



Seat No. _____

HE-003-1204007

M. Sc. (Sem. IV) (CBCS) Examination

April - 2023

ET-11 : Physics

(Electronic Communications)

Faculty Code : 003

Subject Code : 1204007

Time : $2\frac{1}{2}$ Hours / Total Marks : 70

- Instructions :** (1) All questions Q.1 to Q.5 are compulsory.
(2) Numbers in the right margin indicate marks.

1 Answer any seven :

14

- (a) List the three basic modes whereby an electromagnetic wave propagates from a transmitting antenna to receiving antenna.
- (b) Give satellite heights for low earth orbit, medium earth orbit and geo-stationary orbit.
- (c) What will be the radio horizon of a transmitting antenna of height 100 meters ?
- (d) What are the different techniques for pulse modulation ?
- (e) For ionospheric radio wave communication link determine maximum usable frequency for a critical frequency of 20 MHz and an angle of incidence of transmitting ray is 35° .
- (f) What are the types of phase shift keying in digital modulation? Explain each in brief.
- (g) Draw block diagram of optical fiber communication link.
- (h) What is the dominant mode in rectangular waveguide ?
- (i) List the four primary constants of transmission line
- (j) Define characteristic impedance of transmission line.

- 2 Answer any **two** :
- (a) Derive expression for transmission path loss for propagation of electromagnetic wave in free space. For a carrier frequency of 6 GHz and a distance of 50 km, determine free space path loss. 7
- (b) Explain ionospheric HF radio wave propagation hence explain the terms: Plasma and critical frequencies, virtual height, skip distance, service range and secant law. 7
- (c) Explain the geometry with necessary diagrams of space wave line of sight (LOS) radio wave propagation. What is the relation between radio horizon and optical horizon ? Determine height of receiving antenna to obtain a maximum transmission distance of 48.7 km from transmitting antenna of 40 meter height. 7

3 Answer the following :

- (a) Draw the internal layout of a communication satellite and explain function of each section in detail including uplink & down link models and transponder. 7
- (b) What are the satellite orbital patterns ? Write a note on geo-stationary Satellite. 7

OR

3 Answer the following :

- (a) What is quadrature amplitude modulation (QAM) ? Write a note on QAM. 7
- (b) Write a detailed note on pulse code modulation (PCM). 7

4 Answer any **two** :

- (a) Derive expressions for input impedance of short and open circuited transmission lines, Z_{sc} and Z_{oc} , respectively, and show that $Z_0 = \sqrt{Z_{sc} \times Z_{oc}}$. 7

- (b) Show that how a TE₁₀ wave can be formed by superposition of two TEM waves. Prove the relation: 7

$1/\lambda_g^2 = 1/\lambda^2 = 1/2 a^2$ for a rectangular wave guide. where 'a' is broader dimension of rectangular waveguide.

- (c) What is Snell's law ? Explain the physics of light propagation in optical fibers hence define critical angle, acceptance angle and numerical aperture. What are the light sources and detectors used in optical fiber communication. 7

5 Answer any **two** : **14**

- (a) Write a note on Frequency shift keying (FSK).
- (b) Write a note on Ground wave propagation.
- (c) Write a note on transmission line with any termination.
- (d) Write a note on tropospheric scatter and duct propagation as space wave radio communication.
