Subject Name: EMTL

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Year and Sem, Department: III/I ECE

Unit-I: (Title)

Important points / Definitions:

IMPORTANT POINTS

UNIT 1

1.The frequency at which the wave motion ceases is called Cutoff frequency.

2. A Lumped load line behaves as a Low pass filter

3. By inserting inductance in series with the line to increase the inductance is called Loading.

4. One neper is = 8.68 dB.

5. A short circuited λ/4 line can be used a Insulator

6. The range of UHF is 300 MHz to 3 Ghz

7. The loading practice is generally restricted to Cables only.

8. When a transmission line is shorted, the first voltage minimum occurs at Load

9. The center of smith chart represents Matched load impedance.

10. Attenuation factor of TEM wave is proportional to Square root. of frequency.

I.SHORT ANSWER QUESTIONS[2M]

UNIT I

Long Answer Questions

1 (a) State coulomb‘s law in vectorial form and list out its applications and limitations.

(b) A charge, Q1 = -10 nC is at the origin in free space. If the x-component of E is to be zero at the point (3, 1, 1), what charge, Qt should be kept at the point (2, 0, 0)?

2 (a) Explain the concept of electric field intensity.

(b) A point charges of 500 _c each are placed at the corners of a square of $3\sqrt{2}$ m side. The square is located in the Z = 0 plane between x □□□ $\frac{3}{\sqrt{2}}$ m in free space. Find the force on a point charges of 30 µc at (0, 0, 4) m.

3 a) State and explain Coulomb‘s Law.

b) List and explain applications integral of Gauss‘s Law.

4 A parallel plate capacitor has a plate area of separation of 5mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3mm with of 6 and the second has a thickness of 2mm with relative permittivity 4. Find the capacitance?

5 a) State and explain Gauss_s law.

b) Four concentrated charges Q1 = 0.3 µ c, Q2 = 0.2 µc, Q3 = -0.3 µc, Q4 = 0.2 µc are located at the vertices of a plane rectangle. The length of rectangle is 5 cm and breadth of the rectangle is 2 cm. Find the magnitude and direction of resultant

6 (a) Derive the concept of electric field intensity from Columb‘s law.

(b) Derive an expression for electric field intensity at any point _P‘ at a radial height _h‘ from a finite line charge of λ c/m. extending along the z-axis from 32 to 33 distance _P‘ in the x-y plane.

7 (a) State and explain Coulomb_s law of electrostatic field in vector form.

(b) It is required to hold four equal point charges to each in equilibrium at the corners of a square. Find the point charge, which will do this if placed at the center of the square.

8 (a) Explain coulomb_s law.

(b) Two small identical conducting spheres have charge of 2nC and -0.5nC respectively. When they are placed 4 cm apart what is the force between them. If they are brought into contact and then separated by 4 cm what is the force between them.

9 Define the Laplacian Equation for Cartesian coordinates and harmonic condition in a region.

Short Answer Questions

1 State coulomb‘s law in vectorial form and list out its applications and limitations

2 Define Stokes Theorem.

3 Define Gauss Law and Poisson Equation.

4 Define Electric Field Intensity

5 Give the relationship between the D and E
6 List out the application of Guass law.
7 Define Permitivity and Permeability.
8 Give the relationship between the D , V and F.

OBJECTIVE QUESTIONS:

UNIT-1

1. (1) For a good conductor

a) ζ = infinity , ζ << wε , b) ζ = 0, ζ >> wε, c) ζ =1, ζ << wε, (d) ζ = 0, μ = μ_r

(2) The skin depth or penetration depth is having expression

a) δ = 1/β (b) δ = 1/α +iβ (c) δ = 1/α (d) δ = 0

(3) A uniform plane wave propagating in a medium has E = $2e^{-az}$ sin (10^8 t - βz) ay V/m. If the medium is characterized by $\varepsilon_r = 1$, $\mu_r = 20$, and $\sigma = 3$ mhos/m, find α

(a) 61.4 Np/m, (b) 71.4 Np/m (c) 51.4 Np/m (d) 80 Np/m

(4) What is the relation between θη and θ is

(a) θη = 2θ (b) θη = θ (c) 2 θη = θ (d) 1/2 θη = θ

(5) The displacement current is expressed by

(a) $I_d = \int J_d \cdot ds$ (b) $I_d = J_d .ds$ (c) $I_d = dJ_d / dt$ (d) $I_d = J_d / ds$

(6) The wavelength can be expressed as

(a) λ =2πβ (b) λ =2π/β (c) λ =2π/c (d) λ = β/2π

(7) A standing wave

a) Progresses with less than light velocity b) progresses with more than light velocity

c) progresses with equal to light velocity d) does not progress.

