(3hours) **Total Marks:80**

NB:1. Question number 1 is compulsory

2. attempt any 3 questions from the remaining five questions

3. Assume suitable data wherever needed

Q.1 **Answer any 4 questions**: **(20)**

  a) With a neat circuit diagram and waveforms, explain the working of envelope detector. What are its merits and demerits?

  b) Explain double spotting. How it can be overcome in AM receivers?

  c) Define the following terms with respect to Radio Receivers :

      Selectivity , Sensitivity , Fidelity , AGC

  d) A single tone FM signal is given by $e_{FM}(t) = 20 \cos(16\pi 10^6 t + 25 \sin 2\pi 10^3 t)$. Find the modulation index, modulating frequency, deviation, carrier frequency and power in the FM signal.

  e) What is Coherent detection? Explain the method of Coherent detection of SSB-SC signal.

Q.2 a) An AM signal is produced by modulating a carrier signal with peak voltage of 10V and **(6)** frequency of 100KHz by a sinusoidal signal of amplitude 4V and frequency 4 kHz . Determine:

    a) the modulation index and Write its mathematical expression

    b) Bandwidth of AM and sketch its two sided spectrum

    c) Total power of the modulated wave developed across load resistance,

      $R_L = 50\ \Omega$ and power content in each sideband and carrier.

  b) What are the methods employed for generation of SSB? Explain the third method of SSB **(8)** generation with its advantages and disadvantages.

  c) Prove that Balanced modulator circuit (diode based / BJT based) can generate a DSB- **(6)** SC signal.

Q.3 a) Explain the Armstrong method of FM generation. Compare WBFM signal with NBFM **(6)** signal.

  b) A modulating signal $15 \cos(2\pi\ 15\times10^3 t)$ angle modulates a carrier $A \cos \omega_c t$. find **(8)** the modulation index and the bandwidth for FM system.

  (i) Determine the change in the BW and modulation index for FM , if modulating

    signal freq is reduced to 5 KHz. Assume Kf = 15 KHz/V.

  (ii) find bandwidth and modulation index ,if amplitude is reduced to half.

c) Draw and explain the transmitter and receiver of Linear Delta modulation. What is meant **(6)**
by slope overload distortion? Explain How it can be eliminated?

Q.4 a) Explain how Foster- Seelay discriminator can be used for FM detection. List its merits **(6)**
and demerits.

b) Draw the functional block diagram of Super-heterodyne receiver with waveforms at the **(8)**
output of each block. Explain the functions of each block.

c) What is image frequency and its significance? A super-heterodyne Receiver is tuned to **(6)**
a signal of 1100 KHz frequency with the local oscillator frequency being 1555 KHz?
What is the image frequency? What will be the image Frequency rejection ratio   when
the tuned circuit of mixer stage has a loaded Q of 60?

Q.5a) With the help of a neat block diagram explain the generation and detection of a PWM **(10)**
signal. With relevant waveforms, explain how a PPM signal can be generated from a
PWM signal.

b)   State and Prove Sampling theorem for low pass signals. Draw the spectrum of sampled **(10)**
signal for fs > 2W , fs < 2W, fs = 2W. What is Aliasing error? How can you overcome
it?

Q.6   **Write short notes : any four**   **(20)**
a) Block diagram of PCM transmitter and receiver
b) T1 digital carrier system
c) Noise triangle and its significance
d) Block diagram of TRF receiver: its merits and demerits
e) Pre emphasis and de-emphasis circuits.

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