(3 Hours) **[Total Marks:80]**

N. B.: 1) Question No. **1** is **compulsory.**
2) Attempt **any three** questions out of the remaining five questions.
3) Assume suitable data wherever necessary.

1. Answer the following (any four): 20
   a) Explain granular noise and slope overload error in delta modulation.
   b) Explain image frequency and double spotting in AM receivers.
   c) Compare wideband and narrowband FM.
   d) Determine the second, third and fifth harmonics for a 2kHz repetitive wave. Also find out the total harmonic distortion if the fundamental frequency amplitude is $10V_{rms}$, a second harmonic amplitude is $0.2\ V_{rms}$ s, and a third harmonic amplitude is $0.1\ V_{rms}$.
   e) A certain transmitter radiates 9kW with the carrier unmodulated, and 10.125kW when the carrier is sinusoidally modulated. Calculate the modulation index. If another sine wave, corresponding to 40% modulation, is transmitted simultaneously, determine the total power radiated.

2. a) With the help of a neat bock diagram explain the third method for SSB generation. 5
   b) For an AM signal $v(t)=500(1+0.4\sin(3140t))\sin(6.28\times10^5 t)$ volt find the upper sideband frequency, lower sideband frequency, bandwidth, and modulation index. Draw the frequency spectrum for the AM wave. 5
   c) With a neat block diagram explain the working of superheterodyne receiver. State its merits and demerits. 10

3. a) Explain noise triangle in FM. Hence explain pre-emphasis and de-emphasis. 10
   b) Explain the Armstrong method of FM generation giving proper block diagram and vector diagram. 10

4. a) Explain PAM, PWM and PPM generation with waveforms. 10
   b) Explain frequency division multiplexing with a neat block diagram. 10

5. a) Explain companding and state the laws for companding in PCM. 5
   b) Explain negative peak clipping and diagonal clipping in diode detectors. 5
   c) Explain Continuously Variable Slope Delta Modulation giving proper block diagram. 10

6. a) Explain natural sampling and flat top sampling. What is aliasing error? 10
   b) A 25MHz carrier is modulated by a 400Hz audio sine wave. If the carrier voltage is 4V and the maximum deviation is 10kHz, find the modulation index for FM and PM. If the modulating frequency is changed to 2kHz, calculate the new modulation index for FM and PM. 5
   c) Calculate the image rejection of a receiver having an RF amplifier and an IF of 450kHz, if the Qs of the relevant coils are 65, at an incoming frequency of i)1200 kHz and ii) 20MHz. Comment on the image frequency rejection at both frequencies. 5

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