B. Sc. Part-III (Honours) Examination, 2021

Subject: Electronics

Paper: VII

Time: 2 Hours Full Marks: 50

*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 *four* questions of the following: 5×4=20
   (a) Draw a labelled diagram of satellite communication system. What are the functions of transponder?
   (b) Define ASK, PSK and FSK in Digital modulation techniques. Compare their relative merits and demerits.
   (c) What is microwave repeater? Find out the maximum distance between two microwave repeaters each of height 30 meters. Neglect the effect of atmospheric refraction and take the radius of the earth as 6400 km.
   (d) What is effective length of an antenna? If the current distribution in a $\lambda/2$ dipole antenna is $I=I_0\cos(\beta l)$, where $I_0$ is the peak current fed at $l = 0$ and $\beta = 2\pi/\lambda$, find the effective length of the antenna.
   (e) Broader wall dimension of a rectangular waveguide is 2.286 cm. Calculate the critical wavelength of the waveguide. Also calculate the guided wavelength of the EM wave of frequency 10 GHz in $TE_{10}$ mode.
   (f) What is SNR of an amplifier? The input SNR of an amplifier is 20 dB and the value of NF is 6 dB. Find the value of output SNR.

2. Answer any *three* questions of the following 10×3=30

   (a) Explain the working principle of an FM transmitter with proper diagram. Compare the performances of AM and FM transmitters.
   (b) Draw a labelled block diagram of a Super-heterodyne AM radio receiver. Why is it called Super-heterodyne? What are its merits?
   (c) Define the term input of a transmission line. Find its relation with reflection coefficients of the line. Derive the conditions of distortion-less propagation through a practical transmission line.
   (d) Define E-wave and H-wave in the context of a waveguide. Obtain expressions for cut-off frequency and characteristic wave impedance of an air-filled rectangular waveguide in TE mode.
   (e) Show that the phase-velocity of a plane EM wave propagating in an ionized medium is greater than the phase-velocity of EM wave propagating in free-space. Define the terms: i) critical frequency and ii) maximum usable frequency.