Ramgarhia Polytechnic College, Phagwara

Electrical Engineering Department

Head of Department:	S. Jasvir Singh
Name of the Faculty:	Er. Rahul Bahl
Discipline:	Electrical Engineering Department
Semester:	3rd
Subject:	Analog Electronics
Lesson Plan Duration:	16 Weeks

RATIONALE

At present, electronics gadgets are being extensively used in various manufacturing processes in industries, power system operations, communication systems, computers etc. Even for an electrical diploma holder, it is absolutely necessary to have a basic understanding of electronic components, their function and applications. This understanding should facilitate in operation and maintenance equipment, which are electronically controlled. In this course, topics like semi-conductor Diodes, Bipolar transistors, rectifiers, single stage and multistage amplifiers and field effect transistors have been included.

Learning Outcomes

After undergoing this course, the students will be able to:

CO1. Use P.N. junction as rectifier.

CO2. Use Zener diode as voltage stabilizer Use various batteries and their care

CO3. Use bi-polar transistors and its application as an amplifier and as a switch.

CO4. Analyse amplifier and enhance the gain of amplifier

CO5. Use unipolar transistors as amplifier

CO6. Identify and testing of various active and passive components such as resistor, inductor, capacitor, diode and transistor

PO ⇨ / CO ⇩	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓						
CO2		✓					
CO3		✓					
CO4		✓					
CO5	✓						
CO6		✓	✓				
CO7	✓	✓					
CO8		✓	✓				
CO9	✓		✓				

Syllabus

Units	Details	Hours
1.	Semiconductor Diodes. 1.1 PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism 1.2 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance 1.3 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), relation between DC output and AC input voltage, rectifier efficiency 1.4 Concept of ripples, filter circuits – shunt capacitor, series inductor, and pie (π) filters and their applications 1.5 Diode ratings/specifications 1.6 Various types of diodes such as zener diode, varactor diode, schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications 1.7 Zener diode and its characteristics 1.8 Use of zener diode for voltage stabilization	(12 hrs)
2.	2.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current flow 2.2 Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations	(08 hrs)
3.	Transistor Biasing and Stabilization 3.1 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point. 3.2 Different biasing circuits, limitations, simple problems to calculate operating point in different biasing circuits. Use of Thevenin's theorem to determine operating point 3.3 Concept of h-parameters of a transistor 3.4 Use of data book to know the parameters of a given transistor).	(12 hrs)
4.	Single-Stage Transistor Amplifiers 4.1 Single stage transistor amplifier circuit in CE configuration, function of each component 4.2 Working of single stage transistor amplifier, physical and graphical explanation, phase reversal 4.3 Concept of DC and AC load line 4.4 Voltage gain of single stage transistor amplifier using characteristics of the device 4.5 Concept of input and output impedance	(12 hrs)

	4.6 AC equivalent circuit of single stage transistor amplifiers 4.7 Calculation of voltage gain using AC equivalent circuit 4.8 Frequency response of a single stage transistor amplifier	
5.	Multi-Stage Transistor Amplifiers 5.1 Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications. 5.2 Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width 5.3 RC coupled two-stage amplifiers, circuit details, working, frequency response, applications 89 5.4 Loading effect in multistage amplifiers 5.5 Elementary idea about direct coupled amplifier, its limitations and applications 5.6 Transformer coupled amplifiers, its frequency response. Effect of coefficient of coupling on frequency response. Applications of transformer	(10 hrs)
6.	Field Effect Transistor (FET) 6.1 Construction, operation, characteristics and applications of a N channel JFET and P channel JFET 6.2 JFET as an amplifier 6.3 Types, construction, operation, characteristics and applications of a MOSFET 6.4 Comparison between BJT, JFET and MOSFET	(08 hrs)

Reference Books:

1. Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd, New Delhi.

2. Electronic Principles by SK Sahdev, Dhanpat Rai & Co., New Delhi

3. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi

4. Electronic Components and Materials by SM Dhir, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi.

5. Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi

6. Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.

7. Principles of Electronics by Albert Paul Malvino; Tata McGraw Hill Education Pvt Ltd, New Delhi.

8. Basic Electronics – Problems and Solutions by Albert Malvino and David J. Bates; Tata McGraw Hill Education Pvt Ltd, New Delhi.

