

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(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	Which of the following best describes the volt-ampere characteristics of a p-n junction diode? A. Linear in both directions B. Non-linear and allows current only in forward bias C. Zero current in forward bias D. Constant voltage in reverse bias	K1	CO1
	2	Which type of filter circuit combines both capacitor and inductor elements? A. LC filter B. RC filter C. Inductance filter D. Pi filter	K2	CO1
2	3	What is the main advantage of the voltage divider bias method? A. Simple design B. Stable operating point C. High gain D. Low current consumption	K1	CO2
	4	In transistor amplifier design, what does the operating point (Q-point) represent? A. Stable DC bias condition B. Peak output voltage C. Minimum distortion D. Maximum gain	K2	CO2
3	5	What is the condition for proper operation of a zener diode voltage regulator? A. Zener diode must be in breakdown region B. Zener current must be forward biased C. Zener voltage is zero D. Input voltage must be less than the zener voltage	K1	CO3
	6	In an inverting OPAMP configuration, what is the phase relationship between input and output? A. 90° out of phase B. No phase shift C. 180° out of phase D. 270° out of phase	K2	CO3
4	7	Which oscillator is commonly used for generating sine waves in audio frequency range? A. Crystal oscillator B. Weinbridge oscillator C. Tuned collector oscillator D. Phase shift oscillator	K1	CO4
	8	Which stage in a superheterodyne receiver is responsible for signal amplification at intermediate frequency? A. Intermediate frequency amplifier B. Radio frequency amplifier C. Detector D. Audio amplifier	K2	CO4
5	9	Which multivibrator has one stable and one quasi-stable state? A. Astable B. Monostable C. Bistable D. Multistable	K1	CO1
	10	Which of the following is a voltage-controlled device? A. BJT B. SCR C. FET D. Diode	K2	CO2

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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.	Define ripple factor. Compare ripple factor for half-wave and full-wave rectifiers.	K2	CO1
		(OR)		
	11.b.	Explain the need for filter circuits in rectifiers. Describe any two types of filter circuits.		
2	12.a.	A CE amplifier uses a transistor with $\beta = 100$. The collector resistor is $2\text{ k}\Omega$, and the supply voltage is 12 V . If the base current is $20\text{ }\mu\text{A}$, calculate a. Collector current b. Collector-emitter voltage c. Power dissipation in the transistor.	K3	CO2
		(OR)		
	12.b.	Describe the need for transistor biasing. Explain the voltage divider bias method with a circuit diagram.		
3	13.a.	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 $I_{Z\text{ max}} = 100\text{ mA}$) at both extremes of the supply.	K3	CO3
		(OR)		
	13.b.	Explain the working of an OPAMP differentiator. Derive the output expression and discuss limitations.		
4	14.a.	Describe the working of a tuned collector oscillator with a neat circuit diagram.	K2	CO4
		(OR)		
	14.b.	What is demodulation? Explain the working of an envelope detector used for AM demodulation.		
5	15.a.	Explain the working of an astable multivibrator with a neat circuit diagram. Derive the expression for the time period of oscillation and hence obtain the ON-time (high state duration) of the output square wave.	K3	CO5
		(OR)		
	15.b.	Show that the output from an integrating circuit is the integral of the input with a neat circuit diagram. What assumption is made in the derivation?		

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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	a. Distinguishes between intrinsic and extrinsic semiconductors? b. Explain the effect of temperature on the Fermi energy level of an extrinsic semiconductor?	K2	CO1
2	17	Describe the operation of a Class B push-pull amplifier. Derive formulas for: a. Output power delivered to the load b. Power dissipation in each transistor c. Theoretical maximum efficiency Sketch the circuit diagram and explain the origin of distortion.	K3	CO2
3	18	Draw the negative feedback amplifier using OPAMP. If the gain of the amplifier without feedback is 10000, $Z_{in} = 10\text{ K}\Omega$ and $Z_{out} = 100\ \Omega$. Find c. Feedback fraction d. Gain with feedback e. Input impedance with feedback f. Output impedance with feedback.	K3	CO3
4	19	Draw and label the block diagram of a superheterodyne receiver. Explain the function of each stage, discuss the concept of image frequency, and outline measures taken to improve selectivity and sensitivity.	K4	CO4
5	20	Briefly explain the construction, transfer characteristics, and output characteristics of an n-channel JFET and an enhancement-mode n-channel MOSFET with neat diagrams.	K4	CO5

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