

**B.Sc. 5th Semester (Honours) Examination, 2023 (CBCS)**

**Subject : Physics**

**Course : DSE-2**

**(Communication Systems)**

**Time: 2 Hours**

**Full Marks: 40**

*The figures in the margin indicate full marks.*

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

1. Answer *any five* of the following questions:

2×5=10

- (a) Why is FM more immune to noise?
- (b) What is carrier swing? How is it related with frequency deviation?
- (c) Define selectivity and sensitivity for a receiver.
- (d) What is Shannon limit for information capacity?
- (e) When a broadcast AM transmitter is 50 per cent modulated, its antenna current is 12 A. What will be the current when the modulation depth is increased to 0.9?
- (f) In satellite communication, generally frequency for uplink is kept higher than the downlink. — Why?
- (g) What is the ideal bandwidth of an FM wave?
- (h) An amplifier operating on a frequency range from 18 MHz to 20 MHz has a 10 k $\Omega$  input resistance. Find the rms noise voltage at the input to this amplifier if the ambient temperature is 27°C.

2. Answer *any two* of the following questions:

5×2=10

- (a) What are the main methods of Radio Transmission? What are the features of GSM? What are the performance criteria for cellular phones? 2+2+1
- (b) What do you mean by the terms angle of elevation and azimuthal angle? Mention the advantages and disadvantages of satellite communication. Estimate the velocity of a geosynchronous satellite. 1+2+2

- (c) A given AM broadcast station transmits a total power of 50kW when the carrier is modulated by a sinusoidal signal with a modulation index of 0.707. Calculate the carrier power, the transmission efficiency and the peak amplitude of the carrier assuming the antenna to be represented by a  $50\Omega$  load. 2+2+1
- (d) How can a slope detector be employed to detect FM waves? What is its disadvantage? 4+1
3. Answer *any two* of the following questions: 10×2=20
- (a) What do you mean by angle modulation? An angle modulated signal is described by  $S_c(t) = 10 \cos[2\pi(10^6)t + 0.1 \sin(10^3)t]$ .
- (i) Considering  $S_c(t)$  as a PM signal with  $k_p = 10$ , obtain message signal  $m(t)$ .
- (ii) Considering  $S_c(t)$  as a FM signal with  $k_f = 10\pi$ , obtain  $m(t)$ .
- (iii) Determine the maximum phase deviation and maximum frequency deviation of the  $S_c(t)$ . 2+2+3+3
- (b) What is the need of sampling? Define Nyquist sampling theorem. Compare various Pulse Analog Modulation methods (PAM, PWM and PPM). 2+2+6
- (c) What is binary phase shift keying? FSK and PSK signals preferred over ASK signals. — Why? Sketch the digitally modulated waveforms for the binary data 110101 using ASK and FSK. What are the advantages of digital modulation over analog modulation? 2+2+(2+2)+2
- (d) Describe in brief, the principle of operation of cellular mobile system from a customer's perception. 10