22PHU519AN

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER - 2025
(Fifth Semester)

Branch - **PHYSICS**

MAJOR ELECTIVE COURSE - I: SEMICONDUCTOR ELECTRONICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	What happens to the conductivity of a semiconductor when temperature increases? a) It decreases b) It becomes zero c) It increases d) It remains constant	K1	CO1
	2	What is the main purpose of a full wave bridge rectifier? a) Convert AC to DC b) To amplify signals c) To store energy d) Filter the noise in signal	K2	CO1
2	3	What does the load line analysis in Common Emitter configuration help determine? a) Operating point b) Input impedance c) Amplifier gain d) Frequency response	K1	CO2
	4	Which class of power amplifier operates for less than 180° of the input signal cycle? a) Class A b) Class B c) Class AB d) Class C	K2	CO1
3	5	Negative feedback reduces --------- in amplifiers. a) Stability b) Distortion c) Impedance d) bandwidth	K1	CO2
	6	Which OPAMP configuration provides a gain of $1 + \frac{R_f}{R_{in}}$? a) Integrator b) Differentiator c) Non-inverting amplifier d) Inverting amplifier	K2	CO3
4	7	Which oscillator uses a capacitive voltage divider to determine the frequency? a) Colpitts oscillator b) Hartley oscillator c) Phase shift oscillator d) Crystal oscillator	K1	CO2
	8	Which stage in a superheterodyne receiver converts the incoming signal to an intermediate frequency? a) Amplifier b) Detector c) Oscillator d) Mixer	K2	CO1
5	9	What condition makes a transistor act as a switch in the ON state? a) Collector-base junction is forward biased b) Base-emitter junction is reverse biased c) Transistor is in saturation region d) Transistor is in cutoff region	K1	CO2
	10	What is the role of SCRs in a full wave rectifier? a) To amplify signals b) To regulate voltage c) To control conduction during each half cycle d) To store energy	K2	CO4

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SECTION - B (35 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Draw P.N Junction diode and explain its working with volt amp characteristics.	K2	CO3
		(OR)		
	11.b.	With a neat diagram, explain the operation of the Zener diode and its forward and reverse characteristics. Also distinguishes between Avalanche and Zener breakdowns.	K2	CO3
2	12.a.	Explain the concept of load line analysis in a CE amplifier. How is the operating point determined?	K3	CO4
		(OR)		
	12.b.	In a push-pull amplifier, each transistor conducts for half the cycle. If the supply voltage is 20 V and load resistance is 8 Ω, calculate a. Maximum output power b. Efficiency of the amplifier c. Power dissipation in each transistor.	K4	CO3
3	13.a.	What do you understand by feedback? Why is negative feedback applied in high gain amplifiers? Derive an expression for the gain of a negative feedback amplifier.	K2	CO2
		(OR)		
	13.b.	Draw the negative feedback amplifier using OPAMP. If the gain of the amplifier without feedback is 10000. Find a. Feedback fraction b. Overall voltage gain c. Output voltage if input voltage is 1mV.	K3	CO4
4	14.a.	Describe the working of a Weinbridge oscillator. Why is it preferred for generating low-distortion sine waves?	K1	CO1
		(OR)		
	14.b.	Explain the process of amplitude modulation. Derive the expression for an AM wave and define a modulation index.	K1	CO1
5	15.a.	Show that the output from a differentiating circuit is derivative of the input with a neat circuit diagram. What assumption is made in the derivation?	K3	CO5
		(OR)		
	15.b.	What do you understand about clippers and clamping circuits? Describe with neat diagram of a. Positive clipper and clamper b. Negative clipper and clamper c. Combination clipper.	K1	CO1

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Explain the operation of a full-wave bridge rectifier with a neat circuit diagram and sketch the input and output voltage waveforms. Derive expressions for RMS output current, peak inverse voltage (PIV) of each diode, ripple factor (without filter), and rectification efficiency.	K1	CO1
2	17	Describe the operation of an RC-coupled amplifier. Derive expressions for its midband voltage gain, input impedance, and output impedance. Sketch the overall frequency response, clearly marking the low- and high-frequency cutoff points.	K2	CO3
3	18	A 12 V zener-diode regulator feeds a load drawing up to 50 mA. The zener knee current is 5 mA, and its dynamic knee voltage is 12 V. The supply can vary between 15 V and 20 V. a. Calculate the series resistor R_s to maintain regulation. b. Verify that the zener current stays between 5 mA and its maximum (assume $I_{Z\max}$=100 mA) at both extremes of the supply.	K3	CO5
4	19	Compare Hartley and Colpitts oscillators by a. Drawing their circuit diagrams b. Deriving the frequency formulas for each c. Discussing their relative merits and applications	K3	CO4
5	20	Compare astable, monostable and bistable multivibrators. For each type, provide the basic circuit diagram, sketch the output waveform, derive the timing expression, and cite one key application.	K3	CO4

Z-Z-Z END