(8) The range of reflection coefficient is

a) 0 to 1 b) 0 to infinity c) -1 to 1 d) 1 to infinity

(9) As per the boundary condition,

a) The normal component of E is continuous across the boundary.

b) The tangential component of E is continuous across the boundary.

c) The tangential component of D is continuous across the boundary.

d) The normal component of H is continuous across the boundary

10. Hysteresis and eddy current losses in loading coils leads to

a) Increase in L b) Decrease in L c) Increase in R d) decrease in R

UNIT 2
IMPORTANT POINTS

1.The relation between E and H in any medium

2) The value of intrinsic impedance of free space is 377Ω
3) In a perfect dielectric medium attenuation constant is Zero

4) The loss tangent value for a good conductor is (σ/ωε)>>1

5) A wave propagating in a conducting medium attenuation constant and phase constant

values

6) The conductivity of silver is 3x106 mho/m.If the skin depth is 1mm, the frequency is 84.43kHz

7) the expression for reflection coefficient of a perfect dielectic surface when the wave incident normal to the boundary is TR =(η2-η1)/(η2+η1)

8) The Poynting vector physically denotes the power density leaving or entering a given volume in a time-varying field

9) Brewster angle θB when the wave is parallally polarized is

10) Critical angle θc for the total internal reflection is

Long Answer Questions

1 A conducting filament carries current I from point A (0, 0, a) to point B(0, 0, b). show that at point P(x, y, 0).

$$H = \frac{1}{4\pi\sqrt{x^2+y^2}}\left[\frac{b}{\sqrt{x^2+y^2+b^2}} - \frac{a}{\sqrt{x^2+y^2+a^2}}\right] a_\phi$$

An infinitely long conducting filament is placed along the x axis and carries current 10 mA in the a_x direction. Find H at (-2, 3, 3).

2 Write down the Maxwell's equations for Static Electric and Magnetic fields with remarks

3 Write the short notes on Biot Savart's Law and Ampere's Circuit Law

with required equations.

4 Derive the third Maxwell equation using Ampere's Law and explain two applications of Ampere's Law.

5 Derive with neat diagram the special case of BIOT SAVART Law when the conductor is infinite in length

6 Calculate H at (3m, -6m, 2m) due to a current element of length 2 mm located at the origin in free space that carries current 16 mA in the +y direction

7 (a) Describe the characteristics of vector magnetic potential.
(b) If the vector magnetic potential with in a cylindrical conductor of radius _a‘

$A = \frac{\mu_o I r^2}{4\pi a^2} a_z$, find H.

8 A conductor of length 100 cm moves at right angles to uniform field of strength 10000 lines per cm^2 with a velocity of 50 m/s. Calculate emf induced in it when the conductor moves at an angle 300 to the direction of the field.

9 a) Explain behavior of conductors in an electric field.
b) A dipole at the origin in free space has P = 95Πε $_0$U z C-m. Find (a) V at P(x.y,z) in Cartesian coordinate.
c) E at P(x,y,z) in Cartesian coordinate.

10 a) Explain the concept of electric field intensity.

b) A point charges of 500 μC each are placed at the corners of a square of m side. The square is located in the Z = 0 plane

between m in free space. Find the force on a point charges of 30 μC at (0, 0, 4) m.

11 a) Derive an expression for the electric field intensity due to an infinite length line charge along the z-axis at an arbitrary point Q (x, y, z).

b) A charge of -0.3μC is located at A (25, -30, 15) Cm and a second charge of 0.5 μ C is located at B (-10, 8, 12) Cm. Find the electric field strength, E at: i. The origin and ii. Point P (15, 20, 50) cm.

12 Establish Gauss Law in point form and integral form hence deduce the Laplace_s and Poissions_s equations.

13 Show that the torque acting on an dipole of movement p due to an electric field E is p×E Compute the torque for a dipole consisting of 1 μc charges in an electric field E = 103 (z a_x − a_y − a_z) separated by 1 mm and located on the z-axis at the origin.

