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Question Paper Code : 11235

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Third Semester

Electrical and Computer Engineering

EC3301 — ELECTRON DEVICES AND CIRCUITS

(Common to: Electrical and Electronics Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Why does a Zener diode exhibit sharp breakdown at a particular reverse voltage? Distinguish avalanche and Zener breakdown mechanisms.
2. Why is a full-wave rectifier preferred over a half-wave rectifier in power supply applications?
3. Why does the current gain (β) of a BJT vary with collector current and temperature?
4. A JFET has $I_{DSS} = 12$ mA and $V_P = -4$ V. Find the drain current for $V_{GS} = -2$ V using the Shockley equation.
5. Why does a CE amplifier provide higher voltage gain than a CC amplifier?
6. A source follower MOSFET amplifier is used as a buffer. Justify its use in impedance matching.
7. A two-stage CE amplifier has a gain of 50 per stage. Calculate the overall gain in dB.
8. Why is a BiMOS cascade amplifier used instead of only BJT or MOSFET stages?
9. Apply the condition for oscillations to explain why sustained oscillations cannot occur without positive feedback.
10. List the advantages of negative feedback.

PART B — (5 × 13 = 65 marks)

11. (a) Examine the V-I characteristics of a PN junction diode in both forward and reverse bias.

Or

- (b) Analyze how series and parallel clippers modify the input waveform.

12. (a) With neat diagrams, analyze the input-output characteristics of a BJT in CE configuration.

Or

- (b) Compare the enhancement and depletion MOSFET characteristics with respect to threshold voltage, transfer curve, and region of operation.

13. (a) With neat diagrams, analyze the small-signal hybrid- π model of BJT and derive the expressions for voltage gain, input resistance, and output resistance of a CE amplifier.

Or

- (b) Derive the expression for gain-bandwidth product and discuss its significance in amplifier design.

14. (a) Derive the expressions for differential mode gain and common mode gain of a differential amplifier.

Or

- (b) Compare Class A, B, AB, and C amplifiers with respect to conduction angle, efficiency, linearity, and applications.

15. (a) Analyze the four types of negative feedback amplifiers (voltage-series, and current-series).

Or

- (b) A transistor Hartley oscillator is designed with $L_1 = 10 \mu\text{H}$, $L_2 = 40 \mu\text{H}$, and $C = 100 \text{ pF}$. Apply the oscillator frequency formula to determine the oscillation frequency.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the working of the circuit, calculate frequency of oscillation for given R and C, and analyze how varying R affects the triggering angle.

Or

- (b) Design a CE amplifier with $V_{CC} = 12 \text{ V}$, $R_C = 4 \text{ k}\Omega$, $R_L = 10 \text{ k}\Omega$ and $\beta = 100$, to achieve a midband gain of -100 . Calculate suitable biasing resistors, input resistance, and bandwidth considerations.