Code No: R09220404 **R09** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the "poisson's" and "Laplace's" equation.
   (b) Obtain expression for the capacitance of
      i. a parallel plate capacitor and
      ii. a coaxial capacitor. [7+8]

2. (a) In a transmission line, name the types of distortions that occur and explain.
   (b) To avoid distortion, what is the condition for a "Distortionless line" and derive an expression for the same in terms of line parameters. [8+7]

3. (a) Derive the wave equation for a medium with μ, ε and σ and solve the same for the propagation constant γ.
   (b) Derive the expression for α and β for a general medium with μ, ε & σ [7+8]

4. (a) State and prove Boundary Conditions for electric field between a conductor and a dielectric.
   (b) Copper wire carries a conduction current of 1.0 Amp at 60 Hz. Determine the displacement current in the wire? Assume $\varepsilon_{cu} = \varepsilon_0$; $\mu_{cu} = \mu_0$; $\sigma = 5.8 \times 10^7$ mhos/m. [7+8]

5. (a) Explain the constructional features of "Smith's" chart and its importance.
   (b) A load Impedance of 90-j25 Ω is to be matched to a 50 Ω line using single stub mathcing. Find the length and position of the stub. [7+8]

6. (a) Determine the "Electric field" 'E'due to
      i. Point charge Q
      ii. Line charge ρ_l
      iii. "Surface charge" ρ_s at a point distance 'r' from the source.
   (b) Evaluate the Coulomb's force, Electric field intensity and potential due to a line charge 'ρ_l'. [7+8]

7. (a) Show that the magnetic field due to straight current carrying conductor of finite length AB is given by $H = \frac{I}{4\pi R}(\cos\alpha_2 - \cos\alpha_1)\hat{a}_Q$.(figure 1)
   (b) Find the vector magnetic field intensity at P(1,2,3) in Cartesian coordinates caused by a current filament carrying a current of 10Amp along Z-axis, if the filament extends from

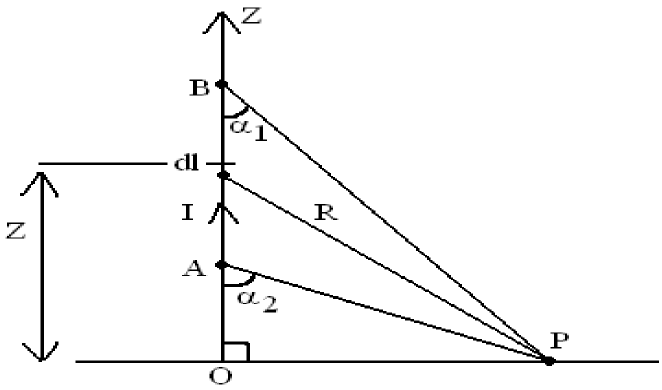

Figure 1:

i. z=0 to z=3
ii. z= -∞ to ∞ [8+7]

8. (a) Derive the Reflection coefficient for a parallel polarised wave at an angle of incidence θ_i between two media (loss less and $\mu_1 = \mu_2 = \mu_0$)
   (b) Define Brewster's angle and obtain an expression for the same in terms of medium parameters. [7+8]

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Code No: R09220404 **R09** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define "Electric field", "Electric Flux density" and "Electric Potential" from charges and explain.
   (b) Explain about equipotential surfaces. [8+7]
2. (a) What is an isotropic and homogeneous medium?
   (b) What is a lossy and lossless medium?
   (c) Explain the term "Conduction Current Density". [5+5+5]
3. (a) State and explain Maxwell's equations obtained from Faraday's and Ampere's laws and their Magnetic field concepts & relationship.
   (b) The plane Y = 2 carries current density K = 30az Amp/mt. Find the Magnetic field intensity at A(0,0,1) and B(1,3,2). [8+7]
4. (a) Compare the impedance matching techniques such as
      i. $\lambda/4$
      ii. Single Stub
      iii. Double Stub on transmission lines.
   (b) A transmission line is terminated in a load Impedance $Z_L = 73+j42.5\ \Omega$, the frequency = 10^7 Hz line length l = 10 m. The inductance L = 10^{-6} H/m C= $\frac{1}{9} \times 10^{-10}$ F/m. Find Z_L? [7+8]
5. (a) A wave is incident from Air on to a perfect conductor normally. Evaluate the reflection coefficient.
   (b) What is surface impedance and explain the power loss between Air & a conductor surface at normal Incidence. [7+8]
6. (a) Evaluate the values of α, β, η and propagation constant, the velocity of propagation of EM waves in good conductors at a frequency W.
   (b) Define "Depth of propagation" and calculate the value of the same in copper at 10 MHz and 10 KHz.($\sigma_{cu} = 5.8 \times 10^7$ mhos/m; $\mu = \mu_0$). [7+8]
7. (a) State and explain Boundary conditions for electric field at a boudary surface between a conductor and dielectric boundary.
   (b) Evalaute the units of
      i. $\frac{\varepsilon}{\sigma}$

ii. $\frac{\sigma}{\omega\varepsilon}$

iii. $\sqrt{\frac{2}{\omega\mu\sigma}}$ [6+9]

8. (a) What is distortion on a line and derive a condition for Distortionless transmission.

