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**Fourth Semester B.E. Degree Examination, June/July 2024**  
**Communication Theory**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Derive the expression in time domain and frequency domain for an AM wave. Outline the waveform and spectrum. (08 Marks)
- b. With neat diagram, explain costas receiver. (06 Marks)
- c. With relevant block diagram, explain the working of FDM transmitter and receiver. (06 Marks)

**OR**

- 2 a. With relevant equations and diagrams, explain the generation of AM waves using switching modulator. (08 Marks)
- b. Explain in detail quadrature carrier multiplexing and demultiplexing system. (06 Marks)
- c. An audio frequency signal  $5 \sin 2\pi (1000)t$  is used to amplitude modulate a carrier of  $100 \sin 2\pi (10^6)t$ . Assume modulation index is 0.4. Find:
  - i) Sideband frequencies
  - ii) Amplitude of each sideband
  - iii) Bandwidth required
  - iv) Total power delivered to a load of  $100\Omega$ . (06 Marks)

**Module-2**

- 3 a. Define modulation index, frequency deviation and derive the time domain and frequency domain representation wideband FM with diagram. (08 Marks)
- b. With neat diagram, explain the FM demodulation using balanced slope detector/balanced frequency discriminator. (08 Marks)
- c. An FM signal has sinusoidal modulation with  $W = 15\text{kHz}$  and modulation index  $\beta = 2$ . Using Carson's rule determine the transmission bandwidth and deviation ratio. Assume  $\Delta f = 75\text{kHz}$ . (04 Marks)

**OR**

- 4 a. With relevant diagram, explain direct method generation of FM using Hartley oscillator and how frequency stability is achieved. (08 Marks)
- b. With block diagram, explain the linear model of PLL. (06 Marks)
- c. With the aid of neat diagram, explain FM stereo multiplexing. (06 Marks)

**Module-3**

- 5 a. Explain shot noise and thermal noise with relevant diagrams and expressions. (06 Marks)
- b. Derive the equation for the figure of merit of an AM receiver and show figure of merit  $= 1/3$  when operating on a single tone AM. (08 Marks)
- c. Explain about FM threshold effect and its reduction method. (06 Marks)

OR

- 6 a. With relevant diagrams and expressions explain noise equivalent bandwidth. (04 Marks)  
 b. Derive the equation for the figure-of-merit for DSB-SC receiver is one. (08 Marks)  
 c. Explain the pre-emphasis and de-emphasis with respect to FM system. (08 Marks)

**Module-4**

- 7 a. List the two operations involved in the generation of PAM and explain with neat waveform and derive the equations for flat-top sampled PAM. (10 Marks)  
 b. Explain the working principle and operation of Time Division Multiplexing (TDM) with neat diagram. (10 Marks)

OR

- 8 a. State sampling theorem for a strictly band limited signal and explain how the effects of aliasing is overcome. (06 Marks)  
 b. With neat diagram and equations explain the generation of PPM waves. (08 Marks)  
 c. What are the advantages of transmission of digital information over analog information? (06 Marks)

**Module-5**

- 9 a. Discuss briefly quantization noise and show the output signal-to-noise ratio of a uniform quantizer is  $(\text{SNR})_0 = \left[ \frac{3P}{m_{\max}^2} \right] 2^{2R}$ . (08 Marks)  
 b. What is delta modulation? With neat block diagram, explain the construction of delta modulation. (06 Marks)  
 c. Explain  $\mu$ -law and A-law of compression. (06 Marks)

OR

- 10 a. Define quantization. Explain how the quantization process takes place. Illustrate the input output characteristics of a quantizer in terms of mid-tread and mid-rise. (08 Marks)  
 b. With neat block diagram, explain the generation and reconstruction of PCM signals. (08 Marks)  
 c. Write a short note on Vocoder. (04 Marks)

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