9. Basic Electronics by J.S. Katre, Sandeep Bajaj, Tech. Max. Publications, Pune.

10. Analog Electronics by DR Arora, Ishan Publications, Ambala City.

Delivery/Instructional

Methodologies

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

Web Source References

Sr. No.	URL
1.	https://nptel.ac.in/

Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	
1st	1st	PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier	1.	1(a)Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits b) Measurement of resistances using multimeter and their comparison with colour code values **Group I**
	2nd	effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions. Breakdown mechanism		
	3rd	Ideal diode, Semiconductor diode characteristics, static and dynamic resistance		

	4th	Use of diode as half wave and full wave rectifiers (centre tapped and bridge type)		
2nd	5th	relation between DC output and AC input voltage, rectifier efficiency	2.	1(a)Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits b) Measurement of resistances using multimeter and their comparison with colour code values **Group II**
	6th			
	7th	Concept of ripples, filter circuits – shunt capacitor,		
	8th	series inductor, and pie (π) filters and their applications		
3rd	9th		3.	To plot V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance **Group I**
	10th	Diode ratings/specifications		
	11th	Zener diode and its characteristics		
	12th	Use of zener diode for voltage stabilization		
4th	13th	Bi-polar Transistors	4.	To plot V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance **Group II**
	14th	Concept of junction transistor, PNP and NPN transistors		
	15th			
	16th	Transisitor symbols and mechanism of current flow		
5th	17th	Transistor configurations	5.	a) To plot V-I characteristics of a zenor diode and finding its reverse breakdown voltage b) Fabrication of
	18th	common base (CB), common emitter (CE)		
	19th			

		common collector (CC), current relation and their input/output characteristics; comparison of the three configurations		a zenor diode voltage stabilizer circuit using PCB **Group I**
	20th			
6th	21st	Transistor Biasing and Stabilization Transistor biasing, its need	6.	a) To plot V-I characteristics of a zenor diode and finding its reverse breakdown voltage b) Fabrication of a zenor diode voltage stabilizer circuit using PCB **Group II**
	22nd			
	23rd	**REVISION**		
	24th	**1st Sessional Test (Tentative)**		
7th	25th	Operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point	7.	4. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage **Group I**
	26th	Different biasing circuits, limitations, simple problems to calculate operating point in different biasing circuits		
	27th			
	28th	Use of Thevenin's theorem to determine operating point		
8th	29th	Concept of h-parameters of a transistor	8.	4. Observation of input and output wave shapes of a half-wave rectifier and verification of relationship between dc output and ac input voltage **Group II**
	30th			
	31st	Use of data book to know the parameters of a given transistor		
	32nd			
	33rd	Single stage transistor amplifier circuit in CE		5. Observation of input and output wave shapes of a full wave rectifier
	34th			

9th		configuration, function of each component	9.	and verification of relationship between dc and ac input voltage **Group I**
	35th	Working of single stage transistor amplifier, physical and graphical explanation, phase reversal		
	36th			
10th	37th	Concept of DC and AC load line	10.	5. Observation of input and output wave shapes of a full wave rectifier and verification of relationship between dc and ac input voltage **Group II**
	38th	Voltage gain of single stage transistor amplifier using characteristics of the device Concept of input and output impedance. AC equivalent circuit of single stage transistor amplifiers		
	39th			
	40th			
11th	41st		11.	6. Observation of input and output wave shapes of a full wave rectifier with (i) shunt capacitor) (ii) series inductor (iii) filter circuits **Group I**
	42nd	Calculation of voltage gain using AC equivalent circuit		
	43rd			
	44th	**REVISION**		
12th	45th	**PTM**	12.	6. Observation of input and output wave shapes of a full wave rectifier with (i) shunt capacitor) (ii) series inductor (iii) filter circuits **Group II**
	46th	**2nd Sessional Test (Tentative)**		
	47th	Frequency response of a single stage transistor amplifier		
	48th			
13th	49th	Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications.	13.	7. Plotting input and output characteristics of a transistor in CB configuration **Group I**
	50th			
	51st			

	52nd	Knowledge of various terms such as voltage gain, current gain, power gain, frequency response, decibel gain and band width		
14th	53rd	RC coupled two-stage amplifiers, circuit details, working, frequency response, applications Loading effect in multistage amplifiers)	14	7. Plotting input and output characteristics of a transistor in CB configuration **Group II**
	54th			
	55th			
	56th	Elementary idea about direct coupled amplifier, its limitations and applications		
15th	57th		15.	8.Plotting input and output characteristics of a transistor in CE configuration **Group I**
	58th	Transformer coupled amplifiers, its frequency response. Effect of coefficient of coupling on frequency response. Applications of transformer coupled amplifiers		
	59th			
	60th	Construction, operation, characteristics and applications of a N channel JFET and P channel JFET JFET as an amplifier		
16th	61st		16.	8.Plotting input and output characteristics of a transistor in CE configuration **Group II**
	62nd	**PTM**		
	63rd	Types, construction, operation, characteristics and applications of a MOSFET Comparison between BJT, JFET and MOSFET		
	64th	**3rd Sessional Test (Tentative)**		

NBA has defined the following seven POs for an Engineering diploma graduate:

i) **Basic and Discipline specific knowledge**: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

ii) **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.

iii**)** **Design/ development of solutions**: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

iv) **Engineering Tools, Experimentation and Testing**: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

v) **Engineering practices for society, sustainability and environment**: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

vi) **Project Management**: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

vii) **Life-long learning**: Ability to analyze individual needs and engage in updating in the context of technological changes.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required.

These are the statements, which are specific to the particular 11 program. They are beyond POs. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.