

**2021**

**PHYSICS — HONOURS**

**Paper : DSE-B2(a)**

**(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 is amplitude modulation? Write down the expression of an AM wave.
- (b) Calculate the power developed by an AM wave across a load of 100 Ω when the peak voltage of the carrier is 100 Volts and modulation index is 0.4.
- (c) What is the need for modulation in case of communication?
- (d) Find the Nyquist rate and Nyquist interval for the continuous time signal given below.  
$$x(t) = \cos(4000 \pi t) \cos(1000 \pi t)$$
- (e) An amplifier has an input of 3 mV and output of 5V. What is the gain of the amplifier in dB?
- (f) Find the bandwidth of 8-PSK.
- (g) What is SIM and IMEI no. in mobile communication?

**Group - B**

Answer **any three** questions.

- 2. A 1 MHz carrier wave is amplitude modulated by audio signals between 400 Hz to 1600 Hz. Find (i) the frequency span of each side band, (ii) the maximum upper side band frequency, (iii) the maximum lower side band frequency and (iv) the channel width. 1+1+1+2
- 3. (a) Show that the total power for a fully amplitude modulated wave is 1.5 times the unmodulated carrier power. 2+3  
(b) Write down differences between amplitude modulation (AM) and frequency modulation (FM). 2+3
- 4. Describe sampling theorem. What is quantization error? Differentiate between impulse, natural and flat-top sampling. 1+1+3

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5. How can non-uniform quantization be used to increase SNR? Draw the constellation diagram for Q-PSK. 2+3
6. What is path loss of satellite communication system? How is the path loss related to the gain and power of the transmitting and receiving antenna? 2+3

### Group - C

Answer *any four* questions.

7. (a) What is frequency modulation? Show that the maximum deviation from the carrier frequency is independent of modulating frequency.
- (b) A frequency modulated wave is represented by
- $$v_{FM} = V_c \cos(\omega_c t + m_f \sin \omega_m t)$$
- where the symbols have their usual meaning. Show that if the modulation index  $m_f \ll 1$ , then the bandwidth of the FM is approximately  $2 \omega_m$ .
- (c) What is thermal noise? Calculate the thermal noise voltage developed across a resistor of  $700 \Omega$ . The bandwidth (B.W.) of measuring instrument is  $7 \text{ MHz}$  and the ambient temperature is  $27^\circ\text{C}$ . (Given Boltzmann constant  $k = 1.38 \times 10^{-23} \text{ J/K}$ ) (1+2)+3+(1+3)
8. (a) What is meant by the terms modulation efficiency and percentage modulation in AM?
- (b) Determine the modulation index and the percentage of total power carried out by the side bands of the AM wave for the modulation, when the modulation index is  $0.5$ . 5+5
9. (a) Describe FDM and TDM.
- (b) What is aliasing? What can be done to reduce aliasing?
- (c) What type of filter is used in TDM receiver? (2½+2½)+(2+2)+1
10. (a) Describe the basic principles of satellite communication.
- (b) What are the differences among 2G, 3G and 4G technologies in mobile communication system?
- (c) What is geostationary satellite? State the advantages of it. 4+3+(2+1)
11. (a) What is ASK? Explain the function of FSK graphically when the digital input message signal is 011001.
- (b) What are the possible levels for BPSK and QPSK?
- (c) Describe A-Law for companding. Define unipolar and bipolar RZ and NRZ. (2+3)+2+(1+2)
12. (a) What do you mean by transponder in satellite communication? What are their basic components?
- (b) Draw the block diagram of Earth station.
- (c) Write down the three basic segments in GPS. What is the basic performance of Master Control System (MCS) in GPS? (2+2)+3+(1+2)
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