Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract.	Tut.	Total
EXC 402	Discrete Electronic Circuits	04	--	-	04	--	-	04

Sub. Code	Subject Name	Examination Scheme							
		Theory Marks				TW	Pract.	Oral	Total
		Internal Assessment			End Semester Exam				
EXC 402	Discrete Electronic Circuits	Test 1	Test 2	Average of Test1 & Test2					
		20	20	20	80	--	--	--	100

Prerequisite: FEC105 Basic Electrical & Electronics Engineering and EXC 302 Electronic Devices

Course Objectives:

1. To understand DC biasing needed for various applications.
2. To understand DC and AC models of semiconductor devices and usefulness of the devices for various applications like amplifiers, oscillators etc..
3. To apply concepts of DC and AC modeling of semiconductor devices for the design and analysis.
4. To understand theoretical concepts and verify through laboratory and simulation experiments.
5. To deliver the core concepts and reinforce the analytical skills learned in Electronic Devices
6. To motivate students to use MOS devices for designing and analyzing electronic circuits which will help them to understand the fundamentals required for further part of Engineering

Course Outcome:

1. Students will be able to understand and the usefulness of semiconductor devices in circuit making.
2. Students will be Able to perform dc and ac analysis of the basic electronic circuits useful to conclude an application based on these.
3. They will be able to analyze and design multistage electronic circuits.
4. Mainly understanding of discrete and integrated biasing will be understood and very useful for mixed mode designs..
5. They will understand the difference between small signal and large signal amplifiers.
6. They will be able to use these basic circuits to develop various useful applications.

Module No.	Topics	Hrs.
1.0	**Bipolar device based circuit analysis**	**08**
1.1	**Review of Diode Based circuits:** Analytical analysis of Single level clippers, Double level Clippers and clampers (both only explanation, no analytical analysis)	
1.2	**DC Circuit Analysis of BJT:** DC load line and region of Operation, Common Bipolar Transistor Configurations, Single base resistor biasing, voltage divider biasing and bias stability, Analysis and Design of biasing circuits	
1.3	**AC Analysis of BJT Amplifiers: Bipolar Junction Transistor (BJT):** Graphical Analysis and AC Equivalents Circuits, Small Signal hybrid-pi model (no other models), early effect, Common-Emitter Amplifiers, Common-Collector Amplifiers, Common-Base Amplifiers.	
2	**Field Effect devices based circuit analysis**	**10**
2.1	**DC Circuit Analysis:** **Junction Field Effect Transistor (JFET):** Self bias, Voltage divider bias, Design and Analysis of Biasing Circuits **Metal-Oxide Field Effect Transistor (MOSFET):** Common-Source circuits, DC load line and region of operation, Common-MOSFETs configurations, Analysis and Design of Biasing Circuits	
2.2	**AC Analysis:** **JFET Amplifiers:** Small-Signal Equivalent Circuit, Small-Signal Analysis **MOSFET Amplifiers:** Graphical Analysis, load line and Small-Signal parameters, AC Equivalent Circuit, Small-Signal Model. Common-Source, Source Follower, Common-Gate	
3.0	**Multistage analysis and Frequency Analysis of Amplifiers**	**10**
3.1	Multistage (CS-CS), (CS-CE) cascode (CS-CG) Amplifiers & Darlington pair.	
3.2	Effect of capacitors (coupling, bypass, load) on frequency response of JFET and MOSFET Amplifiers, High frequency hybrid-pi equivalent circuits of MOSFET, Miller Effect and Miller capacitance, unity gain bandwidth, Low and high frequency response of single stage (CS,CG, CD) and multistage (CS-CS).	
4.0	**Feedback Amplifiers and Oscillators**	**08**
4.1	Types of Negative Feedback, block diagram representation, Effect of negative feedback on Input impedance, Output impedance, Gain and Bandwidth with derivation, feedback topologies (analysis of different feedback circuits is not expected).	
4.2	Positive feedback and principle of oscillations, RC oscillators: Phase shift (no derivations), Wien bridge, LC Oscillators: Hartley, Colpitts and clapp, Tunned Oscillator (no derivations), Twin T Oscillator (no derivations), Crystal Oscillator (BJT circuits analysis).	
5.0	**Differential Amplifiers**	**10**
5.1	**BJT Differential Amplifier:** Terminology and qualitative description, DC transfer characteristics, Small signal Analysis, differential and common mode gain, CMRR,	

	differential and common mode input impedance.	
5.2	**MOSFET Differential Amplifiers:** DC Transfer characteristics, Small signal Analysis, differential and common mode gain, CMRR, differential and common mode input impedance.	
5.3	**Constant Current Sources:** Two transistor (BJT, MOSFET) current source, current relationship, output resistance. Improved three transistor (BJT, MOSFET) current source, Cascode (BJT, MOSFET) current source, Wilson and Widlar current source	
6.0	**Power Amplifiers**	**06**
6.1	Power BJTs, Power MOSFETs, Heat Sinks, Class A, Class B, Class C and Class AB operation, Power efficiency, Class AB output stage with diode biasing, VBE multiplier biasing, input buffer transistors, Darlington configuration.	
	Total	**52**

Recommended Books:

1. Donald A. Neamen, "*Electronic Circuit Analysis and Design*", TATA McGraw Hill, 2nd Edition
2. Adel S. Sedra, Kenneth C. Smith and Arun N Chandorkar," *Microelectronic Circuits Theory and Applications*", International Version, OXFORD International Students Edition, Fifth Edition.
3. David A. Bell, "*Electronic Devices and Circuits*", Oxford, Fifth Edition.
4. S. Salivahanan, N. Suresh Kumar,*"Electronic Devices and Circuits",* Tata McGraw Hill, 3rd Edition
5. Jacob Millman, Christos C Halkias, and Satyabratata TIT, *"Millman's Electronic Devices and Circuits",* McGrawHill, 3rd Edition
6. Muhammad H. Rashid, *"Microelectronics Circuits Analysis and Design",* Cengage Learning, 2nd Edition
7. Jacob Millman and Arvin Grabel, "Mircroelectronics", Tata McGraw-Hill Second Edition

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3: Question No.1 will be compulsory and based on entire syllabus. 4:
Remaining question (Q.2 to Q.6) will be set from all the modules. 5:
Weightage of marks will be as per Blueprint.