14 (a) Prove the Maxwell‘s equation .B 0 .
(b) If H = 10 cos (10^{10}t − βx) a_z A/m, find B, D, E and β when μ =

□□ 1.2□10□10 *F*
2×10^{-5} H/m / *m* , ζ = 0.

15 A parallel plate capacitor has a plate area of 1.5 sq.m and a plate separation of 5mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3mm with a relative permittivity of 6 and the second has a thickness of 2mm with relative permittivity 4. Find the capacitance?

16 a) Derive an expression for Ohm's Law in Point form.

b) Find the relative permittivity of dielectric material used in parallel capacitor if C =45nF, d = 0.4mm and S =0.35 m^2. (b) d = 0.6 mm, E =700 kv/m and ρ =35 μ C/m 2, D =75 μC/m 2 and energy density is 35 J/m ^{3}.

17 (a) Using Ampere's Circuital law, find the magnetic field intensity in the case of a closely wound torroidal coil.

(b) A single-phase circuit comprises two parallel conductors A and B, each 1 cm diameter and spaced 1 m apart. The conductors carry currents of +100 and -100 amps respectively. Determine the field intensity at the surface of each conductor and also in space exactly midway between A and B.

18 (a) Explain duality between D and J

(b) Find the total current in a circular conductor of radius 4 mm if the

current density varies according to J = 104A/m2.

19 A parallel plate capacitor has a plate area of 1.5 sq.m. and a plate

separation of 5 mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3 mm with a relative permittivity of 6 and the second has a thickness of 2 mm with relative permittivity 4.Find the capacitance. Derive the formula uses.

20 (a) For a pure dipole paz C- m at the origin in free space, find the potential at a point A

(b) What is the electric field at (x=0,y=0,z=5m) due to a pure dipole $1a_z$ μc-m at the origin?

21 Calculate the capacitance of a parallel plate capacitor with following details.

Plate area = 150 sq.cm. Dielectric εr1 = 3, d12 = 4mm Dielectric εr2 = 5, d12 = 6 mm. If 200 V is applied across the plates what will be the voltage gradient across each dielectric.

Short Answer Questions

1 Define the magnetic field dH at point due to current element I dI.
2 Name three boundary conditions related to materials.
3 Define the Maxwell equations in integral form.
4 State the BIOT-SAVART'S Law (dH or H) in Line and surface current.
5 Define Maxwell equations in the Differential form.
6 Name two applications of AMPERE'S Law in symmetrical conditions
7 Describe Conductor Dielectric Boundary Condition.
8 Define continuity equation and derive relaxation time equation?

MULTIPLE CHOICE

1. Transverse magnetic (TM) waves have
   a. Magnetic field component H in the direction of propagation
   b. Electric field component E in the direction of propagation
   c. Magnetic field component H in the direction of propagation and no component of electric field E in this direction
   d. Electric field component E in the direction of propagation and no component of magnetic field H in this direction.

2. The velocity of electromagnetic wave in a good conductor is

   a. 3×10^8 m/s b. more than 3×10^8 m/s c. very low d. High

3. A uniform plane wave is one in which

   a x = 0 b . c. and are perpendicular d and lie in a plane

4. The Depth of penetration of EM wave in medium having conductivity ζ at a frequency of 1
   MHz is 25 cm. The depth of penetration at a frequency of 4 MHz will be

   A. 6.25 cm B. 12.50 cm C. 50 cm D. 100 cm

5. In a 100 turn coil, if the flux through each turn is $(t^3 - 2t)mW_b$, the magnitude of the induced emf in the coil at a time of 4 sec is

   A. 46 mV B. 56 mV C. 4.6 V D. 5.6 V

6. In a conductor which of the following relations hold good?

   A. ∇ x D = r B. ∇ . D = r C. ∇ x D = 0 D. ∇ . D = 0

7. A material has conductivity of 10^{-2} mho/m and a relative permittivity of 4. The frequency at which conduction current in the medium is equal to displacement current is

   A.45 MHz B.90 MHz C.450 MHz D. 900 Mhz

8. For static magnetic field Maxwell's curl equation is given by

   A. $\nabla \cdot \vec{B} = \mu_0 \vec{J}$ B. $\nabla \times \vec{B} = 0$ C. $\nabla \times \vec{B} = \mu_0 \vec{J}$ D. $\nabla \times \vec{B} = \mu_0 / \vec{J}$

9.Which one of the following statement is not a correct for a plane wave with $\vec{H} = 0.5e^{-0.1x}$ cos $(10^6 t$ - $2x)a_z$ A/m

A. The wave frequency is 10^{-6} r.p.s.
B. The wavelength is 3.14 m
C. The wave travels + x direction
D. Wave is polarized in the z direction.

