

- 2 (a) In a multistage amplifier, derive the expression for the net equivalent noise resistance in terms of noise resistance R_1, R_2, R_3 etc. at the input of first, second, third etc. stages respectively and the voltage gains of the individual stages. 5
- (b) Determine the PSD and rms value of the signal 4

$$v(t) = \frac{1}{2} + \frac{2}{n} \sum_{n=1, 3, 5, \dots}^{\infty} \frac{(-1)^{(n-1)/2}}{n} \cos nt$$

- 3 (a) Explain how adaptive delta modulation improves the system's tolerance to slope overload. 5
- (b) A 20 MHz, 6 V carrier is modulated by a 500 Hz sinewave. The maximum frequency deviation is 15 kHz and the same modulation index is obtained for both PM and FM. Write the expression for this modulated wave for
- (i) FM and
- (ii) PM Next if the modulating frequency is increased to 6 kHz, other things remaining the same, write new expressions for FM and PM. 4

OR

- 3 (a) Explain pulse code modulation scheme with suitable example. 4
- (b) What are the advantages of VSB over DSB and SSB? 1
- (c) In a single - integration DM system, the voice signal is sampled at a rate of 64 kHz and $A_{max}=1$ 4
- (i) Determine the minimum value of step size to avoid slope overload
- (ii) Determine the quantization noise power if the voice signal bandwidth is 3.5 kHz
- (iii) Assuming that the voice signal is sinusoidal, determine the signal power and signal to quantization noise ratio.

SECTION - II

- 4 (a) Differentiate between p.n. junction and metal semiconductor junction diode. 2
- (b) Describe briefly the phenomenon known as 'Early Effect' in bipolar transistor. 3
- (c) For abrupt junction, show mathematically that the maximum electric field is E_m and is located at $x=0$ 3

- 5 (a) Describe various modes of operation of Gunn diode. 5
 (b) For a linearly graded junction, show mathematically 4
 that the Built-in-Potential V_{bi} of the junction is proportional
 to the impurity gradient 'a'.

OR

- 5 (a) Explain the construction and working of a triac. 5
 Explain its current - voltage characteristics.
 (b) (i) Calculate the upper cut-off wavelength in photo 4
 diode if the band gap is 3.2 e V
 (ii) Calculate the efficiency of the photodetector using
 the following data :
 $\lambda = 800 \text{ nm}$, $I_p = 10 \text{ } \mu\text{A}$ $P_o = 0.5 \text{ } \mu\text{W}$
- 6 (a) Draw the current-voltage characteristics of shockley 5
 diode and explain it. Explain current triggering method
 of switching a three terminal thyristor.
 (b) Find out the tunneling probability in case of 4
 parabolic potential barrier for tunnel diode.

OR

- 6 (a) Write one dimensional electron current density (J_n) 5
 equation and hole current density (J_p) equation and
 explain their applications in device operation.
 (b) Derive the spectral response and current voltage 4
 characteristics of a solar cell and derive the expression
 for conversion efficiency.
