

**M.E. DEGREE EXAMINATIONS: DECEMBER 2008**

First Semester

**COMMUNICATION SYSTEMS**

P07CM101: Advanced Radiation Systems

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (20 x 1 = 20 Marks)**

1. The vector potential  $A$  measured at Point  $Z$  at time  $t$  is known as retarded because
  - a) its velocity suffers retardation in space.
  - b) It is generated due to current at the dipole earlier in time.
  - c) It is attenuated while moving in space.
  - d) It has change in vector orientation.
  
2. An antenna of diameter  $D$  is operating at wavelength  $\lambda$ . The critical distance  $\gamma_c$  beyond which the electrostatic and inductive contribution to the radiated fields can be neglected is
  - a)  $D^2/\lambda$
  - b)  $D^3/\lambda$
  - c)  $2D^2/\lambda$
  - d)  $D^3/\lambda$
  
3. The radiation resistance  $R_{rad}$  is
  - a) Resistance offered by antenna.
  - b) Resistance offered by free space.
  - c) Coupling resistance offered by objects in the free space.
  - d) Coupling resistance between free space and antenna.
  
4. The effective length of antenna depends on
  - a) Wavelength of radiation.
  - b) Current distribution.
  - c) Angle of radiation.
  - d) Area of cross section.
  
5. In an end fire array with antenna spacing of  $\lambda/2$ , the elements are fed
  - a) in phase
  - b)  $90^\circ$  out of phase
  - c)  $180^\circ$  out of phase
  - d)  $60^\circ$  out of phase
  
6. The Tcheby Cheff Polynomial  $T_m(X_L)$  is commonly used in design and synthesis problems. For  $m=0$  and  $m=1$  its values are
  - a) 1 and 0
  - b) 1 and  $\infty$
  - c) 0 and 1
  - d)  $\infty$  and 1
  
7. At 450 MHz the left power beam width of a 3-element array is
  - a)  $10^\circ$
  - b)  $12^\circ$
  - c)  $8^\circ$
  - d)  $28^\circ$
  
8. The directional pattern of an end free array using isotropic radiators is substantially independent of spacing of the antenna radiators provided this spacing does not exceed
  - a)  $\lambda/8$
  - b)  $\lambda/4$
  - c)  $3\lambda/8$
  - d)  $\lambda/2$

9. The dual quantity corresponding for Electric source  $E_A$  when  $J \neq 0, M=0$  in magnetic source ( $J=0, M \neq 0$ ) is  
 a)  $-E_F$       b)  $M$       c)  $H_A$       d)  $H_F$
10. The fields in source free region can be determined only if  
 a) tangential electric fields alone are completely known over a closed surface.  
 b) tangential magnetic fields alone are completely known over a closed surface.  
 c) both the fields are known over closed surface.  
 d) both the fields are known in an open region.
11. For a radiation through an aperture in absorbing screen the Far-zone fields radiated by opening on the screen are related to far-zone fields of the complement by  
 a)  $E_{\theta s} = H_{\theta c}$       b)  $E_{\phi s} = H_{\theta c}$   
 c)  $H_{\theta s} = -E_{\theta c} / \eta_0$       d)  $H_{\phi s} = -E_{\phi c} / \eta_0$
12. A longitudinal slot in a cylinder has a radiation pattern which is practically in a plane perpendicular to the axis provided the cylinder diameters in terms of wavelength is of the order of  
 a)  $\lambda/2$       b)  $\lambda/4$       c)  $\lambda/8$       d)  $\lambda/10$
13. Patch antenna is a  
 a) High gain wide band antenna  
 b) Low gain narrow band antenna  
 c) High gain narrow band antenna  
 d) Low gain wide band antenna
14. Beam widths for corner reflectors are approximately equal in both Principal Planes, provided  $\theta$  is equal to  
 a)  $120^\circ$       b)  $90^\circ$       c)  $60^\circ$       d)  $45^\circ$
15. Cassegrain feed is used with Parabolic reflector to  
 a) increase the gain of the system  
 b) increase the beam width of the system  
 c) reduce the size of main reflector  
 d) allow the feed to be placed at a convenient point
16. Reflector antennas are preferred for gains greater than  
 a) 50 dB      b) 40 dB      c) 30 dB      d) 20 dB
17. For a wave to have linear polarization, the time phase difference between the two components must be  
 a)  $n\pi$       b)  $n\pi/2$       c)  $n\pi/4$       d)  $3n\pi/2$
18. A wave is said to be clockwise elliptically polarized if the time phase difference between the two components is  
 a) not equal to  $\pm (n\pi)/2 > 0$   
 b) not equal to  $\pm n/2 \pi < 0$   
 c) not equal to  $(1/2 + 2n) \pi$   
 d) not equal to  $-(1/2 + 2n)\pi$



23.b) Find the Radiation fields, Beam width, side lobe level and directivity for a rectangular aperture mounted on an infinite ground plane. (16)

24.a) Derive the expression for Aperture fields and radiated fields of a E-Plane sectoral Horn antenna. (16)

(OR)

24.b) Explain the analysis of Rectangular Microstrip Patch antenna using Transmission line model. (16)

25.a)(i) Define Stokes parameters. (4)

(ii) How stokes parameters are represented in fixed bases? (4)

(iii) What are the properties of Stokes Parameters? (4)

(iv) How Stokes Parameters are related to Polarization ellipse? (4)

(OR)

25.b) A uniform plane wave is propagating in the direction of positive Z axis. Find the Polarization (Linear, Circular or Elliptical), sense of rotation (CW or CCW), axial Ratio (AR) and tilt angle for

i)  $E_x = E_y$  and  $\Delta\phi = \pi/2$  (3)

ii)  $E_x \neq E_y$  and  $\Delta\phi = 0$  (3)

iii)  $E_x = E_y$  and  $\Delta\phi = \pi/4$  (5)

iv)  $E_x = 0.5E_y$  and  $\Delta\phi = \pi/2$  (5)

\*\*\*\*\*