GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Electronics & Communication Engineering

Course / Subject Code: DI02011011

Course / Subject Name: Electronics Circuit and Application (ECA)

w. e. f. Academic Year:	2024-25
Semester:	2nd
Category of the Course:	PCC

Prerequisite:	Basic knowledge of R, L, C, Diode, Transistor
Rationale:	Electrical, Electronic, Instrumentation and allied engineering diploma holders are required to use and maintain various types of electronically controlled equipment. The fundamental principles of electronics are to be applied in most of the situations to arrive at the probable solutions which is faced in the world of work, therefore the knowledge of the functions of various basic electronic devices and components and practical skills acquired through the laboratory experiments will help them, when they work with electronic equipment and its sub-circuits. This course is designed to develop the skills to use the basics electronic components and apply the knowledge to maintain the various types of electronic circuits.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain the construction, operation, and characteristics of JFET and MOSFET, and analyze their applications in electronic circuits.	R, U, A,N,E,C
02	Compare different biasing methods for amplifiers, and evaluate the impact of thermal stability techniques on circuit performance.	R, U, A,N,E,C
03	Analyze the frequency response of single and multi-stage amplifiers, considering gain, bandwidth, and coupling techniques.	R, U, A,N,E,C
04	Assess the effects of negative feedback on amplifier parameters, including gain, impedance, stability, and distortion.	R, U, A,N,E,C
05	Demonstrate the design and operation of various oscillators, such as RC, LC, and crystal oscillators, and explain the use of UJT in relaxation oscillators.	R, U, A,N,E,C

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	**Field Effect Transistors(FETs)** 1.1 Junction field effect transistor(JFET) structure, symbol, working, characteristics, parameters 1.2 Metal oxide semiconductor field effect transistor(MOSFET): 1.3 Depletion type MOSFET. structure, symbol, working, characteristics. 1.4 Enhancement type MOSFET. structure, symbol, working, characteristics 1.5 Comparison of BJT, JFET, MOSFET 1.6 List application of FETs	10	25%
2.	**Transistor Biasing circuits And Thermal stability** 1.1 Biasing of Amplifier and Definition of Operating Point 1.2 The Load Lines**:** D.C. Load Line and A.C. Load Line. 1.3 Biasing Methods. 1.4 Stability Factor: Definition and features. 1.5 Compensation techniques for bias stability. 1.6 Thermal Runaway, Thermal Resistance & Thermal Stability. 1.7 Heat Sink and its types.	9	20%
3.	**Frequency Response of Transistor Amplifier** 3.1Amplifier Parameters Gain, Bandwidth and Gain Bandwidth product.	7	15%

	3.2Effect of Emitter Bypass Capacitor and Coupling Capacitor on frequency response. 3.3Frequency Response of Single Stage Amplifier. 3.4 Gain of multi-stage amplifier. 3.5Different Coupling Techniques for cascading: Direct, RC, LC and Transformer. 3.6Frequency Response of Two Stage RC Coupled amplifier.		
4.	**Feedback in amplifiers** 4.1 Concept of feedback in amplifiers: Negative and Positive 4.2 Types of feedback 4.3 Voltage gain of feedback amplifier. 4.4 Describe the effect of negative feedback on amplifier parameters like Gain, input impedance, output impedance, stability, bandwidth, frequency response, distortion, and noise 4.4 List the advantages and disadvantages of negative feedback. 4.5 Emitter follower circuit	9	20%
5.	**Oscillators.** 5.1 Use of positive feedback in oscillators. 5.2 Barkhausen's criteria for oscillation 5.3 Overall gain of positive feedback amplifier. 5.4 Tank circuit 5.5 Different types of oscillators. 5.6 LC oscillators (1) Hartley oscillator. (2) Colpitts oscillator 5.7 RC oscillators (1) Phase shift oscillator (2) Wein bridge oscillator 5.8 Crystal Oscillator Piezoelectric effect, characteristics of crystal, crystal oscillator circuits 5.9 Uni junction transistor(UJT) Structure, symbol, working, characteristics. 5.10 Use of UJT as relaxation oscillator	10	20%
	Total	**45**	**100%**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
25	**40**	**35**			

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Basic Electronics and linear circuits. By N.N.Bhargava, D.C.Kulshreshtha, S.C. Gupta .McGraw Hill Publication.
2. Electronic Principles. By Malvino A. P. MGH, Latest edition.
3. Principles of Electronics.By V.K.Metha, Rohit Mehta. S. Chand.
4. Electronic Devices and Circuit: An Introduction Mottershead Allen Goodyear Publishing Co.

(b) Open source software and website:

1. https://youtube.com/playlist?list=PLwjK_iyK4LLBVM18VZ7JKW-q88FAtnr8_&si=Rcg5IZlRmTYXR-c8
2. www.nptel.iitm.ac.in
3. www .electronics-tutorials.ws
4. https://lectures.gtu.ac.in/listview.aspx?br=11&course=DI

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required.
1	JFET Characteristics	I	02
2	MOSFET Characteristics	I	02
3	Build and test voltage divider biased type amplifier and measure voltage at different points on the circuit and observe waveforms.	II	02
4	Test thermal stability of fixed biased type amplifier.	II	02
5	Obtain frequency response of single stage transistor amplifier.	III	02
6	Obtain frequency response of two stage RC-coupled amplifier.	III	02
7	Test the performance of negative feedback amplifier and compare gain, BW with amplifier without feedback.	IV	02

8	Emitter follower circuit	IV	02
9	Build / test Colpitts oscillator for variable frequency.	V	02
10	Build / test Hartley oscillator for variable frequency.	V	02
11	Phase shift oscillator	V	02
12	Wein bridge oscillator	V	02
13	Build / test UJT as a Relaxation Oscillator.	V	02
14	Mini/Micro project	I to V	02
15	Mini/Micro project	I to V	02

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Dual variable DC power supply, 0- 30V, 2A, With Short circuit protection, separate display for voltage and current.	All
2	Cathode Ray Oscilloscope, Dual Trace 20 MHz, 1MΩ Input Impedance.	All
3	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	5-6
4	Digital Multimeters	All

Suggested Project List:

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

1. **FET/MOSFET Application:** Build any application based on FET/MOSFET and prepare a mini project report.
2. **Transistor Amplifier:** a common emitter amplifier using transistor and prepare a mini project report
3. Emitter follower circuit/Any amplifier with negative feedback.
4. Oscillators. Build and test any oscillator circuit.
5. UJT application. Build any application based on UJT and test it.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, the following are the suggested student-related ***co-curricular*** activities that can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform the following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidence for their (student's) portfolio which may be useful for their placement interviews:

a) Prepare a table and interpret the technical specification of various BJT/FET/MOSFET using data sheet.
b) Collect information and seminar on any relevant topic related with the course.
c) Undertake a market survey of different semiconductor components, amplifiers, function generators.
d) Identify various types of transistor
e.) Analysis of different oscillator circuits
f.) Maintaining/Repairing of kits and equipments in department.

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