Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Electronics and Instrumentation Engg.)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
3EIRC4	**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

Revision of the concept of BJT and its characteristics CE, CB, CC comparison, transistor as an amplifier and as a switch (principle & working), hybrid models of BJT & its application in small signal low frequency analysis, exact and simplified H-parameter models & their applications in Inter conversion formulae for CE,CB,CC H-parameters, transistor circuit solving, Miller's theorem & its dual, problem based on them to be solved, cascading of transistors, multistage amplifiers. High input impedance circuits, Darlington pair and circuits. Error analysis based on exact and simplified models, bootstrapping method and biasing problems.

Unit-II

Overview of field effect transistors, JFETs and its types, construction and principle of working, formulae, I/P & O/P characteristics, pinch off voltage etc. Shockley's equation, FET small signal model, FET as voltage variable resistor & its application. MOSFET depletion type and enhancement type construction and principle of working, I/P & O/P characteristics, low frequency common source and common drain amplifiers.

Unit-III

Transistor at high frequencies, Hybrid π-model, understanding & derivation of its parameters, concept of f_β & f_T and relationship between them and importance, current gain with resistive load and its frequency response. Distortions in amplifiers and its causes, step response of an amplifier and to understand how time domain parameters are related to frequency domain parameters.

Unit-IV

Feedback in amplifiers, negative feedback scheme & its advantages and disadvantages, classification of amplifiers, voltage amplifier, current amplifier, transconductance and trans-resistance amplifiers, gain with feedback, R_i and R_o with feedback, how negative feedback reduces distortion and improves SNR, sensitivity and de-sensitivity of amplifier, circuit solving based on negative feedbacks, voltage series, voltage shunt, current series and current shunt, topologies and their circuit analysis.

Unit-V

Different types of coupling in amplifier, power amplifier and its application. Class A, class B, class AB and class c analysis, efficiency of amplifier to be calculated. Load lines AC and DC. Oscillators, Barkhausen criteria, RC phase shift oscillator (BJT) based, Wien bridge, Hartley, Colpitts etc.

Learning Outcomes:

Upon completing the 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 RECOMMENDED:

[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