   (b) A lossless T_X line has 75 ohms characteristic impedance. The line is terminated in a load impedance of (50-J100) ohms. The maximum voltage measured on the line is 100volts. Find the maximum and minimum current and minimum voltage on the line. At what distance from the load, the voltage and current are maximum. [7+8]

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Code No: R09220404 **R09** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the wave equation for a general medium with μ, ε and σ solve the same for 'γ' the propagation constant.
   (b) If the medium is assumed to be a good conductor, evaulate the values of α, β, η and υ at a frequency ω. [7+8]
2. (a) State and explain boundary conditions between two dielectric media.
   (b) A circular loop conductor having radius of o.2mt.is placed in XY plane. The loop consists of a resistance of 10 ohms. If the Magnetic field is B = Sin10^4t Tesla, find the current flowing in the loop. [7+8]
3. (a) Name the types of distortions on the transmission lines and explain.
   (b) Derive an expression for a distortionless line. [8+7]
4. (a) Explain "Reflection and Refraction" of plane waves.
   (b) Obtain an expression for the Reflection and Transmission coefficients of uniform waves between two media for normal incidence. [5+10]
5. (a) State and prove Ampere's circiutal law.
   (b) Explain the action of transformer and capacitor in terms of static and time varying fields. Give examples. [7+8]
6. (a) Obtain an expression for the Input Impedance of lossless line of length 'l' with Z_0 as characteristic Impedance and terminated by a load Z_L.
   (b) A line with z_0 = 100 Ω is connected to an impedance (load) Z_L = 300 + j200. Find
      i. the line length 'd_1' required to transform this load to a pure resistance
      ii. the impedance of a $\lambda/4$ line required for a match
      iii. VSWR on the 'd_1' line and VSWR on $\lambda/4$ line. Use Smith chart. [7+8]
7. (a) Derive Poisson's and Laplace's equations and mention their applications.
   (b) Obtain an expression for the capacitance of a coaxial line in terms of outer conductor dia 'b' and inner conductor dia 'a'. [7+8]
8. (a) State and explain Gauss's law and prove that $\nabla.D = \rho_v$.

(b) A volume charge density inside a hollow sphere is $\rho = 10e^{-20r} c/m^3$. Find the total charge enclosed with in the sphere also find the electric flux density on the surface of the sphere. [7+8]

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II B.Tech II Semester Examinations,APRIL 2011
ELECTRO MAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the conditions to be satisfied for
   i. Brewster's angle
   ii. Critical angle.

   Explain in detail.

   (b) Derive an expression for Reflection Coefficient and Transmission Coefficient for a uniform plane wave incident normally between two Dielectric media. $(\mu_1\varepsilon_1 \ and \ \mu_2\varepsilon_2)$ [7+8]

2. (a) A material has a dielectric constant 30 and conductivity of 3×10^5 mhos/mt. What is the frequency above which the materials can not behave as a good conductor. If a plane wave of 15MHz isincident on the material, upto what depth can the wave penetrate the material, and what will be the wave length of the wave in the material.

   (b) A uniform plane wave in free space is having $\vec{E} = 200.\exp\left[-J(0.1)z\right].a_x V/mt.$ Find the instantaneous value of poyinting vector at t = 0, z = 1mt. [7+8]

3. Derive the Boundary conditions for Magnetic field at the boundary of two Media. [15]

4. (a) Name the different applications of "Short Circuited" loss lines of various lengths in transmission line problems.

   (b) Explain the terms
   i. quarter wavelength mathcing
   ii. Single stub matching in detail.

   (c) An antenna of 76 Ω is to be matched to a loss less line of 50(=Z_0)Ω. Explain the procedure. [5+5+5]

5. (a) Define "Electric field Intensity" and 'potential V' due to "point charges" and "line charges" & explain.

   (b) Find the 'E' field intensity on the axis of a circular ring carrying a charge density 'Q' C/m. [7+8]

6. (a) Write Maxwells equations for Time Varying fields in integral and differential form. Discuss the difference between static fields and Time Varying fields.

(b) A parallel plate capacitor with plate area of 5.0 cm^2 and plate separation of 3.0 mm has a voltage 50 sin 10^3 t volts applied to its plate. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$ [7+8]

7. (a) What are Linear, Homogeneous and isotropic media?

   (b) Explain "Point charge", "Line charge" and "Surface charge" distributions and the 'E' & 'V' expressions also to the above, given examples of their applications. [7+8]

8. (a) What are frequency distortion and phase (delay) distortions in Transmission lines? What is the condition for a Distortionless line? Derive an expression for the same.

