

Total No. of Questions: 22

Total No. of Pages: 02

Roll No. _____

Paper Code

3E1217

B.Tech. III-Sem (Main & Back) January-2026

Electrical & Electronics Engg.

3EX4-06 Analog Electronics

EE,EX

3E1217

Time : 3 Hours

Maximum Marks : 70

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly. Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. _____

2. _____

Part-A

(Answer should be given up to 25 words only)

All questions are compulsory

10x2=20

- Q. 1 Distinguish between clamping and clipping circuits.
- Q. 2 A transistor has $\beta = 100$ and $I_B = 40 \mu A$. Determine I_C .
- Q. 3 State two differences between enhancement - type and depletion-type MOSFETs. T-437
- Q. 4 In a CS MOSFET amplifier, $g_m = 3 \text{ mA/V}$ and $R_D = 4 \text{ k}\Omega$. Compute voltage gain.
- Q. 5 State two advantages of using a differential amplifier as an input stage.
- Q. 6 What is the function of an instrumentation amplifier?
- Q. 7 List any two practical limitations of an ideal differentiator circuit.
- Q. 8 A comparator used $\pm 12 \text{ V}$ saturation limits. If reference voltage is 3 V , sketch the expected output levels.
- Q. 9 Define hysteresis width in a Schmitt trigger. T-437
- Q.10 Write any two assumptions used in a small-signal BJT model.

Part B

(Analytical/Problem solving questions)

Attempt any Five questions. T-437

5x4=20

- Q. 1 Explain the working of a zener regulated power supply. For $V_{in}=20\text{ V}$, $V_Z=12\text{ V}$, $R_S=220\ \Omega$ compute load current range for $R_L=300 - 800\ \Omega$.
- Q. 2 Describe the operation of a current mirror and derive expression for mirror current assuming $\beta \rightarrow \infty$.
- Q. 3 A MOSFET amplifier has $g_m = 4\text{ mA/V}$, $r_d = 50\text{ k}\Omega$, $R_D = 12\text{ k}\Omega$. Calculate overall voltage gain using small-signal model.
- Q. 4 A differential amplifier has $A_D=300$, $A_{CM}=0.8$. If input differential voltage is 6 mV and common-mode voltage is 2 mV , calculate output differential and CM voltages.
- Q. 5 Explain the working of an instrumentation amplifier and derive its differential gain formula.
- Q. 6 Explain a monostable multivibrator using op-amp. Derive pulse-width expression.
- Q. 7 Describe the process of clipping and clamping using diodes. Illustrate with suitable waveforms for a biased clipper.

Part C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions.

3x10=30

- Q. 1 Using carrier drift and diffusion mechanism, derive the I-V characteristics of a PN junction diode and explain how piecewise-linear approximation is obtained.
- Q. 2 Derive expressions for voltage gain, input resistance and output resistance of a CE amplifier using the hybrid- π model. For $\beta=150$, $g_m=40\text{ mA/V}$, $r_\pi=3\text{ k}\Omega$, $R_C=2.2\text{ k}\Omega$ compute A_v and R_i .
- Q. 3 Describe the internal block diagram of operational amplifier and explain each stage (input differential stage, gain stage, level shifter, output stage). T-437
- Q. 4 Derive the transfer functions of inverting and non-inverting integrators. For $R=47\ \Omega$ and $C=0.1\ \mu\text{F}$, find output waveform for a 1 kHz sine wave of amplitude 2 V .
- Q. 5 Explain precision rectifier behavior at low voltage levels. Design a full wave precision rectifier and calculate peak output for input 15 V_{pp} with ideal op-amp.