Course: B.Tech.	*Semester: VII*	*Time: 03 Hours*
Code: 100704	*Subject: ELECTROMAGNETIC WAVES*	*Full Marks: 70*

Instructions:-
(i)   The marks are indicated in the right-hand margin.
(ii) There are **NINE** questions in this paper.
(iii) Attempt **FIVE** questions in all.
(iv) Question No. **1** is compulsory

Q.1 Choose the correct answer of the following (any seven):   [2 x 7 = 14]

(a) The non existence of the magnetic monopole is due to which operation?
   I.   Gradient
   II.   Divergence
   III. Curl
   IV.   Laplacian

(b) The charge density of a electrostatic field is given by
   I.   Curl of E
   II.   Divergence of E
   III. Curl of D
   IV.   Divergence of D

(c) The Brewster angle is valid for which type of polarisation?
   I.   S polarised
   II.   P polarised
   III. Elliptical
   IV.   Linear

(d) In conductors, which condition will be true?
   I. $\sigma/\omega\varepsilon > 1$
   II. $\sigma\omega\varepsilon > 1$
   III. $\sigma/\omega\varepsilon < 1$
   IV. $\sigma\omega\varepsilon < 1$

(e) Power density is basically termed as --------------- power per unit area.
   I.   Reflected
   II.   Refracted
   III. Radiated
   IV.   Diffracted

(f) Most of the radar antennas use ------------.
   I.   Dipole
   II.   Collinear array
   III. Broadside array
   IV.   Horn and parabolic reflector

(g) In an electrical circuit, which nature of impedance causes the current and voltages in phase?
   I.   Reactive
   II.   Resistive
   III. Capacitive
   IV.   Inductive

(h) Magnetic field can be produced by _____.
   I.   Conduction current
   II.   Displacement current
   III. Both conduction and displacement current
   IV.   None of the above

(i) The ratio of radiation intensity in a given direction from antenna to the radiation intensity over all directions is called as _____
  I. Directivity
  II. Radiation power density
  III. Gain of antenna
  IV. Array Factor

(j) The phenomenon employed in the waveguide operation is
  I. Reflection
  II. Refraction
  III. Total internal reflection
  IV. Adsorption

Q.2 (a) Explain all the forms of Maxwell's equation in time varying conditions with its physical significance. [7]

(b) Consider the reflection phenomenon of plane wave through a medium having permittivity ε_1 and permeability μ_1 is incident normally to the surface of perfect dielectric medium with permittivity ε_2 and permeability μ_2. Derive the expression of reflection and transmission coefficients for electric and magnetic field. [7]

Q.3 (a) A transmission line of characteristic impedance 50 Ω is terminated in a load impedance Z_L. The VSWR of the line is measured as 5 and the first of the voltage maxima in the line is observed at a distance of $\lambda / 4$ from the load. What is the value Z_L ? [7]

(b) 30 m long lossless transmission line with $Z_0 = 50$ Ω operating at 2 MHz is terminated with a load $Z_L = 60 + j40$ Ω. If u = 0.6c on the line, find reflection coefficient, standing wave ration and input impedance. [7]

Q.4 (a) Derive the radiation resistance of half-wave dipole antenna. [7]

(b) Derive transmission line differential equation. Also derive the condition of loss-less transmission from it. [7]

Q.5 (a) for a given medium, $\mu = \mu_o$, $\epsilon = \epsilon_0$ and $\sigma = 5.8 \times 10^7$ ℧ / m . A copper wire carries a conduction current of 2 Amp at 50 Hz then find out the displacement current in the wire? [7]

(b) Define Waveguide? What is mode? Explain different types of modes? [7]

Q.6 (a) What is the Poynting vector? An isotropic antenna is radiating in free space at a distance of 50m from the antenna. The total magnetic field is measured to be 10mA/m. Find (i) power density and (ii) power radiated. [7]

(b) Derive the relation between E and H in uniform plane wave propagation. Derive intrinsic impedance and give its physical significance. [7]

Q.7 (a) What do you understand the term power gain , directive gain and efficiency of antenna ? Find the relation among them. [7]

(b) Find the expression of radiated field from the half wave dipole? Also find the radiation resistance of the half wave dipole. [7]

Q.8 (a) Derive the expression for the attenuation constant, phase constant and intrinsic impedance for a uniform plane wave in a good conductor. [7]

(b) Derive the one dimensional general wave equation and find the solution for wave equation. [7]

Q.9 Write short notes on any two of the following:- [7 X 2 = 14]
  I. Hertz dipole antenna.
  II. Transverse electromagnetic mode.
  III. Faraday's Law of electromagnetic induction.
  IV. Gauss's Law.

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