



WEST BENGAL UNIVERSITY OF TECHNOLOGY

CS-401

COMMUNICATION ENGINEERING AND CODING THEORY

Time Allotted: 3 Hours

Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

- I. Answer any ten questions. 10 x 1 = 10
(i) With AM which of the following conveys no information?
(A) lower sideband (B) upper sideband
(C) carrier (D) both sidebands
(ii) PAM is a _____ modulation
(A) analog (B) digital
(C) analog pulse (D) digital pulse
(iii) Double-sideband suppressed carrier signals are generated by a circuit called a
(A) balanced demodulator (B) balanced modulator
(C) beat frequency oscillator (D) notch filter
(iv) What is the low-level carrier called that is sometimes transmitted along with the two sidebands in DSB?
(A) pilot carrier (B) suppressed carrier
(C) composite carrier (D) sideband carrier

- (v) By using a high frequency carrier we _____ the size of antenna.
(A) reduce (B) increase (C) maximize (D) change
(vi) The maximum value of modulation index for AM
(A) 1 (B) >1 (C) <1 (D) 0
(vii) The single tone amplitude modulated signal has _____ frequency component
(A) 1 (B) 2 (C) 3 (D) 4
(viii) Quantization noise occurs in
(A) TDM (B) PCM (C) AM (D) PWM
(ix) Number of bits in QPSK symbol is
(A) 1 (B) 2 (C) 3 (D) 4
(x) Foster-Seeley detector is for detecting
(A) AM (B) FM (C) PCM (D) PM
(xi) Which of the following method is employed in telephony
(A) TDM (B) FDM
(C) FM (D) both (A) and (B)

GROUP B
(Short Answer Type Questions)

- Answer any three questions.
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2. (a) What is baseband communication? Show that maximum value of transmission efficiency is 33.33%.
(b) Why FM and PM waves are called inseparable?
3. State Sampling theorem? What is Aliasing?
4. (a) What is advantage of digital modulated over analog modulation?
(b) What is the need of modulation?

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5. (a) A 400 watt carrier is modulated to a depth of 75 percent. Find the total power in AM wave. Assume the modulating signal to be the sinusoidal one. 3+2
 (b) Define Carson's rule for bandwidth requirement in FM.
6. (a) What is companding? 2+1+2
 (b) What is Entropy? If the receiver knows the message being transmitted the amount of information carried will be zero – Justify your answer.

GROUP C
(Long Answer Type Questions)

Answer any three questions. 3×15 = 45

7. (a) Draw the transistorized Balanced Modulator to generate Double Side-Band Suppressed Carrier (DSB-SC) and explain with its expressions. 6+4+(3+2)
 (b) Show that $P_t = P_c \left(1 + \frac{m^2}{2}\right)$, where P_t = total power in AM, P_c = carrier power, m = modulation index.
 (c) The efficiency η of ordinary AM is defined as the percentage of the power carried by the sidebands, that is,

$$\eta = \frac{P_s}{P_t} \times 100\%$$
 Where, P_s is the power carried by sidebands and P_t is the power of AM signal.
 (i) Find η for $m = 0.5$ (50 percent modulation).
 (ii) Show that for a single-tone AM, η_{max} is 33.3 percent at $m = 1$.
8. (a) What is super-heterodyne principle? 2+7+5+1
 (b) Draw the block diagram of a super-heterodyne receiver and explain the function of each block.
 (c) Compare PAM, PWM and PPM signals.
 (d) What is VSB modulation?
9. (a) Draw and explain the transmitter and receiver model of pulse code modulation (PCM). 2+2
 (b) What is quantization noise in PCM and how it can be reduced? 2+1

- (c) A single-tone FM wave is represented by the voltage equation as: 1+1+1+1
 $e_{mod} = 10 \cos(8 \times 10^5 t) + 6 \sin(3 \times 10^4 t)$ Determine the following:
 (i) modulating frequency,
 (ii) carrier frequency,
 (iii) the modulation index,
 (iv) frequency deviation,
 (v) Power dissipated in 8Ω load.
- (d) Encode the sequence 10110100 in the following form: 1+1+1
 (i) Unipolar NRZ
 (ii) Polar RZ
 (iii) Bipolar NRZ.

- 10.(a) Determine the set of codewords for the (6,3) code with generator matrix 5+5+5

$$G = \begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

- (b) What do you mean by Delta Modulation (DM)?
 (c) Explain Adaptive Delta Modulation (ADM) with proper waveform.

11. Write short notes on any three of the following: 3×5
 (a) Varactor diode modulator
 (b) Carson's rule
 (c) TDM
 (d) Foster Seeley Detector
 (e) Frequency Shift Keying (FSK).