	Utech
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# **COMMUNICATION ENGINEERING**

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

#### GROUP - A

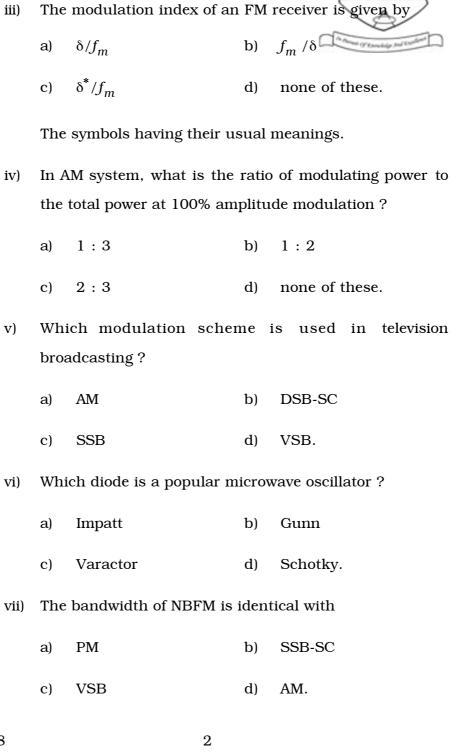
# ( Multiple Choice Type Questions )

1. Choose the correct alternatives for any ten of the following:

 $10 \times 1 = 10$ 

- i) PCM is preferred to PAM because of the
  - a) Resistance to quantizing error
  - b) Simplicity
  - c) Lower cost
  - d) Superior noise immunity.
- ii) A superheterodyne receiver with an IF of 450 kHz is tuned to a signal at 1600 kHz. The image frequency is
  - a) 1150 kHz
- b) 900 kHz
- c) 2050 kHz
- d) 2500 kHz.

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viii) In a communication system, noise is most likely to affect the signal

- a) in the channel
- b) at the transmitter
- c) in the information source
- d) at the destination.
- ix) Which of the following pulse modulation systems is analog?
  - a) PWM

b) DPCM

c) PCM

- d) DELTA.
- x) AM is the process of
  - a) superimposing a low frequency on a high frequency
  - b) carrier interruption
  - c) superimposing a high frequency on a low frequency
  - d) frequency shift & phase shift.

- xi) The envelope detector is
  - a) synchronous detector
  - b) band-pass filter
  - c) asynchronous detector
  - d) balanced modulator.
- xii) Average information of entropy is maximum when all the message are
  - a) equiprobable
- b) not equiprobable
- c) (a) or (b) is possible
- d) none of these.

#### **GROUP - B**

### (Short Answer Type Questions)

Answer any *three* of the following.

 $3 \times 5 = 15$ 

- 2. a) Prove that the total power required to transmit an amplitude modulated wave is P  $_1\,$  = P  $_C\,$  ( 1 + m  $^2/2$  ) .
  - b) Show that for single tone AM,  $\eta_{\text{max}}$  is 33% for m=1 where symbols have their usual meanings. 3+2
- 3. A modulating signal m ( t ) is applied to a DSB-SC carrier system modulator operating at  $f_c$  = 50 kHz. Determine and sketch the modulated signal if
  - a)  $m(t) = 2 \cos(4000 \pi t) + 5 \cos(6000 \pi t)$
  - b) M ( f ) = { [ 1 + cos ( ( $\pi f$  )/1000 )]/2} for |f| < 1000 and 0 elsewhee.

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4. A binary data sequence is 0110110001

Plot the data sequence in Unipolar NRZ, Bipolar NRZ, Unipolar RZ-Bipolar RZ, Manchester signalling formats.

 Show that the maximum output signal-to-quantization noise ratio in a Delta modulated system under the assumption of no slope overload is given by

(SNR)  $_{\rm o}$  = (S/N  $_{q}$ )  $_{\rm o}$  =  $3f_{\rm s}^{3}$ /( $8\pi^{2}f_{m}^{2}f_{M}$ ) where  $f_{\rm s}$  is sampling frequency and  $f_{M}$  is the cut-off frequency of a low-pass filter at the output end of the receiver.

- 6. Define the following terms in AM receiver:
  - i) Sensitivity
  - ii) Selectivity
  - iii) Image frequency.

# **GROUP - C**

### (Long Answer Type Questions)

Answer any *three* of the following.  $3 \times 15 = 45$ 

- 7. a) Explain the working principle of a BPSK system ( both transmitter and receiver ).
  - b) Explain the operation of delta modulator and demodulator.
  - c) What is the advantage of QPSK over BPSK?

- 8. a) What is noise figure? What is its significance?
  - b) Calculate  $\frac{S}{N}$  ratio in SSB-SC scheme.
  - c) Explain the operation of PCM transmitter and receiver. 6
- 9. a) What is thermal noise and how are the RMS value of the noise voltage and current expressed? 2 + 3
  - b) Two resistors of 30 k.ohm and 50 k.ohm are at room temperature of 30°C. For a BW of 2 MHz, determine the thermal noise voltage of
    - i) each resistor
    - ii) two resistors in series
    - iii) two resistors in parallel.

c) Derive an expression for maximum channel capacity of a communication channel in the presence of Gaussian noise.

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A Gaussian channel has a BW of 100 kHz. If the signal power to noise power spectral density (  $\rm S/N$  ) is 10  $^6$  Hz, find the channel capacity. 3 + 3

- 10. a) Explain SSB generation and demodulation with block diagram.
  - b) Explain the generation of narrow band frequency modulation system. Compare between AM & FM systems relative to bandwidth requirement, power requirement and performance of noise. (4 + 4) + 3 + 4

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11. Write short notes on any three of the following.

- a) Vestigial Sideband modulation (VSB)
- b) Comparative study among AM, DSB-SC and SSB-SC
- c) Pre-emphasis and De-emphasis in FM
- d) Balanced Modulator
- e) PLL
- f) Block code.

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