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COMPREHENSIVE EXAMINATION [CLOSED BOOK]

III Year EEE-II Sem 2006- 2007
EEE UC 433 - ELECTROMAGNETIC FIELDS AND WAVES

Date: 29/04/07 **Time:3 Hrs**
Max.Marks:40 **Answer All question** **Weigtage: 40%**

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1. A) Given the potential $V = \frac{10}{r^2}\sin\theta\cos\phi$ .a) Find the electric flux density D at $(2, \pi/2, 0)$ b) calculate the work done in moving a 10 μC charge from point A(1,30^0, 120^0) to B(4,90^0, 60^0)

   B)Derive the expression for the magnetic field intensity at a point P on the axis of circular loop carrying current I in the anti clockwise direction. The loop has origin as center, 'R' m as radius, and located on XY plane. The point P is on Z axis and in located at distance of 'z' m from the loop.

2. A)Derive the expression for the input impedance of transmission line and prove that $Z_0 = \sqrt{Z_{oc}Z_{sc}}$ .The transmission line has following parameters: The characteristics Impedance Zo, the propagation constant γ, the attenuation constant α, the phase constant β and the length of the line is ℓ m

   B) A co axial line terminated in a load impedance of Z_L =100 +j 50 Ω is with two short circuited Stub tuners. The main transmission line and the stub have characteristic impedance of 50 Ω.Using Smith chart calculate the following

   I. The locations of both stub
   II. Length of both stub
   III. The input impedance of the line if the line length is 5.25λ
   IV. The Reflection Coefficient

3. A) Given $E = E_m \sin(\omega t - \beta z)\hat{a}_y$ and $H = -\frac{\beta E_m}{\omega \mu_0}\sin(\omega t - \beta z)\hat{a}_x$ in free space. Show that the E and H fields constitute a wave traveling in the Z direction. Verify that the wave speed in free space and E/H of free space

B) A normally incident E field has amplitude Ei=1.0 V/m in free space just outside the sea water in which μ_r =1, ε_r=80 and σ=2.5 S/m .Find the distance E becomes 1.0 mV/m inside the sea water. Assume the frequency of the waves in 30 Mhz and $\eta_2 = 9.73\angle 43.5^0$ of sea water.

4. A) Obtain the expression for Radiation pattern of Broad side array having 4 elements with separation $\lambda/2$ between the elements. Also draw the radiation pattern.

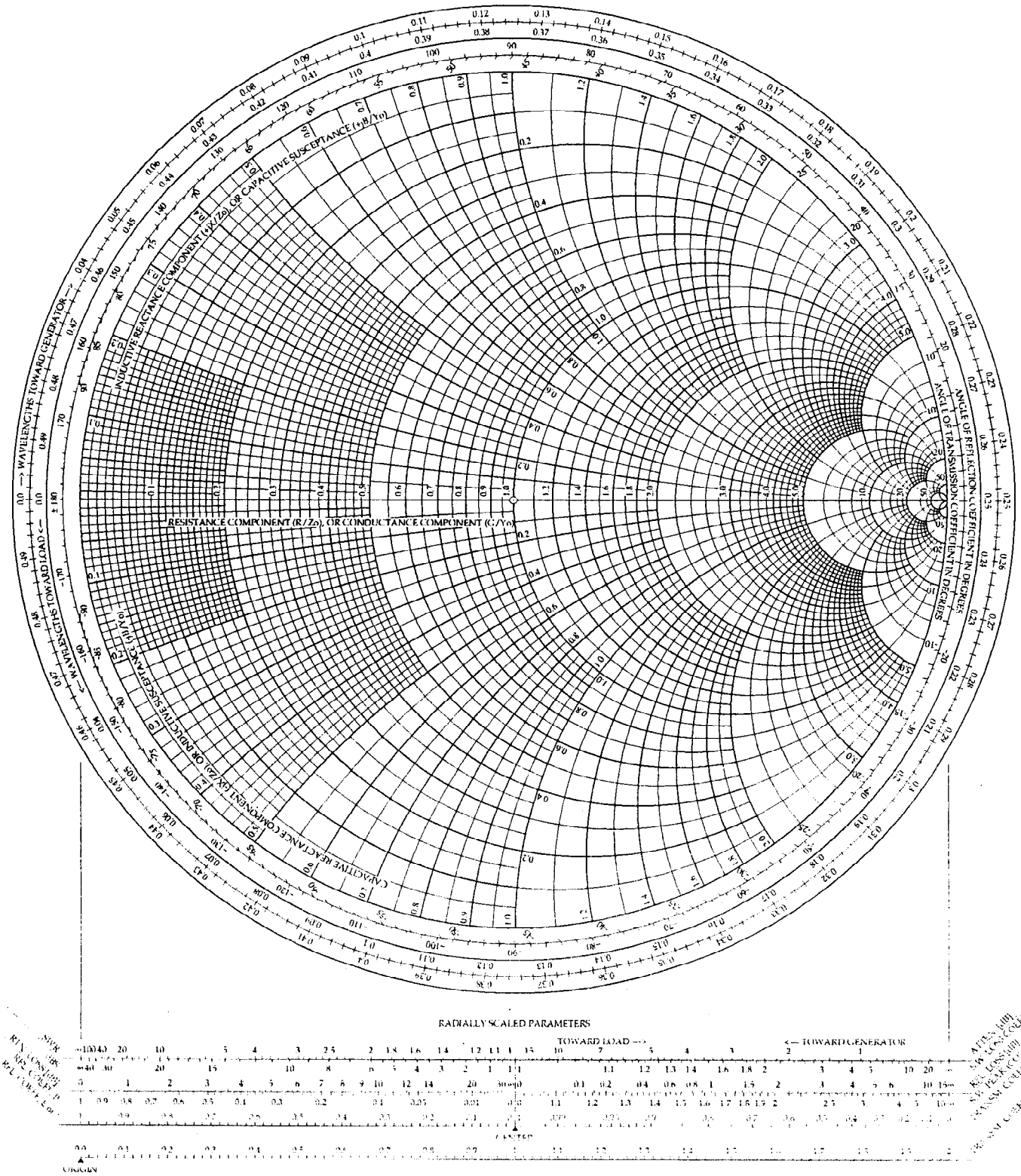
B) Explain the principle of operation and design procedure of YADI UDHA ANTENNA

