<table>
<tr><td colspan="5">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td colspan="2">II Year B.Tech.
(Electronics and Telecommunication Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">3RTPC2

ANALOG ELECTRONICS</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>30</td><td>10</td><td>20</td><td>60</td></tr>
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Course Learning Objectives:

1. To understanding of transistors working and small-signal models are applied, enabling them to analyze low-frequency amplifier circuits effectively.
2. To familiarize students with the high-frequency transistor amplifier model and the effect of capacitances, allowing them to analyze amplifier performance at higher frequencies.
3. To help students improve their ability to design an amplifiers for real-world applications.

Prerequisites:
Fundamental knowledge of Basic Electronics.

COURSE CONTENTS

Unit-I
Low-Frequency Analysis: Small-signal equivalent circuit of the transistors (BJT & MOSFET) using re model and 'h'-parameters, Analysis of single stage BJT amplifier circuits (CE, CB & CC), Analysis of single stage MOSFET amplifier circuits (CS, CG & CD), Low frequency response of amplifier circuits, Effect of bypass and coupling capacitors on the low frequency response of the amplifier.

Unit-II
High-Frequency Analysis: Classification of amplifiers, Distortion in amplifiers, Frequency response of an Amplifier, Bode plots, Step response of an amplifier, CE short circuit current gain, Internal capacitance effect, High frequency model of the MOSFET and BJT, High frequency response of CS and CE amplifiers. Miller's theorem, High frequency response of source and emitter follower, Gain bandwidth product. Cascode stage: cascode as a current source, cascode as an amplifier.

Unit-III
Differential Amplifier: The Fundamental concepts of differential pair operation**,** common-mode and differential-mode behavior, and the evaluation of Common-Mode Rejection Ratio (CMRR)**.** The analysis and design of differential amplifier circuits using BJT and MOSFET for both small-signal and large-signal analyses**,** emphasizing the impact of biasing and transistor parameters on amplifier performance. Analysis of current mirror and its applications. Frequency response analysis of two-stage and multistage amplifier configurations**,** highlighting bandwidth enhancement and cascading effects in analog systems.

Unit-IV

Feedback Amplifiers: Classification and representation of amplifiers, Feedback concept, and transfer gain with feedback, General Characteristics of negative feedback amplifiers. Impedance in feedback amplifiers. Properties of feedback amplifier topologies, approx. analysis of feedback amplifiers, Method of analysis of a feedback amplifier. The shunt feedback triple, Shunt-series pair, Series shunt pair, series triple, and general analysis of multistage feedback amplifiers.

Unit-V

Oscillators: Sinusoidal oscillators, Barkhausen Criterion, Analysis and design of RC phase shift (BJT) oscillator, Wien bridge oscillators. Resonant circuit oscillators, General form of oscillator circuit (Hartley &Colpitts), Crystal oscillators.

Course Outcomes:

CO.No.	CO
CO1	Analyze low-frequency BJT and MOSFET amplifier circuits using small-signal models, and evaluate the effects of coupling and bypass capacitors on amplifier performance.
CO2	Examine high-frequency response of transistor amplifiers, apply Miller's theorem, and design cascode stages to optimize gain-bandwidth trade-offs.
CO3	Design and analyze differential and multistage amplifiers, including current mirrors and common-mode rejection, to achieve the desired frequency response and performance.
CO4	Evaluate the impact of various feedback topologies on amplifier gain, bandwidth, and input/output impedance, and design feedback amplifiers for stability and desired characteristics.
CO5	Analyze sinusoidal oscillators, including RC, Wien Bridge, Hartley, Colpitts, and crystal oscillators, for stable signal generation.

BOOKS RECOMMENDED:

[1]. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson, 2013, 11th Edition.
[2]. Adel S Sedra, K C Smith, and A N Chandorkar, Microelectronic Circuits: Theory and Applications, Oxford University Press, 2017, 7th Edition.
[3]. Donald Neamen, Microelectronics Circuit Analysis and Design, McGraw-Hill, 2010, 4th Edition.
[4]. Ben Streetman, Solid State Electronic Devices, Pearson, 2015, 7th Edition.
[5]. Jacob Millman, Christos Halkias, Chetan Parikh, Integrated Electronics (Analog & Digital Circuits & Systems), McGraw-Hill Education, 2017, 2nd Edition.
[6]. David A Bell, Electronic Devices and Circuits, Oxford publication, 2008, Fifth edition.

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
3RTPC2.CO1	3	3	2		1							3	3	1
3RTPC2.CO2	3	3	2		2							3	3	1
3RTPC2.CO3	3	3	3	2	3							3	3	1

3RTPC2.CO4	3	2	3		2							3	3	1
3RTPC2.CO5	3	2	3		2							3	3	1

LIST OF EXPERIMENTS:

1. Single-Stage BJT and MOSFET Amplifier
Aim: To design and study the operation of single-stage CE-BJT and CS-MOSFET amplifiers.
Parameters to Analyze: Voltage gain, input/output impedance, low-frequency response (effect of coupling and bypass capacitors), high-frequency response (parasitic capacitances and -3 dB cutoff).
2.Differential Amplifier
Aim: To analyze the differential and common-mode operation of a BJT and MOSFET differential amplifier.
Parameters to Analyze: Differential gain, common-mode gain, CMRR, frequency response.
3.Two-Stage Cascade Amplifier
Aim: To design and study cascaded two-stage CE-BJT and CS-MOSFET amplifiers.
Parameters to Analyze: Overall voltage gain, input/output impedance, low-frequency cutoff (due to inter-stage coupling capacitors), high-frequency cutoff (due to device capacitances and Miller effect), bandwidth comparison with single-stage amplifier.
4.Cascode Amplifier
Aim: To analyze cascode configuration for improved high-frequency performance.
Parameters to Analyze: Midband gain, input/output impedance, and extended high-frequency response compared to the common-emitter amplifier.
5.Emitter Follower
Aim: To design and study a BJT emitter follower (common-collector) amplifier.
Parameters to Analyze: voltage gain, input impedance, output impedance, and frequency response.
6.Negative Feedback Amplifier
Aim: To study the operation of a negative feedback amplifier.
Parameters to Analyze: feedback effects on gain, bandwidth, input impedance, and output impedance of the amplifier circuit.
7.RC Phase Shift Oscillator
Aim: To design and analyze an RC phase shift oscillator.
Parameters to Analyze: Frequency of oscillation, amplitude stability, and conditions for oscillation.
8.Wien Bridge Oscillator
Aim: To study frequency stability in the Wien bridge oscillator.
Parameters to Analyze:: Oscillation frequency, amplitude stabilization, waveform purity.
9.Hartley and Colpitts Oscillators
Aim: To design and compare Hartley and Colpitts oscillators.
Parameters to Analyze: Oscillation frequency, amplitude stability, waveform quality.
10.Design Project
Aim: PCB/Breadboard design project based on syllabus.