CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Electrical Engineering)

Semester: III

Course Code: 202050301

Course Title: Analog and Digital Electronics

Course Group: Engineering Science

Course Objectives: To provide a thorough understanding of the operational amplifier circuits and their design. To provide knowledge about different types of amplifier & oscillator circuits and their applications. To impart knowledge about digital logic and to gain the ability to design various digital circuits. To describe the process of A-to-D & D-to-A conversion via different techniques.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25/9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Differential amplifiers and Operational Amplifiers**: Introduction, Block diagram representation of a typical op-amp Differential amplifier; power amplifier; direct coupled multi-stage amplifier, Analysis of op-amp ICC circuits, types, designations, pin configurations and power supplies. Ideal op-amp, equivalent circuit, open loop op-amp configurations of differential, inverting and non-inverting amplifiers, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product) op-amp feedback amplifier analysis, differential amplifier with one, two and three op-amps. Op-amp parameters.	09

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2	**Linear and Non-Linear Op-amp applications:** Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, Zero crossing detector, Schmitt trigger, window detector, precision rectifier and various circuits ,Triangular & square wave generator, phase-shift oscillators, Wein bridge oscillator, summing scaling and averaging amplifiers ,V to I and I to V converters, integrator, differentiator comparator.	**08**
3	**Timer Circuits and Signal Generators:** IC 555 and its functions, Astable, bistable and mono-stable circuits using IC 555, various applications of IC 555, IC 566 - VCO, IC 565 – PLL, IC – 9400 V/F and F/V – Pin Diagrams, functions, applications.	**04**
4	**Number system and Logic families:** Decimal, Binary, octal, and hexa-decimal number systems, binary arithmetic. Number base conversion, Complements, Binary code. Logic families: Positive logic and Negative Logic, AND, OR, NOT,NAND, NOR, X-OR GATE, , Significance and type like TTL, CMOS. Boolean Algebra: Introduction, Logic Operators, Postulates and theorems, properties –Product of Sums and Sum of Products– Karnaugh Map method – Two, three, four, five variable K-maps, Converting Boolean expressions to Logic and Vice versa, NAND and NOR implementation – Don't-Care conditions, Introduction to Quine McCluskey's reduction method for more than five variables., ID of hazards, noise and immunity solutions.	**08**
5	**Combinational Logic Circuit:** Half and full Adder – Half and full Subtracter – Binary parallel adder – BCD Adder, Decimal adder – Magnitude comparator – Encoders & Decoders – Multiplexers–De-multiplexer.	**04**
6	**Flip Flops & Design of Sequential Circuits:** S-R latch, edge triggered S-R flip flop, JK flip flop, D flip flop, T flip flop, flip flop operating characteristics, shift registers, controlled buffer register, data transmission in shift register, serial in serial out, parallel in parallel out shift register, serial in parallel out, parallel in serial out shift register, asynchronous up/down counters, synchronous up/down counters.	**05**
7	**Analog to Digital and Digital to Analog Converters:** Digital to analog conversion, R-2R ladder type DAC, weighted resistor type DAC, switched current source type DAC, analog to digital conversion, counter type ADC, tracking type ADC, successive approximation type ADC, flash type ADC.	**05**
8	**Memories and programmable logic devices:** Role of memory in computer system, memory types & terminology, types of ROM, sequential memories, programmable logic devices, and programmable logic array	**03**

List of Practicals / Tutorials:

1	Study the different parameter of op-amp.
2	Study of op-amp as inverting amplifier and non-inverting amplifier
3	OPAMP circuits –integrator, differentiator, and comparator.
4	OPAMP applications as waveform generator
5	Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs..
6	Verification of function of Half/Full adder circuits.
7	Verification of function of Binary to Grey code conversion.
8	Verification of function of Latch and flip-flop.

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9	Verification of Mux/Demux logic
10	Verification of Encoder/Decoder logic
11	Verification of Counter circuit like binary up/down counter, decimal counter, ring counter
12	Verification of Specification and Performance indices of D/A and A/D converters
13	Monostable multivibrators and noise sensitivity

Reference Books:

1	Boylestad R. L. and L. Nashelsky, Electronic Devices and Circuit Theory, 10/e, Pearson Education India, 2009.
2	Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India
3	Choudhury R., Linear Integrated Circuits, New Age International Publishers. 2008.
4	Malvino A. and D. J. Bates, Electronic Principles 7/e, Tata McGraw Hill, 2010.
5	M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
6	C.H.Roth and L.L.Kimney Fundamentals of Logic Design, 7/e, Cengage Learning, 2013
7	A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
8	Floyd T.L, Digital Fundamentals, 10/e, Pearson Education, 2011
9	R.P. Jain, “Modern Digital electronics”, Tata Mc-Graw Hill, Fourth Edition, 2010.
10	Zvi Kohavi, "Switching and Finite Automata Theory", Cambridge University Press.
11	Choudhury R., Linear Integrated Circuits, New Age International Publishers. 2008.

Supplementary learning Material:	
1	https://www.analog.com/en/education/education-library/tutorials/analog-electronics.html
2	https://www.allaboutcircuits.com/textbook/digital/
3	https://www.javatpoint.com/digital-electronics

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

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Internal Evaluation: The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
40%	20%	20%	20%	0%	0%	

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.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Design op-amp circuits for mathematical operations & as amplifiers	**20**
CO-2	Design waveform generators using op-amp circuits	**20**
CO-3	Apply fundamentals of digital logic for building digital circuits	**15**
CO-4	Understand & implement working of combinational & sequential logic circuits	**30**
CO-5	Recognize the analog to digital & digital to analog conversion process	**15**

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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