   (b) A T_X line has primary constants R = 0.1Ω/mt, G = 0.01 mhos/mt, L = 0.01μH/mt; C = 100PF/mt. If the line is connected to a load impedance of (10+J20) ohms, find reflection coefficient at the

      i. load end
      ii. 20 cm from load. [7+8]

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Code No: R09220404 **R09** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Derive the expression for Curl of a Vector in Cartesian, Cylindrical and Spherical Co-Ordinate system. [15]

2. (a) State and explain boundary conditions between two dielectric media.
   (b) A circular loop conductor having radius of 0.2 m is placed in XY plane. The loop consists of a resistance of 10 ohms. If the Magnetic field is B = $\text{Sin}10^4$t Tesla, find the current flowing in the loop. [7+8]

3. (a) Explain the concepts of conduction, convection and displacement current in materials.
   (b) What are "isotropic" and "homogeneous" dielectric materials?
   (c) What is "Relaxation time" and discuss its effect on conductors? [5+5+5]

4. (a) Explain the terms "work" and Energy density in electrostatic fields.
   (b) Esablish the relationship between potential energy and the work done on charges. Four point charges of 0.8 nC are located in free space at the corners of a square 4 cms side. Find the total potential energy stored. [7+8]

5. (a) Explain the importance of the parameter "$\frac{\sigma}{\omega\varepsilon}$" of a medium and evaluate the values of α, β, η and propagation constant of the medium if $\frac{\sigma}{\omega\varepsilon} << 1$.
   (b) Earth is considered to be a good conductor where $\frac{\sigma}{\omega\varepsilon} << 1$. Determine the highest frequency for which earth can be considered as good conductor if $\frac{\sigma}{\omega\varepsilon} << 0.1$. Assume the following constant for earth: $\sigma = 5 \times 10^{-3}$; $\varepsilon = 10\varepsilon_0$. [7+8]

6. (a) Define Polyting's theorem and Polyting Vector.
   (b) A sinusoidally varying EM wave in a medium of $\varepsilon_r = 1$; μ_r is transmitting power at a density 1.2 watts/sqm. Find the maximum values of 'E' and 'H' fields. [7+8]

7. (a) Using transmission lines how to obtain various impedances. Explain.
   (b) What is the input impedance of a short circuited loss less line whose lengths are
      i. $\lambda/8$
      ii. $\lambda/4$
      iii. $3\lambda/8$ [8+7]

8. (a) What is a quarter wave transformer and how is it used for matching? Explain.

   (b) Explain the method of measuring an unknown load impedance Z_L using a slotted transmission line and VSWR with the help of Smith's chart.
   . [7+8]

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II B.Tech II Semester Examinations,April/May 2012
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define and explain Biot - Savart's law. Hence obtain the magnetic field due to a straight current carrying filamentary conductor of finite length.
   (b) A current element (ax+2ay-az)mA, located at P(-1, 2,-2) produces a Magnetic field "dH" at Q(2,2,2). Find a unit vector in the direction of "dH", at the point Q. [7+8]

2. (a) What are Primary and Secondary Parameters of a Transmission line?
   (b) Obtain an expression for the propagation constant of a line at W in terms of line parameters.
   (c) Given R = 10.4 Ω/mt
   L = 0.00367 H/mt
   G = 0.8×10^{-4} mhos/mt
   C = 0.00835 μF/mt.
   Calculate Z_0 and γ at 1.0 KHz. [5+5+5]

3. (a) Evalaute the equivalent lumped element parameters of a lossless short circuited line of different lengths such as $l = \frac{\lambda}{8}$; $l = \frac{\lambda}{4}$; $l = \frac{5\lambda}{16}$; $l = \frac{3\lambda}{8}$ and $l = \frac{\lambda}{2}$.
   (b) An antenna with Radiation resistance of $Z_L = 73\ \Omega$ is to be matched to a lossless line of $Z_0 = 50$ ohms. Evaluate a simple matching mechanism to match the antenna to the line. Give the values. [8+7]

4. (a) Explain the terms charges, electric forces, Electric fields and Potentials.
   (b) Derive the expression for the energy stored in an electrostatic field. [7+8]

5. (a) Write Maxwells equaitons for time varying fileds in Defferential and Integral form.
   (b) Derive the expression for Displacement current density in a medium.
   (c) Given the conduction current density in Silicon as $J_c = 1$ mA, evaluate the displacement current density in Silicon at 1 MHz. (use $\sigma_{Si} = 10^2$ mhos/m; $\varepsilon r_{(Si)} = 9$) [5+5+5]

6. (a) Explain $\nabla.J = -\frac{\partial \rho}{dt}$ and what is its importance in Maxwell's equation and prove the equation.
   (b) $\nabla \times H = \sigma E + \varepsilon \frac{\partial E}{\partial t}$ is a Maxwells equation called Ampere's law. Explain the equation in respect of conduction and Displacement current. [7+8]

7. (a) Derive the wave equation for 'E' field from Maxwell's equation and solve the same for uniform plane wave propagating in freespace.

   (b) Determine the relationship $\frac{E}{H}$ and show that it is equal to $\sqrt{\frac{\mu}{\varepsilon}}$ [7+8]

8. (a) Derive the Reflection coefficient for a parallel polarised wave at an angle of incidence θ_i between two media (loss less and $\mu_1 = \mu_2 = \mu_0$)

   (b) Define Brewster's angle and obtain an expression for the same in terms of medium parameters. [7+8]

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Code No: R09220404 **R09** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define "Poynting Vector" and "Power flow".
   (b) A medium is characterised by $\sigma = 0$; and $\mu = 2\mu_0$ and $\varepsilon = 5\varepsilon_0$. If $H = 2\cos\hat{z}(wt - 3y)A/m$, calculate W and E. [7+8]

2. (a) Distinguish between conduction current and displacement current with examples.
   (b) If the Magnetic flux density is B = Cos(10^4t).Sin(0.1x). a_z milli Tesla, find the magnetic flux passing through the surface Z = 0, $0 < x <$ 10mt., $0 < y < 3$ mt. at t = 2Microsec. [7+8]