10. A uniform plane wave is one in which
A. x = 0 B. . C. and are perpendicular, D. and lie in a plane

UNIT 3

1. An electromagnetic wave is incident at air-conductor interface. If impedance of the conductor is 120π, the ratio of transmitted and incident electric fields is 2

2. The critical angle for a wave propagating from Teflon (εr=4) into free space is 30˚

3. The orientation of the electric field with respect to the plane of incidence determines Polarization
of a wave at the interface between two different regions.

4. When the free-space wavelength of a signal equals the cutoff wavelength of the guide, the phase velocity of the signal becomes infinite

5. The wave impedances for waves between parallel planes are functions of frequency

6. A line is of a length ‘l’ has characteristic impedance ‘Zo’. The line is cut into half. The value of characteristic impedance becomes Zo

7. Impedance inversion may be obtained with Quarter wave line

8. The velocity factor of a transmission line depends on the dielectric constant of the material used

9. In a transmission line, the attenuation is given as 0.3dB/km. After 10km the power will be 0.5 of input power

10. In electromagnetic waves, polarization is due to the transverse nature of the waves

Long Answer Questions

1 (a) Derive expression for attenuation constant of EM wave.

(b) A medium like copper conductor which is characterized by the parameters ζ =5.8 × 10^7 mho/m, ϵ_r = 1, μ_r = 1 supports a uniform plane wave of frequency 60 Hz. Find attenuation constant, propagation constant, Intrinsic impedance, wavelength

2 Explain the concept of vector magnetic potential and derive the expression for the same.

3 a) Explain the relationship between magnetic flux and magnetic flux density.

b) State and prove Maxwell‘s Divergence equation for static magnetic field.

4 A conductor of length 100 cm moves at right angles to uniform field of strength 10000 lines per cm^2 with a velocity of 50 m/s. Calculate emf induced in it when the conductor moves at an angle 300 to the direction

of the field.

5 A steady current of 10 A is established in a long straight hollow aluminum conductor having inner and outer radius of 1.5 cm and 3 cm respectively. Find the value of B as function of radius. Also define the law used.

6

A conductor of length 4m, with current held at 10A in the

laid along the y - axis between

, T find the work done in moving the conductor parallel to itself at constant speed to x = y = 2m. Derive the formula

7 A conductor is in the form of a Regular polygon of n sides inscribed in a circle of radius R. Show that the expression for B at the center for a

current is given by

8 Two narrow circular coils A and B have a common axis and are placed 10 cms apart. Coil A has 10 turns of radius 5cm with a current of 1A passing through it.Coil B has a single turn radius 7.5 cm magnetic field at the centre of coil A is to be zero, what current should be passed through coil B.

9 Explain the wave propagation in Lossy Dielectric.

10 Explain and elaborate the conditions of Lossless Dielectrics and free space.

Short Answer Questions

1 Define skin depth with illustration of waveform.

2 Give the general expression of □ , □ , □ in wave propagation.

3 Express Intrinsic Impedance in wave propagation and give relation between E and H.

4 Write short notes on plane waves in good conductor.

5 A plane wave in a nonmagnetic medium has E □ $50\sin(10^8 t$ □ $2z)\, a_y$ V/m. Find direction of wave propagation, □, f .

6 Define Poynting's Theorem and give expression of time average Poynting Vector.

MULTIPLE CHOICE

1.E*V

Which of the following relations is valid

2. If ∇ ∇ ∇ ∇

A. x x = (.) - ^{2} A, B. x x = (x) - 2 A

) D. none of the above

the electric field intensity associated with a uniform plane electromagnetic wave travelling in a perfect dielectric medium is given by E(z, t) = 10 cos (2p x $10^7 t$ - 0.1 pz) volt/metre, then the velocity of the travelling wave is

A.3.0 x 10^8 m/sec B.2 x 10^8 m/sec C.6.28 x 10^7 m/sec D.2 x 10^7 m/sec

3. The intrinsic impedance of free space
   A. increases with increase of frequency C. is independent of frequency
   B. decreases with increase of frequency D. None

