

M.SC. PHYSICS
FOURTH SEMESTER
ELECTRONICS & COMMUNICATION TECHNOLOGY-II
MSP - 402B [SPECIAL REPEAT]
[USE OMR FOR OBJECTIVE PART]

SET
A

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

(Objective)

Marks: 20

Choose the correct answer from the following:

1X20=20

- The length of a short monopole antenna element is
 - $\lambda/2$
 - Less than $\lambda/8$
 - $\lambda/4$
 - Less than $\lambda/2$
- The induction and radiation fields are equal at a distance of _____
 - $\lambda/4$
 - $\lambda/8$
 - $\lambda/2$
 - $\lambda/6$
- The ratio of radiation intensity in a given direction from antenna to the radiation intensity over all directions is called as _____
 - Directivity
 - Radiation power density
 - Gain of antenna
 - Array factor
- Which of the following field varies inversely with r^2 ?
 - Far Field
 - Electrostatic Field
 - Near Field
 - Radiation Field
- The radiation lobe containing the direction of maximum radiation is called as
 - Back lobe
 - Side lobe
 - Minor lobe
 - Major lobe
- An ideal source in which the power is radiated equally in all directions is called as _____ radiator
 - Isotropic
 - Omni-directional
 - Directional
 - Transducer
- One of the following microwave tubes is based on the principal of velocity modulation
 - Disk seal tube
 - Acron tube
 - Klystron
 - Magnetron
- Electron bunching in a 2-cavity klystron occurs in
 - Buncher cavity
 - Catcher cavity
 - Free drift-space between the two cavities
 - None of these
- Repeller electrode is associated with one of the following microwave tube
 - Multicavity klystron
 - Gyrotron
 - Crossed field amplifier
 - 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 is achieved, 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 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

(Descriptive)

Time : 2 hrs. 30 mins.

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 basic 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
b. Draw the block diagram of a basic radar system and explain different parts. =10
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, $G=2000$, $\lambda=0.23$ m, $PRF=524$ Hz, $\sigma=2.0$ m².

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 a neat and labelled energy band diagram, explain the working of a heterostructure high intensity LED. 6+4=10
b. Explain the different types of losses in optical fibre.

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