

**B.Sc. 6<sup>th</sup> Semester (Honours) Examinations, 2020****PHYSICS****(Communication Electronics)****Paper: 604/DSE-4/T-8****Course ID: 62417****Time: 1 Hour****Full Marks: 12**

*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 two* questions of the following: 1×2=2
  - (a) In which case, noise is most likely to affect the signal - Transmitter, Channel & Receiver?
  - (b) Most receivers conform to the super-heterodyne group -- Justify.
  - (c) If the modulation index of an AM wave is changed from 0 to 1, the transmitted power will be increased by  $x\%$ . Find the value of  $x$ .
  - (d) A carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4. Find the effective modulation index.
  - (e) Calculate the Power-SNR (dB) for a noise level of  $1\mu\text{V}$  in a signal of  $200\text{mV}$ .
  - (f) Mention the frequency bands used in mobile communication.
  
2. Answer *any one* of the following: 4×1=4
  - (a) What do you mean by modulation efficiency in AM? Find out modulation efficiency of a 70.7 % AM-modulated wave. Provide a block diagram. 1+2+1=4
  - (b) The equation of a carrier signal is given by  $e_c = E_C \sin(\omega_c t + \phi)$  and that of the modulating signal  $e_m = E_m \cos \omega_m t$ . Derive an equation for the modulated signal and modulation index for amplitude modulation. What do you mean by upper and lower side frequency? 3+1=4
  - (c) What do you mean by numerical aperture? Find an expression for numerical aperture of a step-index fibre. Discuss the advantage of graded-index fibre over step-index fibre. 1+2+1=4
  
3. Answer *any one* of the following: 6×1=6
  - (a) Provide a block diagram of a radio telephone transmitting system and mention the significance of each stage. Discuss the working of a superheterodyne receiver with proper block diagram. 3+3=6

**Please Turn Over**

- (b) A carrier of  $10\cos(2\pi \times 10^6 t)$  volt is amplitude modulated by a message signal of  $4\cos(4\pi \times 10^3 t)$  volt with 50% of modulation. Antenna resistance is 5 ohm.

Find/Identify/Determine the following:

- |   |   |
|---|---|
| i. Band Width,                              | 1 |
| ii. Modulation index,                       | 1 |
| iii. Power carried by carrier,              | 1 |
| iv. Total power contained in side bands,    | 1 |
| v. Power contained in upper side band,      | 1 |
| vi. Total power transmitted by the Antenna, | 1 |

- (c) Mention the name of a few types of communication satellites. What is a transponder in a satellite and why it is used? What is the difference between geo-synchronous and geo-stationary orbits? What are uplink and downlink frequencies? Give with proper labelling the block diagram of an earth station.

$$1+2+1+1+1=6$$

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