M.Sc. PHYSICS
FOURTH SEMESTER
ELECTRONICS & COMMUNICATION TECHNOLOGY-II
MSP - 403B

(Use Separate Answer Scripts for Objective & Descriptive)

Duration: 3 hrs. **Full Marks: 70**

(PART-A: Objective)

Time: 20 min. **Marks: 20**

Choose the correct answer from the following: ***1X20=20***

1. The length of a short monopole antenna element is
   a. $\lambda/2$ b. Less than $\lambda/8$
   c. $\lambda/4$ d. Less than $\lambda/2$

2. The induction and radiation fields are equal at a distance of _____
   a. $\lambda/4$ b. $\lambda/8$
   c. $\lambda/2$ d. $\lambda/6$

3. The ratio of radiation intensity in a given direction from antenna to the radiation intensity over all directions is called as _____
   a. Directivity b. Radiation power density
   c. Gain of antenna d. Array factor

4. Which of the following field varies inversely with r^2?
   a. Far Field b. Electrostatic Field
   c. Near Field d. Radiation Field

5. The radiation lobe containing the direction of maximum radiation is called as
   a. Back lobe b. Side lobe
   c. Minor lobe d. Major lobe

6. An ideal source in which the power is radiated equally in all directions is called as _____ radiator
   a. Isotropic b. Omni-directional
   c. Directional d. Transducer

7. One of the following microwave tubes is based on the principal of velocity modulation
   a. Disk seal tube b. Acron tube
   c. Klystron d. Magnetron

8. Electron bunching in a 2-cavity klystron occurs in
   a. Buncher cavity b. Catcher cavity
   c. Free drift-space between the two cavities d. None of these

9. Repeller electrode is associated with one of the following microwave tube
   a. Multicavity klystron b. Gyrotron
   c. Crossed field amplifier d. Reflex klystron

10. The major advantage of TWT over a klystron lies in its
    a. higher bandwidth
    b. higher gain
    c. higher frequency
    d. higher output

11. The kinetic energy of the beam remains unchanged in the interaction between an electron beam and an RF wave is
    a. multicavity klystron
    b. TWTA
    c. cross field amplifier
    d. reflex-klystron

12. For a given bandwidth of the receiver in a radar system, high discrimination between targets isachieved, when the
    a. PRF is high
    b. receiver sensitivity is high
    c. pulse width is increased
    d. diameter of the antenna aperture is increased

13. The maximum unambiguous range is a system depends on
    a. maximum power of the transmitter
    b. pulse repetition frequency
    c. width of the transmitted pulse
    d. sensitivity of the radar receiver

14. In radar system, pulse repetition frequency is used to resolve range and doppler ambiguities using
    a. CW radar
    b. pulsed radar
    c. moving target indicator
    d. pulse-doppler radar

15. One of the following radar systems has both a higher detection capability as well as a higher range resolution
    a. MTI
    b. Tracking radar
    c. Pulse doppler radar
    d. Pulse compression radar

16. The maximum PRF that can be used for a maximum unambiguous range is given by
    a. $c/2R_{max}$
    b. c/R_{max}
    c. $2c/R_{max}$
    d. $R_{max}/2c$

17. Doppler effect is not used in
    a. FM radar
    b. MTI radar
    c. CW radar
    d. moving target plotting on the PPI

18. The absorption of photons in a photodiode is dependent on
    a. Absorption coefficient
    b. Properties of the material
    c. Charge carrier at junction
    d. Amount of light

19. Multimode step index fiber has _____
    a. Large core diameter and small numerical aperture
    b. Small core diameter and large numerical aperture
    c. Large core diameter & large numerical aperture
    d. Small core diameter & small numerical aperture

20. What is the principle of fibre optical communication?
    a. Frequency modulation
    b. Population inversion
    c. Total internal reflection
    d. Doppler effect

-- --- --

PART-B : Descriptive

Time : 2 hrs. 40 min. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. Derive the expression of magnetic vector potential for a half wave dipole and a quarter wave monopole antenna. **10**

2. a. State and explain the two basics antenna parameters. **4+6=10**

   b. Derive the expression for Friis transmission formula for radio communication link.

3. a. Define velocity modulation. Explain the methods of producing velocity modulation of electrons. **3+7=10**

   b. Draw the sketch of a two-cavity Klystron amplifier and explain the working principle using Applegate diagram

4. Explain the mathematical analysis of a reflex klystron and established the relation between accelerating voltage and repeller voltage. **10**

5. a. What is the basic principle of operation of radar? **1+5+4 =10**

   b. Draw the block diagram of a basic radar system and explain different parts.

   c. A radar operating at 10 GHz has a maximum range of 50 km with an antenna gain of 4000. If the transmitter has a power of 250 kW and minimum detectable signal is 10^{-11} W. Calculate the cross section of the target the radar can sight.

6. a. Explain the various factors affecting the performance of a radar. **8+2=10**

   b. Use the radar range to determine the required transmitted power for the TRACS radar. Give that: $S_{min}=10^{-13}$ W, G=2000, λ=0.23 m, PRF=524 Hz, σ=2.0 m^2.

7. a. Write down different possible mechanisms by which photon interacts with semiconductor. 3+7=10

b. Derive the expression for the total steady state diode photo current density of a photo diode.

8. a. With the help of e neat and labelled energy band diagram, explain the working of a heterostructure high intensity LED. 6+4=10

b. Explain the different types of loses in optical fibre.

= = *** = =