3. (a) State and explain Biot - Savart's Law.
   (b) Derive an expression for the magnetic force on a current element. mention its applications.
   (c) A surface current Density K = 20ax Amp/mt flows in Y = 1 plane. Find the Magnetic field intensity at (-1,3,2). [5+5+5]

4. (a) What are isotropic and homogeneous media? Give examples.
   (b) The z - axis carries a non - uniform charge density of (Z^2+1)nC/mt for $-2 < Z < 2$ in free space. Find the electric field intensity at P(1,0,0). [5+10]

5. (a) Show that a loss less quater wave length line behaves as impedance inverter and a half-wavelength line behaves as 1:1 transformer
   (b) Show that a lossless transsmission line of different lengths can be made to behave as
      i. inductance 'L'
      ii. capacitance 'C'
      iii. series impedance(figure 1) and

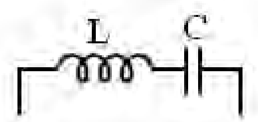

Figure 1:

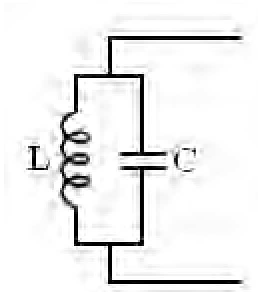

Figure 2:

iv. shunt impedance resonant circuits(figure 2) (either shorted or open). [5+5+5]

6. (a) Define 'E' field and 'H' fields.
   (b) Determine the Electric field intensity due to
      i. a point charge 'Q'
      ii. to a line charge P_l in space at a point P.
   (c) Evaluate the potential at that point from 'E' fields. [5+5+5]

7. (a) Derive the wave equation for 'H' field from Maxwell's equation and solve the same for propagation constant in homogeneous, isotropic medium for uniform plane wave propagating in Z-direction. Get the value of 'E' field.
   (b) Determine the value of α, β, η and propagation constant for a good conductor and Depth of penetration. [7+8]

8. (a) What is distortion on a line and derive a condition for Distortionless transmission.
   (b) A lossless T_X line has 75 ohms characteristic impedance. The line is terminated in a load impedance of (50-J100) ohms. The maximum voltage measured on the line is 100volts. Find the maximum and minimum current and minimum voltage on the line. At what distance from the load, the voltage and current are maximum. [7+8]

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Code No: R09220404 **R09** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
ELECTROMAGNETIC THEORY AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering, Electrical And Electronics Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and explain Coulomb's law & Faraday's law.
   (b) Evaluate the electrostatic force(F) field 'E' and potential 'V' due to
      i. point charge and
      ii. a line charge at a distance 'r' from the source. [7+8]
2. (a) Define Faradays's law and Lenz law.
   (b) State Ampere's law and explain. [8+7]
3. (a) Explain the principle of quarter wave matching and single stub matching on transmission lines at μHF.
   (b) A load has admittance $\frac{Y_L}{Y_0}$ = 1.25 + j0.25. Find the length and location of a single stub to match the line to the load use Smith chart. [7+8]
4. (a) What is Total Internal reflection and critical angle between two media?
   (b) Explain the term "Surface impedance" and "depth of penetration". [7+8]
5. (a) State and explain Biot-Savart's law.
   (b) Deduce Biot-Savart Law considering
      i. Surface Current
      ii. Volume Current. [8+7]
6. (a) Write the basic transmission equations in terms of R,L,C,G and V & I and explain.
   (b) Obtain the wave equation from the basic equation and solve the same for propagation constant and characteristic impedance of the transmission line at a frequency 'W' in terms of R,L,C,G. [8+7]
7. (a) Derive Poisson's and Laplace's equations and mention their applications.
   (b) Obtain an expression for the capacitance of a coaxial line in terms of outer conductor dia 'b' and inner conductor dia 'a'. [7+8]
8. (a) Derive the wave equation for a general medium and solve the same for a uniform plane wave propagating in a medium with μ, ε, σ at a frequency ω. Obtain the values of $\gamma = \alpha + j\beta$.
   (b) Define loss Tangent and explain how materials are clasified based on loss Tangent. [7+8]

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Code No: NR220403 **NR** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an expression for the electrostatic energy stored in a capacitor of value C in terms of the total charge Q as well as the voltage V.
   (b) Consider two thin infinitely long concentric conducting cylinders with inner cylinder of radius a. and outer cylinder of radius b. Derive an expression for its capacitance, with air as dielectric, assuming required charge distribution. [8+8]

2. (a) Define Ampere's Force Law and establish the associated relations.
   (b) A long coaxial cable has an inner conductor carrying a current of 1 mA. along $+\hat{Z}$ direction , its axis coinciding with Z-axis. Its inner conductor diameter is 6 mm. If its outer conductor has an inside diameter of 12 mm. and a thickness of 2 mm., determine $\bar{H}$ at (0, 0, 0), (0, 1.5 mm, 0), (0, 4.5 mm, 0) and (0, 1 cm, 0). (No derivations) [8+8]

3. (a) Explain the causes for attenuation in Parallel plane wave guides.
   (b) Define and explain the significance of the following terms as applicable to parallel plane guides:
      i. Wave impedance.
      ii. Phase and group velocities
      iii. Principal wave and its characteristics [4+4+4+4]

4. (a) Show that the line will be distortion free if CR = LG. How is this achieved in practice? [8+8]
   (b) A Telephone line has $R = 10\Omega/km$, L = 0.0037 H/km, $C = 0.0083\mu F/km$ and $G = 0.4x10^{-6}mho/km$. Determine Z_0, α and β at 1 KHz .