5. A) A Rectangular wave guide of size 2 X 4.5 cm transmits 9 GHz signal. Find the cut off wave length, guide wave length and the characteristic impedance of $TE_{1,0}$

B) Derive the expression for Radar Cross Section

ID NO:

Smith Chart



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III Year EEE-II Sem 2006- 2007
EEE UC 433 - ELECTROMAGNETIC FIELDS AND WAVES

Date: 29/04/07	**TEST-2[OPEN BOOK]**	**Time: 50 Min**
Max.Marks:20	**Answer All question**	**Weigtage: 10%**

Note: [Permitted to refer Text book, PPTs, OHB slides and Class Notes]

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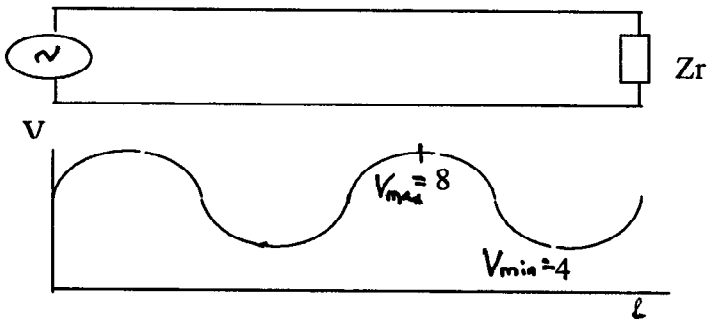
1 Find the length and location of the stub employed in single stub matching . The main transmission line having following parameters: Zo=50 Ohm, First Minima occurs at 0.2 λ. Also find the reflection co efficient, Maximum and Minimum Line impedance and the terminating impedance

