

2025

PHYSICS — HONOURS

Paper : DSE-B-2.1

(Communication Electronics)

Full Marks : 65

*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

1. Answer *any five* questions :

2×5

- (a) What are the different types of Angle Modulation? Name them.
- (b) What do you mean by Pulse Code Modulation (PCM)?
- (c) What is the BW of an AM wave?
- (d) What is Manchester format of coding? What is its main advantage?
- (e) Find the Nyquist rate for the signal $x(t) = 25 \cos(500\pi t)$.
- (f) What is GPS navigation system?
- (g) How many bits can be transmitted at a time in 8-PSK transmission? Give reason for your answer.

Group - B

2. Answer *any three* questions :

- (a) (i) Prove that for amplitude modulated signal

$$\frac{P_{SB}}{P_t} = \frac{1}{\left(1 + \frac{m_a^2}{2}\right)},$$

where P_{SB} = Two side band power P_t = Total power of AM wave m_a = modulation index.

- (ii) Draw a neat circuit diagram of an emitter modulator circuit to generate AM wave. 3+2
- (b) (i) How is digital modulation different from analog modulation?
- (ii) What is aliasing? What can be done to reduce aliasing? 2+(2+1)

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- (c) (i) What are the advantages of FM over AM?
 (ii) A carrier voltage of frequency 100 MHz is frequency modulated by an audio signal of maximum frequency 15 kHz producing a maximum frequency deviation of 75 kHz. Find the transmission bandwidth and the frequencies of the first three significant pair of sidebands. 2+3
- (d) (i) What is quantization in pulse modulation?
 (ii) Draw the output characteristics of A-law in companding. 1+2+2
 (iii) What is delta modulation?
- (e) (i) Describe briefly an earth station with the help of a neat block diagram. 3+2
 (ii) What is the difference between SIM and IEMI number?

Group - C

Answer *any four* questions.

3. (a) State and explain sampling theorem in pulse modulation. For any message signal represented by a sine wave draw the PAM, PWM and PPM waveforms.
 (b) Draw a neat circuit diagram to generate PAM signal and explain its operation. (2+3)+(3+2)
4. (a) State Shannon's Sampling theorem.
 (b) What are the differences between geosynchronous and geostationary orbits?
 (c) Draw the block diagram of transponder and explain its functions. 2+3+(2+3)
5. (a) What do you mean by the term modulation index for A.M.?
 (b) With a neat circuit or block diagram, describe any one method of generation of A.M. waves.
 (c) Derive the following expression of modulation index :

$$m = \frac{E_{\max} - E_{\min}}{E_{\max} + E_{\min}}$$
, where E stands for the amplitude of the modulated wave. 2+4+4
6. (a) Explain the concept of cell splitting and cell-sectoring in mobile communication.
 (b) Compare the multiple access techniques, TDMA and CDMA.
 (c) How 5G technology differs from 4G technology? (2½+2½)+3+2
7. (a) What is 'Square law Detector' using diode in A.M. demodulation? Explain it with a block diagram.
 (b) What is 'Intermediate Frequency' (IF)? With a schematic block diagram of the different stages, briefly describe the working of a superheterodyne receiver. 3+(2+5)
8. (a) Why multiplexing is needed in communication? Compare between the different multiplexing techniques used in communication.
 (b) What do you understand by line-coding? Why it is required for digital transmission?
 (c) Explain unipolar and polar line-coding with a suitable diagram. (2+2)+(2+2)+2