5. (a) Sketch the configuration of dominant mode fields in the cross section of
      i. a rectangular wave guide. [4+4+8]
      ii. a circular wave guide.
   (b) Derive an expression for the Q factor of a wave guide explaining the terms involved.

6. (a) What is the significance of standing wave ratio in a transmission line? Calculate the reflection coefficient & VSWR for a 50Ω line, terminated with
      i. matched Load. [2+2+2+2]

ii. short circuit .

iii. $+j50\Omega$ Loads.

iv. $-j50\Omega$ load.

(b) A 50Ω transmission line is terminated by an unknown impedance. The VSWR is 4 and the first minima is formed at 2 cm from the load end. The frequency of operation is 1 GHz. Design a single stub line matching for the above conditions. [8]

7. (a) What is meant by the polarization of wave? When is the wave linearly polarized and circularly polarized?

(b) A traveling wave has two linearly polarized components $E_x = 2Cos\ \omega t$ and $E_y = 3\ Cos\ (\ \omega t + \pi/2)$

i. What is the axial ratio.

ii. What is the tilt angle of the major axis of the polarization ellipse?

iii. What is the sense of rotation? [8+3+3+2]

8. (a) State the boundary conditions satisfied by electromagnetic fields E and H at the interface of air and a perfect dielectric. If the dielectric material is replaced by a perfect conductor, how do the boundary conditions get modified?

(b) In a medium of $\mu_r = 2$, find $\bar{E}$, $\bar{B}$ and displacement current density if $\bar{H} = 25Sin\ (2x10^8 t + 6x)\ \hat{y}$ mA/m . [8+8]

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II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Define Ampere's Force Law and establish the associated relations.
   (b) A long coaxial cable has an inner conductor carrying a current of 1 mA. along $+\hat{Z}$ direction , its axis coinciding with Z-axis. Its inner conductor diameter is 6 mm. If its outer conductor has an inside diameter of 12 mm. and a thickness of 2 mm., determine $\bar{H}$ at (0, 0, 0), (0, 1.5 mm, 0), (0, 4.5 mm, 0) and (0, 1 cm, 0). (No derivations) [8+8]

2. (a) Derive an expression for the electrostatic energy stored in a capacitor of value C in terms of the total charge Q as well as the voltage V.
   (b) Consider two thin infinitely long concentric conducting cylinders with inner cylinder of radius a. and outer cylinder of radius b. Derive an expression for its capacitance, with air as dielectric, assuming required charge distribution. [8+8]

3. (a) Explain the causes for attenuation in Parallel plane wave guides.
   (b) Define and explain the significance of the following terms as applicable to parallel plane guides:
      i. Wave impedance.
      ii. Phase and group velocities
      iii. Principal wave and its characteristics [4+4+4+4]

4. (a) State the boundary conditions satisfied by electromagnetic fields E and H at the interface of air and a perfect dielectric. If the dielectric material is replaced by a perfect conductor, how do the boundary conditions get modified?
   (b) In a medium of $\mu_r = 2$, find $\bar{E}$, $\bar{B}$ and displacement current density if $\bar{H} = 25Sin\ (2x10^8 t + 6x)\ \hat{y}$ mA/m . [8+8]

5. (a) Sketch the configuration of dominant mode fields in the cross section of
      i. a rectangular wave guide. [4+4+8]
      ii. a circular wave guide.
   (b) Derive an expression for the Q factor of a wave guide explaining the terms involved.

6. (a) Show that the line will be distortion free if CR = LG. How is this achieved in practice? [8+8]

(b) A Telephone line has $R = 10\Omega/km$, L = 0.0037 H/km, $C = 0.0083\mu F/km$ and $G = 0.4x10^{-6}mho/km$. Determine Z_0, α and β at 1 KHz .

7. (a) What is meant by the polarization of wave? When is the wave linearly polarized and circularly polarized?

   (b) A traveling wave has two linearly polarized components $E_x = 2Cos\,\omega\,t$ and $E_y = 3\ Cos\ (\ \omega\,t + \pi/2)$

   i. What is the axial ratio.
   ii. What is the tilt angle of the major axis of the polarization ellipse?
   iii. What is the sense of rotation? [8+3+3+2]

8. (a) What is the significance of standing wave ratio in a transmission line? Calculate the reflection coefficient & VSWR for a 50Ω line, terminated with

   i. matched Load. [2+2+2+2]
   ii. short circuit .
   iii. $+j50\Omega$ Loads.
   iv. $-j50\Omega$ load.

   (b) A 50Ω transmission line is terminated by an unknown impedance. The VSWR is 4 and the first minima is formed at 2 cm from the load end. The frequency of operation is 1 GHz. Design a single stub line matching for the above conditions. [8]

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II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Sketch the configuration of dominant mode fields in the cross section of
    i. a rectangular wave guide. [4+4+8]
    ii. a circular wave guide.