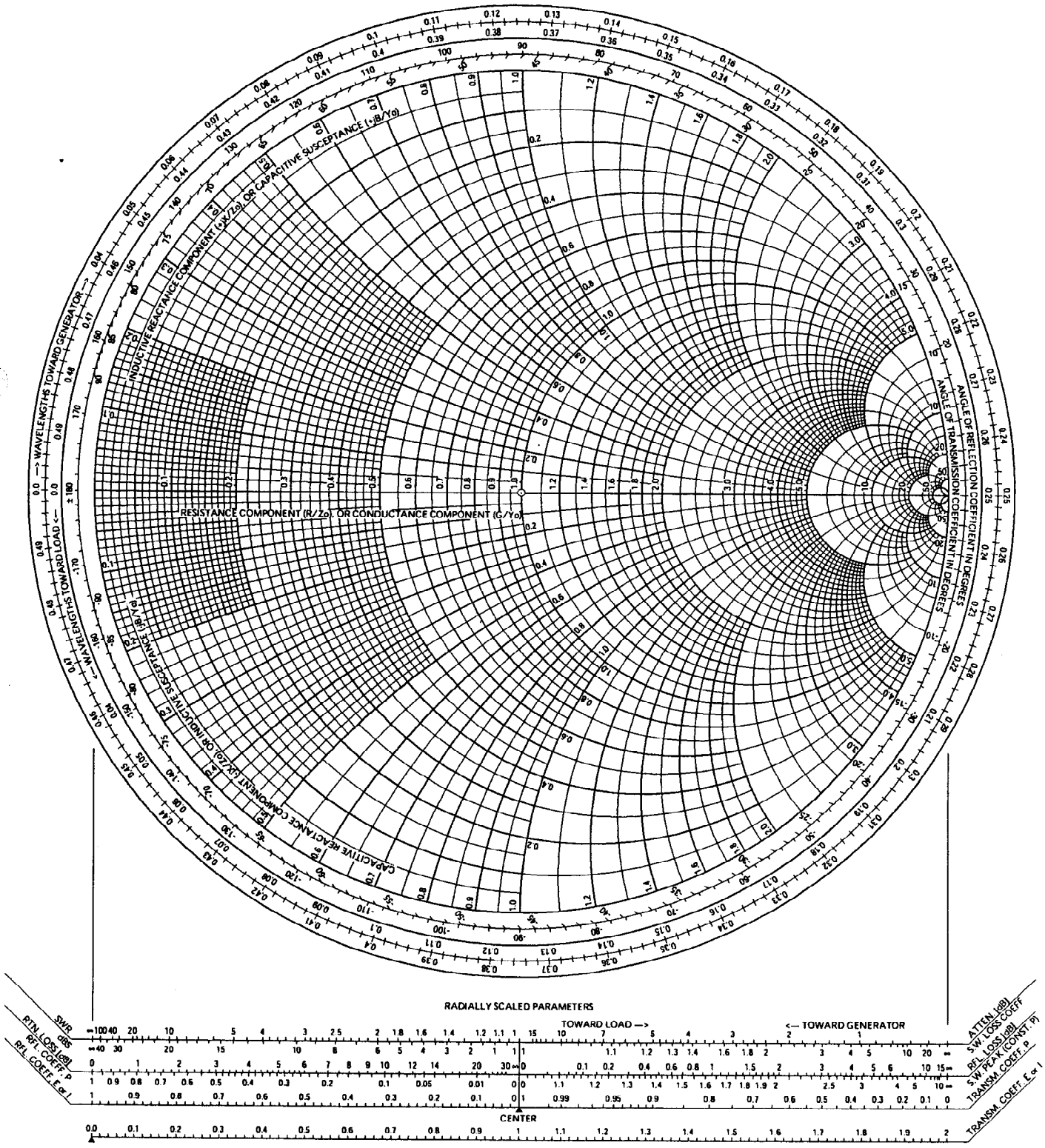
(8 Marks)



2 An EM wave in free space with the electric field component $E = 8\cos(\omega t - 4x - 3z)\, a_y$ V/m is incident on a dielectric slab($z>=0$) with $\mu_r = 1$, $\varepsilon_r = 2.5$ and $\sigma = 0$.Find

a) the polarization of the wave
b) the angle of incidence
c) the reflected electric field
d) the transmitted magnetic field (4 marks)

Smith Chart



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KNOWLEDGE VILLAGE, DUBAI II SEMESTER 2006-2007

Test-I

Course No: UC433: Electromagnetic Fields and Waves

Section: EEE **18-03-2007**

Answer All question Max.Marks:20 Time:50 Min

1. a) Derive the transmission line equations from sending end for the infinite length line. (2.5 Marks)

   b) Given $E_m = \sin(\omega t - \beta z)\hat{a}_y$ in free space. Find D,B,H. Sketch E and H at t=0 (2.5 Marks)

2. a) Derive the expression for reflection co efficient in terms of Impedance.(2.5 Marks)

   b) Prove that $z_0 = \sqrt{z_{oc} z_{sc}}$ for any transmission line, Where Z_0 is the characteristics impedance of line, Zoc is Open circuited impedance of the line and Zsc is short circuited impedance of the line.(2.5 Marks)

3. A transmission Line has following constants
   R=10.4 ohm/km,L=3.366 mH/km
   C=0.00835 Mfd,G=0.08 micro mho
   Calculate the followings
   Z_0, α, β, v_p at ω=5000 radians per sec (5 Marks)

4. Show that for small R and G but non zero $\alpha = \frac{R}{2}\sqrt{\frac{C}{L}} + \frac{G}{2}\sqrt{\frac{L}{C}}$

   and $\beta = \omega\sqrt{LC}$ $\beta = \omega\sqrt{LC}$ (5 Marks)

