Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Electronics and Telecommunication)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
ETR4C3	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
ANALOG ELECTRONICS	**3**	**1**	**2**	**3**	**1**	**1**	**5**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To recall various BJT parameters, connections and configurations.
- To Explain and Demonstrate BJT Amplifier, Hybrid Equivalent and Hybrid Models.
- To explain construction and characteristics of JFETs and MOSFETs.
- To explain various types of FET biasing, and demonstrate the use of FET amplifiers.
- To Demonstrate and Construct Frequency response of BJT and FET amplifiers at various frequencies.
- To Define, Demonstrate and Analyze Power amplifier circuits in different modes of operation.
- To Demonstrate and Apply Feedback and Oscillator circuits using FET.

Prerequisites: Basic knowledge and understanding of semiconductor devices and operation required.

COURSE CONTENTS

Unit I

BJT AC Analysis: BJT AC Analysis:

BJT Transistor Modeling, The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid π Model.

Unit II

Field Effect Transistors:
Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET.

FET Amplifiers:
JFET small signal model, Fixed bias configuration, Self-bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.

Unit III

BJT and JFET Frequency Response:

Logarithms, Decibels, Low frequency response – BJT Amplifier with RL, Low frequency response FET Amplifier, Miller effect capacitance, High frequency response – BJT Amplifier, High frequency response-FET Amplifier, Multistage Frequency Effects.

Unit IV

Feedback and Oscillator Circuits:

Feedback concept, Feedback connection types, Voltage Series, Voltage Shunt, Current Series, Current Shunt, practical feedback circuit Phase shift oscillator, wien bridge oscillator, colpitts Oscillator, hartely oscillator, Crystal Oscillator.

Unit V

Power Amplifiers:

Definition and amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and circuits, Amplifier distortion, Class C and Class D amplifiers. Voltage regulators: Discrete transistor voltage regulation - Series and Shunt Voltage regulators.

Learning Outcomes: After studying this course, students will be able to:

- Acquire knowledge of and Working principles, characteristics and basic applications of BJT and FET.
- Single stage, cascaded and feedback amplifier configurations and Frequency response characteristics of BJT and FET.
- Analyze the performance of FET amplifier in CS configuration and Power Amplifiers and Oscillator circuits.
- Interpretation of performance characteristics of transistors amplifiers, frequency Response and Oscillators.
- Apply the knowledge gained in the design of transistorized circuits, amplifiers and Oscillators.

BOOKS RECOMMEDED

[1]. Adel S. Sedra and Kenneth C. Smith, "*Micro Electronic Circuits Theory And Applicatication*," 5th Edition ISBN:0198062257
[2]. Behzad Razavi, "*Fundamentals of Microelectronics*", John Weily ISBN 2013 978-81-265-2307-8
[3]. J.Millman & C.C.Halkias, "*Integrated Electronics*", 2nd edition, 2010, TMH. ISBN 0-07-462245-5
[4]. K. A. Navas, "*Electronics Lab Manual*", Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424.

List of Practical Assignments:

1. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances.
2. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain bandwidth product from its frequency response.
3. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.
4. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.
5. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
6. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency.
7. Design and set-up the RC-Phase Shift Oscillator using FET, and calculate the frequency of output waveform.
8. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator
9. Design and set-up the crystal oscillator and determine the frequency of oscillation