

Time : 3 Hours]

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[Total Marks : 100
 [Min. Passing Marks : 33]

Attempt any five questions. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same.

Use of following supporting material is permitted during examination.

(Merchandise Item No. 205)

1. _____ Nil

2. _____ Nil

1. (a) A horizontal infinitesimal electric dipole of constant current I is placed symmetrically about the origin and directed along the x -axis. Derive the :
 (i) Far zone fields radiated by the dipole
 (ii) Directivity of the antenna.

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12

- (b) Find the radiation resistance of an infinitesimal dipole whose overall length is $l = \lambda/25$.

$\text{Ch}-4$

8

2. (a) Derive the electric and magnetic radiated fields equation for small circular loop.

12

- (b) Find the radiation resistance of a single turn and an 8-turn small circular loop the radius of the loop is $\lambda/25$ and the medium in free space.

$\text{Ch}-5$

8

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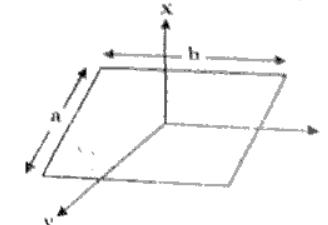
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[Contd...]

3. A rectangular aperture, of dimension a and b , is mounted on infinite ground plane as shown in Fig.



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Assuming the tangential field over the aperture is given by

$$\vec{E}_o = a_z E_o, \quad -a/2 \leq y' \leq a/2, \quad -b/2 \leq z' \leq b/2,$$

Find the far-zone spherical electric and magnetic field components radiated by the aperture.

4. (a) Describe the waveguide antennas.

- (b) Design a helical antenna with a diameter of 15 mm that is operating in the axial mode and whose polarization is nearly circular, the spacing between the turn is $\lambda/10$. Determine the

- (i) Number of turns /
 (ii) Axial ratio A.R.
 (iii) Directivity
 (iv) Progressive phase shift (in degrees) between the turns to achieve the axial mode radiation

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5. (a) Using the cavity model, find the electric and magnetic fields within the cavity of microstrip antenna.

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- (b) A rectangular microstrip patch antenna operating at 10 GHz with substrate with $\epsilon_r = 10.2$ has dimension of length $L = 0.4097 \text{ cm}$, width $W = 0.634 \text{ cm}$, and substrate height $h = 0.127 \text{ cm}$. It is desired to feed the patch using a probe feed. Neglect mutual coupling, calculate :

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2

(i) What is the input impedance of the patch at one of the radiating edges based on the transmission line model?

(ii) At what distance y_0 (in cm) from one of the radiating edge should the coax feed be placed so that the input impedance is 50 ohms.

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10

(a) Design a corporate feed for 4-element array of microstrip antenna. The operating frequency is 10 GHz. The input impedance of the antenna is 200Ω and feed line impedance is 50Ω .

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(b) Write short notes on active antennas.

10

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(a) Write short notes on lens antenna.

10

(b) Describe the working of smart antennas for mobile communications.

10

(a) For copper reflectors with included angles of $\alpha = \underline{60^\circ, 45^\circ}$,
and 30° :

(i) Derive the array factors

(ii) Plot the field strength along the axis ($\theta = 90^\circ, \phi = 0$)

as a function if the feed to vertex spacing, $0 \leq S/\lambda \leq 10$

(b) Draw the sketch for different feed configuration for paraboloidal reflector antenna.

① front fed
② wavelet

8