   (b) Derive an expression for the Q factor of a wave guide explaining the terms involved.

2. (a) Define Ampere's Force Law and establish the associated relations.

   (b) A long coaxial cable has an inner conductor carrying a current of 1 mA. along $+\hat{Z}$ direction , its axis coinciding with Z-axis. Its inner conductor diameter is 6 mm. If its outer conductor has an inside diameter of 12 mm. and a thickness of 2 mm., determine $\bar{H}$ at (0, 0, 0), (0, 1.5 mm, 0), (0, 4.5 mm, 0) and (0, 1 cm, 0). (No derivations) [8+8]

3. (a) State the boundary conditions satisfied by electromagnetic fields E and H at the interface of air and a perfect dielectric. If the dielectric material is replaced by a perfect conductor, how do the boundary conditions get modified?

   (b) In a medium of $\mu_r = 2$, find $\bar{E}$, $\bar{B}$ and displacement current density if $\bar{H} = 25Sin\ (2x10^8 t + 6x)\ \hat{y}$ mA/m . [8+8]

4. (a) Explain the causes for attenuation in Parallel plane wave guides.

   (b) Define and explain the significance of the following terms as applicable to parallel plane guides:
    i. Wave impedance.
    ii. Phase and group velocities
    iii. Principal wave and its characteristics [4+4+4+4]

5. (a) What is meant by the polarization of wave? When is the wave linearly polarized and circularly polarized?

   (b) A traveling wave has two linearly polarized components $E_x = 2Cos\ \omega t$ and $E_y = 3\ Cos\ (\ \omega t + \pi/2)$
    i. What is the axial ratio.
    ii. What is the tilt angle of the major axis of the polarization ellipse?
    iii. What is the sense of rotation? [8+3+3+2]

6. (a) Derive an expression for the electrostatic energy stored in a capacitor of value C in terms of the total charge Q as well as the voltage V.

   (b) Consider two thin infinitely long concentric conducting cylinders with inner cylinder of radius a. and outer cylinder of radius b. Derive an expression for its capacitance, with air as dielectric, assuming required charge distribution. [8+8]

7. (a) Show that the line will be distortion free if CR = LG. How is this achieved in practice? [8+8]

   (b) A Telephone line has $R = 10\Omega/km$, L = 0.0037 H/km, $C = 0.0083\mu F/km$ and $G = 0.4x10^{-6}mho/km$. Determine Z_0, α and β at 1 KHz .

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Code No: NR220403 **NR** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define Ampere's Force Law and establish the associated relations.
   (b) A long coaxial cable has an inner conductor carrying a current of 1 mA. along $+\hat{Z}$ direction , its axis coinciding with Z-axis. Its inner conductor diameter is 6 mm. If its outer conductor has an inside diameter of 12 mm. and a thickness of 2 mm., determine $\bar{H}$ at (0, 0, 0), (0, 1.5 mm, 0), (0, 4.5 mm, 0) and (0, 1 cm, 0). (No derivations) [8+8]

2. (a) Show that the line will be distortion free if CR = LG. How is this achieved in practice? [8+8]
   (b) A Telephone line has $R = 10\Omega/km$, L = 0.0037 H/km, $C = 0.0083\mu F/km$ and $G = 0.4x10^{-6} mho/km$. Determine Z_0, α and β at 1 KHz .

3. (a) What is meant by the polarization of wave? When is the wave linearly polarized and circularly polarized?
   (b) A traveling wave has two linearly polarized components $E_x = 2Cos\ \omega t$ and $E_y = 3\ Cos\ (\ \omega t + \pi/2)$
      i. What is the axial ratio.
      ii. What is the tilt angle of the major axis of the polarization ellipse?
      iii. What is the sense of rotation? [8+3+3+2]

4. (a) State the boundary conditions satisfied by electromagnetic fields E and H at the interface of air and a perfect dielectric. If the dielectric material is replaced by a perfect conductor, how do the boundary conditions get modified?
   (b) In a medium of $\mu_r = 2$, find $\bar{E}$, $\bar{B}$ and displacement current density if $\bar{H} = 25Sin\ (2x10^8 t + 6x)\ \hat{y}$ mA/m . [8+8]

5. (a) Derive an expression for the electrostatic energy stored in a capacitor of value C in terms of the total charge Q as well as the voltage V.
   (b) Consider two thin infinitely long concentric conducting cylinders with inner cylinder of radius a. and outer cylinder of radius b. Derive an expression for its capacitance, with air as dielectric, assuming required charge distribution. [8+8]

6. (a) Explain the causes for attenuation in Parallel plane wave guides.
   (b) Define and explain the significance of the following terms as applicable to parallel plane guides:

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ii. Phase and group velocities
iii. Principal wave and its characteristics [4+4+4+4]

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    ii. short circuit .
    iii. $+j50\Omega$ Loads.
    iv. $-j50\Omega$ load.
   (b) A 50Ω transmission line is terminated by an unknown impedance. The VSWR is 4 and the first minima is formed at 2 cm from the load end. The frequency of operation is 1 GHz. Design a single stub line matching for the above conditions. [8]

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    i. a rectangular wave guide. [4+4+8]
    ii. a circular wave guide.
   (b) Derive an expression for the Q factor of a wave guide explaining the terms involved.

