

University Of Salahaddin.

College Of Science – Department Of Physics . Third Class Physics .

Syllabus : Electronic . Semiconductor Bipolar Transistors , Junction Field Effect Transistors , Circuits Analysis , Amplifiers , Differential Amplifiers , Operation amplifiers .

Credit Time re: 3 hours

Credit Units : 3

Course Code – Phy – C3. elec.

Credit Lab : 3hours

Course Book Name : Electronic - (Basics On Transistors Electronic Circuits) .

Course Description : The goal of this (academic year of 30 weeks) course, is to help the students to understand theoretical analysis , practical operation and application of the semiconductor transistors in designing electronic circuits. Study of the BJT transistors as an active semiconductor device which consist Of two (P- N) semiconductor junctions (diodes) connected back to back, where the basic current components across internal junction barriers related to the external transistor terminal currents, which behaviors as input and output currents, where their ratio leads to current gain, and also resulting into voltage and power gains of the transistor. So a transistor as active element in close circuits , and by using circuit model analysis which helps to understand how useful functional electronic circuit can be designed for different applications .

Student Objective : As a result of this course it is expected that the student will be able to do : 1 – Design and analyze single and multistage transistor amplifier circuits and calculate their parameters such as voltage , current gains, input , output resistances, frequency – voltage gain response curves .

2 – Design different operation amplifier circuits for different application usages .

3 – Understanding the differences between BJT and JFET transistors and their difference applications .

4 – The out coming of the course subjects should help the student to be interested as good technician .

Grading and Test Schedule

1 – Lectures will be in the class room for three hours per a week .

2 – Three sessional examination their average from 40 % Marks including quizzes and home works

3 – Final examination including all the course subjects will be from 60 % Marks

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4 – Maximum success level is 100 % and minimum success level is 50 % .

5 - Final Second trail examination will be from 60 marks including all course subjects . The final succeeding marks will be the marks attained from 60 + the marks attained from 40.

Keys to Success

1 – Lecture duration is three hours per a week in the class room , using power point and white board for lecture explanation .student must read the reference text book subjects related to the lectures .

2 – Attend class with lecture notes.

3 – Read the lectures and understand the Solved examples and try to solve more exercises as home working exercises.

4 – The key of success of the student depending on his activity, he must read understand and lean .

Physical Purposes Of The Course.

Major Subject Themes : This course will cover a variety of aspects of electronic technology that relate semiconductor based devices such as different types of BJT, JFET ,and MOSFET transistors moving from physical microscopic processes such as internal current components at the junctions to macroscopic view at the external nodes or terminals of the transistors. The course can be classified into four general themes :

1 – Current – Voltage Characteristics : The internal microscopic processes of free charge carries electrons and holes transport inside the device will yield macroscopic measureable quantity of the circuit current which is ($I - V$) characteristics . The basics of physical phenomena are related to introduce transistor current laws which are important for evaluation transistor output developed power.

2 – Equivalent Circuits: The complex behavior of electronic device in the closed circuit can be solved by proper equivalent circuit model from which circuit parameters can be determined .Providing analyses of $h -$ parameter model for transistor amplifier circuits .

3 – Transistor DC Biasing : For small input signal when the transistor is biased such that its input is forward and its output is reverse word biased then it is in the active mode biasing which can operate as voltage amplifier .this means the changes of $Q-$ point must be small and in linear portion of the $I - V$ curve of the input characteristics, then the transistor has properties of linear active device ,where $h -$ model analysis can be applied to the amplifier circuit .

Course Structures : The lectures are distributed among thirty weeks three hours per week .The chapters are arranged in proper sequences that permits each topic to build earlier studies and understanding be in proper manner.

Chapter One : Bipolar Junction Transistor Structure. Internal Junctions current components related to the external current or transistor terminal currents for difference configurations common base , common emitter, common collector .6h

Chapter Two : Bipolar Junction Transistors (I – V) Characteristics Curves at different Configurations Of C.B, C.E , C.C , circuits. Determinations of transistor parameters DC and ac input , output resistances. Transistor Current and voltage gains . 6 hours .

Chapter Three : Bipolar junction Transistor DC Bias Methods . DC load line, Q – operation point , ac load Line , Circuits Biasing Stability Factors . 8 hours.

Chapter Four : Bipolar Junction Transistors ac analysis , h – parameter equivalent circuit. Using the input and output (I – V) Characteristics curves at liner portion or at small changes of input at low frequency. This analysis helps to find transistor ac input , output resistances ,current gain . Analysis of BJT amplifiers circuits using transistor hybrid h – parameter equivalent circuit . From this analysis, amplifier parameters such as input , output resistances , current , voltage gains can be calculated .
8 hours.

Chapter Five : Circuit analysis For different BJT low voltage low frequencies amplifier Circuits configurations , C.E , C . C , using hybrid h – parameters Model With Feedback using (Millers Theorem) and Without Feedback. This method is useful For Determination Of all values of amplifier parameters and helping to design practical amplifier circuits for different applications. Modulation and De Modulation BJT Amplifier Circuits which has applications in signal transmission in communication 6 hours

Chapter Six : Double Stage BJT Amplifier Circuits. (R – C) Coupling or Series Connection Of Two Common – Emitter Amplifier Stages . (R – C) Connection Of Common – Emitter and Common – Common – Collector Amplifier Stages, h – Model Circuit Analysis And Over All Amplifier Parameters . 6 hours .

Chapter Seven : Classification Of Amplifier Circuits . Voltage Amplifier Circuit , Current Amplifier Circuit , Trans - conductance Amplifier Circuit , 6 hours Trans – resistance Amplifier Circuit . This Classification is Based on the magnitudes of the input and output impedance of an amplifier relative to the Source and Load Impedances , respectively .Showing the Conditions at which each Class Satisfied.

Chapter eight : Power Amplifiers . Class A and B (push – pull) Power Amplifiers . principles of their working , Analysis ,and differences . 6 hours.

Sinusoidal Oscillators , Phase – shift Oscillators . Multi – Vibrator Oscillators.

Chapter Ten : Field Effect Transistor : Junction Field Effect Transistor (JFET) , Construction ,(I – V) Characteristics , DC Load Line , Q – Of Operation, Difference DC biasing Circuits ,Transistor ac equivalent circuit , JFET Amplifiers (Common – Source , Common – Drain , Common - Gait) Their ac circuit Analysis 6 hours.

Chapter Eleven : BJT Differential Amplifier Circuits , has two input terminal low voltage, high input resistance, two output or one output terminals high voltage . Its application in IC – Op - Amp .

6 hours

Chapter Twelve : Operation Amplifier. Symbol , Ideal open loop Characteristics . It is a direct coupling ,infinity input resistance , zero output resistance , very high voltage gain, it is used to perform a wide variety of linear functions. can be connected in difference circuit configurations such as Non – inverting OP – Amp , Inverting OP – Amp. Closed loop Voltage Gain , Voltage gain frequency response 8 hours

References As Text Books .

1 - Semiconductor Devices And Circuits . By : A.P.Gods and U.A . Bakshi . Sixth Revised Edition 2008 .

2 – *Electronic Devices and Circuit Theory . By : Boylestad , R . and Nashelsky.*

3 – *Electronic Devices and Circuits . By : Millman , J. and Halkias , C . C .*

4 – *Electronic Circuit Analysis and Design. 2nd edition . By : Donald A . Neaman .*

5 – *Electronic Devices and Circuits . 2012 . By : Balbir Kumar and Shail B . Jain .*