4. For a good conducting medium the intrinsic impedance is

   A. ζωμ ∠p/2 B. ωμ /ζ ∠45° C. ωμ/ζ ∠p/2 D. ωμ/ζ ∠ 0°

5. A uniform wave have components
   A. in the perpendicular direction E existing while H is zero
   B.in the direction of propagation E existing while H is zero
   C.E and H are zero in direction perpendicular to direction of propagation
   D.E and H existing only in direction perpendicular to direction of propagation

6. The electric flux and field intensity inside a conducting sphere is

   A. minimum B. Maximum C. Uniform D. Zero

7. Curl of gradient A is

   A.∇ x (∇ A) = 1 B.∇ x (∇ A) = ∞ C.∇ x (∇ A) = 0 D.∇ x (∇ A) = - ∞

8. For a plane good conductor, skin depth varies

   A. directly as square root of permeability B. directly as square root of frequency
   C. inversely as permittivity D.inversely as square root of conductivity

9. The attenuation factor a and phase shift factor β for a wave propagated in a good dielectric

   having $\frac{\sigma}{\omega\varepsilon} >> 1$ are given by

   A. a = $\frac{\sigma}{2}$μ/ε , β = ωμ/εB.a = β = $\frac{\sigma}{2}$μ/εC.a = μ/ε , β = ωμ/ε D.a = β = ωμ/ε

10. A time varying magnetic field produces…………………….. field

UNIT 4

1.The relation between E and V in any medium is ____________

2) The value of intrinsic impedance of free space is 377Ω

3) In a perfect dielectric medium attenuation constant is Zero

4) The loss tangent value for a good conductor is (σ/ωε)>>1

5) A wave propagating in a conducting medium attenuation constant and phase constant values are_____________

6) The conductivity of silver is 3x106 mho/m.If the skin depth is 1mm,find the frequency? 84.43kHz

7)The range of UHF is 300 MHz to 3 Ghz

8). The loading practice is generally restricted to Cables only.

9). When a transmission line is shorted, the first voltage minimum occurs at Load

10). The center of smith chart represents Matched load impedance.

Long Answer Questions

1 Obtain the general solution of Transmission line?

2 Explain about waveform distortion and distortion less line condition?

3 Explain about reflection loss?

4 Discuss in details about inductance loading of telephone cables and derive the attenuation constant and phase constant andvelocity of signal transmission (v) for the uniformly loaded cable?

5 Derive the equation of attenuation constant and phase constant of TL in terms of R,L, C, G?

6 Explain in details about the reflection on a line not terminated in its characteristic impedance (z0)?

7 Explain in following terms

(i) Reflection factor (ii) Reflection loss (iii) Return loss

8 Explain about physical significance of TL?

9 Derive the equation for transfer impedance?
10 Derive the expression for input impedance of lossless line?
11 Explain about telephone cable?

Short Answer Questions

1 What is group velocity?

2 What is patch loading?
3 What do you understand by loading of transmission lines?

4 Define Characteristic impedance?
5 What is frequency distortion?
6 Calculate the load reflection coefficient of open and short circuited lines?

7 Calculate the characteristic impedance for the following line arameters
R = 10.4 ohms /km L = 0.00367 H/km
C = 0.00835μf /km G = 10.8x10-6 mhos /km
8 Define phase distortion?

9 Write the equation for the input impedance of a TL?
10 Define propagation constant?
11 Write the condition for a distortion less line?
12 When does reflection take place on a TL?
13 What is transfer impedance? State its expression?
14 What is difference between lumped and distributed parameters?
15 Draw the equivalent circuit of a TL?
16 Write the Campbell‘s formula for propagation constant of a loaded line?

17 What is the need for loading?

18 Define reflection factor?
19 Define reflection loss?
20 What is meant by reflection co – efficient?
21 State the properties of infinite line?

MULTIPLE CHOICE

1. Ex = cos(ωt +βz) represents a wave travelling in the ___________________

(a)-ve x-direction (b)+ve x-direction (c)+ve z-direction (d)-ve z-direction

2.An electromagnetic wave is to pass through an interface separating two media having dielectric constants ε_1 and ε_2 respectively. If $\varepsilon_1 = 4\varepsilon_2$, the wave will be totally reflected if angle of incidence is

(a) 0^0 (b) 30^0 (c) 45^0 (d) 60^0

3. The Snell's law of refraction gives -------------

(d)) (2 *EHx*

(a) E x H (b) *B* • ∇ *D* (c) *B* • ∇ *D* • ∇ ∇ ∇

5. When electromagnetic waves are reflected at an angle from a wall, their wavelength along the wall is

(a) shortened because of the Doppler effect (b) the same as in free space

(c) greater than in the actual direction of propagation (d) same as the wavelength perpendicular to the wall

