fundamentals of Digital Circuits	A. Kumar	Prentice Hall India,	2016	Latest

Course Outcome:

Sr. No.	**Students will be able to,**	**Marks % weightage**
CO-1	Analyze important and unique engineering issues regarding linear amplifier.	15
CO-2	Design and implement various comparators and witness its performance parameters using OP-AMP.	15
CO-3	Able to design op amp based converters and generators.	25
CO-4	Apply knowledge of Boolean algebra, and logic gates for logic function minimization.	15
CO-5	Design and implement Combinational and Sequential logic circuits.	15
CO-6	Describe the process of Analog to Digital conversion and Digital to Analog conversion.	15

Mapping with POs:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**	**PSO 3**
CO-1	3	2	2	3	2	3	3	3	2	1	2	2	3	2	3
CO-2	3	2	3	3	3	3	3	3	2	1	2	2	3	2	3
CO-3	3	2	3	3	3	3	3	3	2	1	2	2	3	2	3
CO-4	3	2	2	3	2	3	3	3	2	1	2	2	3	2	3
CO-5	3	2	3	3	3	3	3	3	2	1	2	2	3	2	3
CO-6	2	2	1	2	2	2	3	3	2	1	2	2	3	1	3
Rationale*															

Rationale*: Explaining why it is matching this particular program outcome

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List of Practical:

Minimum 9 practical	
1.	Design & implement ZCD, PLD & NLD using Inverting and Non-inverting configuration.
2.	Design & implement Inverting and Non-inverting Amplifiers with feedback for given value of gain
3.	Design & implement Summing, Scaling & Averaging circuit with Inverting configuration
4.	Design & implement Integrator circuits using OP-AMP for the cut-off frequency 5 KHz.
5.	Design & implement Differentiator circuits using OP-AMP for the cut-off frequency 1 KHz
	Configuring NAND and NOR logic gates as universal gates.
6.	Verification of function of code conversion
7.	Study and configure various digital circuits such as adder, subtractor, decoder, encoder, code converters.
8.	Study and configure multiplexer and DE multiplexer circuits
9.	Verification of function of Latch and flip-flop
10.	Study and configure flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
11.	Verification of counter circuit like binary up/down counter, decimal counter, ring counter, Johnson counter.
12.	Verification of Specification and Performance indices of D/A and A/D converters

List of Open Source/learning website:

- https://nptel.ac.in/courses/108105113
  (Digital Section NPTEL videos)
- https://onlinecourses.nptel.ac.in/noc22_ee27
  (OPAMP Section NPTEL videos)
  (Digital Section NPTEL videos)

List of Open Source software:

- LT spice
- Logisim

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