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III Year EEE-II Sem 2007

UC 433 - **ELECTROMAGNETIC FIELDS AND WAVES**

QUIZ-2

Date: 05/04/07 **Time: 30 Min**

Max.Marks:10 **Weigtage: 10%**

Answer all questions

1. Given H= $H_m e^{jwt+\beta z} a_x$ in free Space, Find the electric filed E.

2. In free space, $E(z,t) = 10^3 \sin(wt - \beta z) a_y$ V/m. Find H(z,t)

3. Determine the propagation constant for EM wave traveling in free space, if f=95.5 MHz

Rule: There should be only one tick against the answer for objective type question

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4. If the pointing vector or power density of a TEM wave =100 w/m^2 in a lossless medium(σ=0) with ϵr=4,Find the magnitude of electric field and magnetic field

5. A uniform plane wave in air with $E = 8\cos(wt - 4x - 3z)a_y V/m$ is incident on dielectric slab(Z>=0 with μr=1.0,ϵr=2.5,σ=0.find the polarization of wave

6. In smith chart ,When R value increases
   A) the radius of R circle is decreased and the centre of R circle shift towards the point in Kr and Kx axes
   B) only the radius of R circle is decreased
   C) the radius of R circle is increased and the centre of R circle shift towards the point in Kr and Kx axes
   D) the radius of R circle is decreased and the centre R of circle stables at a point in Kr and Kx axes

7. The reason for preferring the short circuited stub is
   A) It avoids radiation from the stub
   B) It avoids reflection from the stub
   C) It avoids transmission from the stub
   D) None of above

8. Using Smith Chart, to convert Admittance into Impedance
   A) Find the diametrically opposite point of admittance on S Circle
   B) Find the point displace by the distance $\lambda/2$
   C) Find the point displace by the distance $\lambda/3$
   D) Find the point displace by the distance $2\lambda/2$

9. In double Stub matching, location of stub1 from the load and location of stub2 from stub1 are at
   A) distance of $\lambda/2$ B) distance of $\lambda/6$
   C) distance of $\lambda/8$ D) distance of $\lambda/10$

10. The medium impedance is given by $Z_0 = \sqrt{\frac{jw\mu}{\sigma + jw\varepsilon}}$ .For free space the value of Zo is_____

Rule: There should be only one tick against the answer for objective type question

Version B

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III Year EEE-II Sem 2007
ELECTROMAGNETIC FIELDS AND WAVES

QUIZ

Date: 01/03/07 **Time: 30 Min**

Max.Marks:10 **Weigtage: 10%**

Answer all questions

1. The expression finds $\nabla.\hat{D} = 40\ \text{pC/m}^3$ .The total charge in the volume specified by $0 \le x \le 10cm, 5cm \le y \le 15cm, 0 \le z \le 12cm$

   A) 10fC B) 0 C

   C) 48fC D) 40pC

2. Identify the incorrect Statement
   A) The closed surface integral of $\hat{B}$ is equal to zero
   B) The Gauss law for Magnetic field finds the charge associated with the system
   C) The Ampere law finds the current passing through the wire

3. Identify the Lorentz force Equation

   A) $F = \frac{Q_1 Q_2}{4\pi\varepsilon_0 R^2}$ B) $F = (IxB)L$

   C) $V = \int E.dl$

4. How many turns are required for a 30-cm long solenoid to have an inductance of 10mH.The solenoid diameter is 4cm.Assume the medium is air

   A) 1234 B) 2000

   C) 5000 D) 1380

5. The differential form Maxwell Equation from Ampere's Law is

A) $\nabla x\hat{H} = J + \frac{\partial D}{\partial t}$ B) $\nabla.\hat{D} = \rho$

C) $\nabla x\hat{B} = -\frac{\partial B}{\partial t}$

6. If the electric field E is 100 Vm^{-1} at a distance of 2 m from a point charge Q, find the magnitude of the charge Q located in free space.

A) 44.5nC B) 44.5μC

C) 30nC D) 30μC

7. The closed line integral of E in electrostatic field is

A) Always 0 B) Always 1

C) Infinity D) 10

8. Identify the correct relation

A) $\nabla.D = 2C$ B) $\nabla.D = \rho$ C/m^3

C) $\nabla.D = V$ D) $\nabla.D = E$

9. Find out the value of E if V =3. e^{-2x}

A) 5.7 X 10^{-6} V/m B) 5.7 X 10^{-7} V/m

C) 6. e^{-2x}V/m D) 3. e^{-2x} V/m

10. A long straight wire carries a current I =10A.The distance at which the magnetic field H = 1 A/m is

A) 30m B) 2.5μm

C) 5m D) 1.59m