At the cut-off wave length, the wave between the walls of parallel plane guide

(a) is travel almost parallel to the axis of the guide

(b) is travel perpendicular to the axis of the guide

(c) is travel in zig-zag path (d) has no wave motion

If the time dependence of voltage is given as e^{-jwt} , then $V_o e^{-\gamma z}$ will represent

(a) forward travelling wave (b) backward travelling wave (c) standing wave

(d) refracted wave

A lossless line of length 500m has L=10µH/m and C=0.1pF/m at 1 MHz. The electrical Length of the line is

(a) 360^0 (b) 270^0 (c) 180^0 (d) 90^0

For an open circuited line which is not true

(a) Zin = -jZo cotβl (b) 1 = Γ (c) 1 = Γ 1 1 = Γ 1 (d) S = ∞

10. Short-circuited stubs are preferred to open-circuited stubs because the latter are

(a) more difficult to make and connect

(b) made of a transmission line with a different characteristic impedance

(c) liable to radiate (d) incapable of giving a full range of reactances

UNIT 5

1) SMITH CHART

2) R AND X

Long Answer Questions

1 Explain about half wave transformer?

2 Application of smith chart?

3 Explain about voltage and current waveform of dissipation less line?

4 Derive the expression for the input impedance of the dissipation less line and the expression for the input impedance of a quarter wave line. Also discuss the application of quarter wave line?

5 Explain single stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?

6 Design a single stub match for a load of 150+j225 ohms for a 75 ohms line at 500 MHz using smith chart?

7 A 30 m long lossless transmission line with characteristic impedance (zo) of 50 ohm is terminated by a load impedance (ZL) = 60 + j40 ohm. The operating wavelength is 90m. find the input impedance and SWR using smith chart?

8 Explain double stub matching on a transmission line and derive the expression and the length of the stub used for matching on a line?

9 Explain about Lamda/ 8 wave transformer?

10 Explain about properties of smith chart?

Short Answer Questions

1 Name few applications of half – wave line?

2 Find the VSWR and reflection co – efficient of a perfectly matched line with no Reflection from load?

3 Explain the use of quarter wave line for impedance matching?

4 What is the need for stub matching in transmission lines?

5 Why do standing waves exist on TL?

6 Define Node and antinodes?

7 What are constant S circles?

9 What are the advantages of double stub matching over single stub

matching?

11 Derive the relationship between standing wave ratio and reflection co – efficient?

12 Explain the use of quarter wave line for impedance matching?

13 Write the expression for the characteristic impedance Ro‘ of the matching quarter –wave section of the line?

14 Give the applications of smith chart?

15 Define standing wave ratio?

16 Give the analytical expression for input impedance of dissipation less line?

17 Design a quarter wave transformers to match a load of 200 to a source resistance of 500. The operating frequency is 200 MHz?

18 Define skin effect?

MULTIPLE CHOICE

1. (Nov 1998) What determines the velocity factor in transmission line ?

a) The termination impedance b) The center conductor resistivity

c) Dielectrics in the line d) The termination impedance

2. A transmission line has a capacitance of 25 pF / ft. and an inductance of 0.15 mH / ft. Determine the characteristic impedance of the line.

a) 100 W b) 75 W c) 77.5 W d) 50 W

3. What is the impedance of most waveguide?

a) 300 ohms b) 75 ohms c) 600 ohms d) 50 ohms

4. Who developed the Smith Chart?

a) James N. Smith b) Philip S. Char c) Philip H. Smith d) Gunn Chart

5. The ratio of incident and reflected voltage waves representing transmission and reflection coefficients used to characterize a linear microwave device.

a) Z Parameter b) Y Parameter c) S Parameter d) H Parameter

6. An open circuit line greater than wavelength L/4 but less than wavelength L/2 in length will exhibit
_____ reactance.

a) capacitive b) minimum c) inductive d) maximum

7. How can SWR be minimized?

a) using filters b) using limiter c) using Smith Chart d) using stubs

8. What is a short (< l/4) length of transmission line, shorted at one end and attached at the appropriate distance from the load for the purpose of matching a complex load to the transmission line?

a) quarter-wave transformer b) stub c) balun d) network