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Code No: R05220404 **R05** **Set No. 2**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the equation of continuity for time varying fields.
   (b) Find all the relations between E and H in a uniform plane wave. Hence find the value of intrinsic independence of free space. [6+10]

2. (a) Explain uniform plane wave propagation
   (b) A lossy dielectric has an intrinsic impedance of $200\angle 30^0\Omega$ at a particular frequency. If at that frequency, the plane wave propagating through the dielectric has the magnetic field component H=10e^{-ax} cos(Wt-1/2x)ay A/m. Find α *and* δ? [8+8]

3. (a) An open-wire transmission line having $Z_0 = 650 - 12^0\Omega$ is terminated in Z_0 at the receiving end. If this line is supplied from a source of internal resistance 200Ω, calculate the reflection factor and reflection loss at the sending end terminals.
   (b) A two wire line has a characteristic impedance of 300 Ω and is to feed a 90 Ω resistor at 100 MHz. A Quarter wave line is to be used as a tube, 0.6cm in diameter .Find centre-to-centre spacing in air? [8+8]

4. (a) Find magnetic field strength, H, on the Z- axis at a point P(0,0,h), due to a current carrying circular loop, $x^2 + y^2 = A^2$ in Z=0 plane.
   (b) Find the total magnetic flux crossing a surface, $\phi = \frac{\pi}{2},\ 1 \leq \rho \leq 2\ and$ $0 \leq Z \leq 5$ due to a vector magnetic potential $\overline{A} = (-\rho^2/4).\widehat{z}$ webers/m. [8+8]

5. The parallel plate transmission line shown in figure 2 has dimensions b=4cm and d=8mm and the medium between the plates is characterized by μr=1 ∈r=20 and σ=0. neglect fields outside the dielectric. given the field H=5cos $(10^9t - \beta$z)ay A/m. use maxwells equations to find [5+5+6]
   (a) $\beta\ if\ \beta > 0$
   (b) The displacement current density at z=0
   (c) The total displacement current crossing the surface x=0.5d, $0 < y < b, 0 < z < 0.1$m in the ax direction.

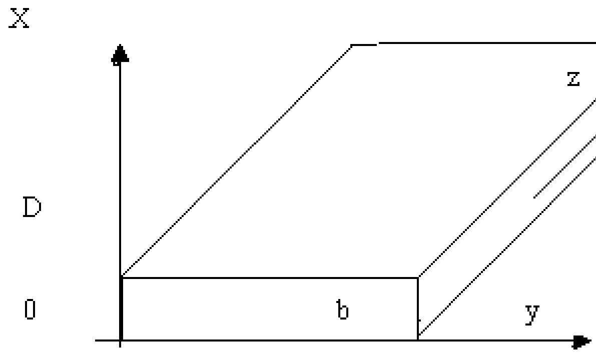

Figure 2

6. (a) Derive the relation $\lambda = \frac{\lambda_c \ \lambda_g}{\sqrt{\ \lambda_g^2 \ + \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.

   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

7. (a) Using Gauss's law derive expressions for electric field intensity and electric flux density due to an infinite sheet of conductor of charge density ρ C/cm

   (b) A parallel plate capacitance has 500mm side plates of square shape separated by 10mm distance. A sulphur slab of 6mm thickness with $\in_r = 4$ is kept on the lower plate. Find the capacitance of the set-up. If a voltage of 100 volts is applied across the capacitor, calculate the voltages at both the regions of the capacitor between the plates. [8+8]

8. (a) Determine the resultant Electric and Magnetic fields of plane wave when it is incident on a perfect conductor normally.

   (b) A plane wave traveling in a medium of $\varepsilon_r = 1, \mu_r = 1$ has an electric field intensity of $100 \times \sqrt{\pi}$V/m. Determine the energy density in the magnetic field and also the total energy density. [8+8]

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Code No: R05220404 **R05** **Set No. 4**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the resultant Electric and Magnetic fields of plane wave when it is incident on a perfect conductor normally.
   (b) A plane wave traveling in a medium of $\varepsilon_r = 1, \mu_r = 1$ has an electric field intensity of $100 \times \sqrt{\pi}$V/m. Determine the energy density in the magnetic field and also the total energy density. [8+8]

2. The parallel plate transmission line shown in figure 2 has dimensions b=4cm and d=8mm and the medium between the plates is characterized by μr=1 $\in$r=20 and σ=0. neglect fields outside the dielectric. given the field H=5cos $(10^9 t - \beta$z)ay A/m. use maxwells equations to find [5+5+6]
   (a) $\beta \ \ if \ \ \beta > 0$
   (b) The displacement current density at z=0
   (c) The total displacement current crossing the surface x=0.5d, $0 < y < b, 0 < z < 0.1$m in the ax direction.

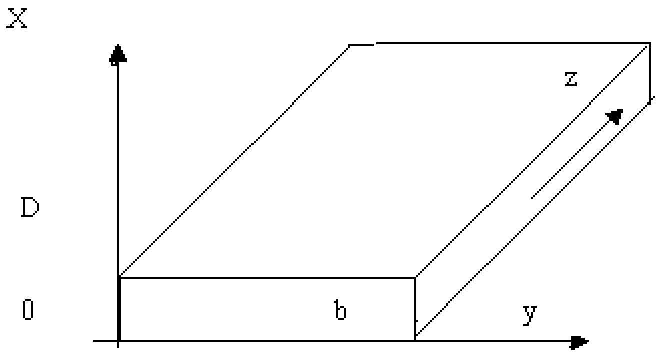

Figure 2

3. (a) Explain uniform plane wave propagation
   (b) A lossy dielectric has an intrinsic impedance of $200\angle 30^0\Omega$ at a particular frequency. If at that frequency, the plane wave propagating through the dielectric has the magnetic field component H=10e^{-ax} cos(Wt-1/2x)ay A/m. Find α *and* δ? [8+8]

4. (a) An open-wire transmission line having $Z_0 = 650 - 12^0\Omega$ is terminated in Z_0 at the receiving end. If this line is supplied from a source of internal resistance 200Ω, calculate the reflection factor and reflection loss at the sending end terminals.

(b) A two wire line has a characteristic impedance of 300 Ω and is to feed a 90 Ω resistor at 100 MHz. A Quarter wave line is to be used as a tube, 0.6cm in diameter .Find centre-to-centre spacing in air? [8+8]

5. (a) Using Gauss's law derive expressions for electric field intensity and electric flux density due to an infinite sheet of conductor of charge density ρ C/cm

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Code No: R05220404 **R05** **Set No. 1**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Determine the resultant Electric and Magnetic fields of plane wave when it is incident on a perfect conductor normally.
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3. (a) Using Gauss's law derive expressions for electric field intensity and electric flux density due to an infinite sheet of conductor of charge density ρ C/cm
   (b) A parallel plate capacitance has 500mm side plates of square shape separated by 10mm distance. A sulphur slab of 6mm thickness with $\in_r = 4$ is kept on the lower plate. Find the capacitance of the set-up. If a voltage of 100 volts is applied across the capacitor, calculate the voltages at both the regions of the capacitor between the plates. [8+8]

4. The parallel plate transmission line shown in figure 2 has dimensions b=4cm and d=8mm and the medium between the plates is characterized by μr=1 $\in$r=20 and σ=0. neglect fields outside the dielectric. given the field H=5cos $(10^9 t - \beta$z)ay A/m. use maxwells equations to find [5+5+6]
   (a) $\beta \ \ if \ \ \beta > 0$
   (b) The displacement current density at z=0
   (c) The total displacement current crossing the surface x=0.5d, $0 < y < b, 0 < z < 0.1$m in the ax direction.

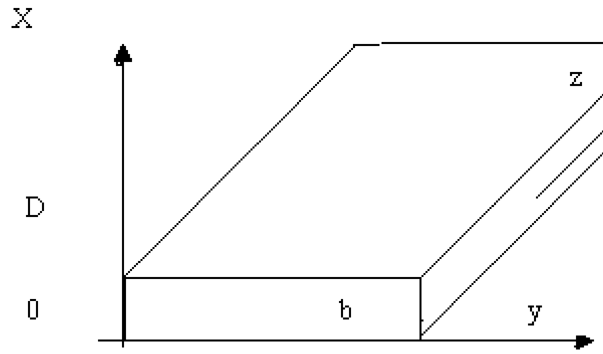

Figure 2

5. (a) Explain the equation of continuity for time varying fields.
   (b) Find all the relations between E and H in a uniform plane wave. Hence find the value of intrinsic independence of free space. [6+10]

6. (a) Derive the relation $\lambda = \frac{\lambda_c \lambda_g}{\sqrt{\lambda_g^2 + \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.
   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

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   (b) A lossy dielectric has an intrinsic impedance of $200\angle 30^0\Omega$ at a particular frequency. If at that frequency, the plane wave propagating through the dielectric has the magnetic field component H=10e^{-ax} cos(Wt-1/2x)ay A/m. Find α *and* δ? [8+8]

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Code No: R05220404 **R05** **Set No. 3**

II B.Tech II Semester Examinations,APRIL 2011
EM WAVES AND TRANSMISSION LINES
Common to Electronics And Telematics, Electronics And Communication Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the equation of continuity for time varying fields.
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2. The parallel plate transmission line shown in figure 2 has dimensions b=4cm and d=8mm and the medium between the plates is characterized by μr=1 $\in$r=20 and σ=0. neglect fields outside the dielectric. given the field H=5cos $(10^9 t - \beta$z)ay A/m. use maxwells equations to find [5+5+6]
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   (b) The displacement current density at z=0
   (c) The total displacement current crossing the surface x=0.5d, $0 < y < b, 0 < z < 0.1$m in the ax direction.

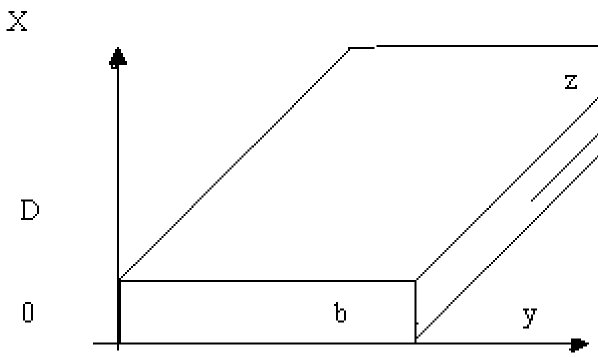

Figure 2

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