S V COLLEGE OF ENGINEERING:: Tirupati

Subject: Electromagnetic Theory & Transmission Lines

Unit – 1

1. The First law in electrostatics to find the force of a point charge is …. [a]

   a) Coulomb's Law b) Gauss's Law c) Divergence Theorem d) Stoke's Theorem

2. The force per unit charge is called…… [c]

   a) Electric field intensity b) Electric field strength c) Both a and b d)None

3. The Electric flux density, D is …… [b]

   a) Dependent of medium b) Independent of medium c) Both a & b d) None

4. Conductors are also called as……. [c]

   a) Insulators b) Dielectrics c) Metals d) Both a & b

5. Non-Conductors are also called as……. [d]

   a) Insulators b) Dielectrics c) Metals d) Both a & b

6. The materials having $\sigma << 1$ are called…… [b]

   a) Conductors b) Non-Conductors c)Both a & b d) None

7. The materials having $\sigma >> 1$ are called…… [a]

   a) Conductors b) Non-Conductors c) Both a & b d) None

8. The following are the two fundamental quantities in Electric Fields [c]

   a) Voltage b) Current c) Both a & b d) None

9. Current is ……quantity [b]

   a) Scalar b) Vector c) Both a & b d) None

10. The following are the types of current densities that can exist [d]

    a) Convection b) Conduction c) Displacement d) All the above

11. Biot-Savart's Law is similar to…….. [c]

a) Ampere's law. b) Gauss's law c) Couloumb's law. d) Lorentz law.

12. Convert the point (3,4,5) from Cartesian to spherical coordinates……. [a]

a) $(7.07,45^{\circ},53^{\circ})$ b) $(0.707,45^{\circ},53^{\circ})$ c) $(7.07,54^{\circ},63^{\circ})$ d) $(0.707,54^{\circ},63^{\circ})$

13. Example of spherical system in the following is…….. [a]

a) Charge in space b) Charge in box c) Charge in dielectric d) Uncharged system

14. Line integral is used to calculate…….. [d]

a) Force b) Area c) Volume d) Length

15. Find potential b/w A(-7,2,1) & B(4,1,2). Given E = $(-6y/x^2)i+(6/x)j+5k$. [a]

a) -8.014 b) -8.114 c) -8.214 d) -8.314

16. Find the force between 2C and -1C separated by a distance 1m in air(in newton). [b]

a) 18 X 10^6 b) -18 X 10^6 c) 18 X 10^{-6} d) -18 X 10^{-6}

17. For a charge Q1, the effect of charge Q2 on Q1 will be…….. [b]

a) F1 = F2 b) F1 = -F2 c) F1 = F2 = 0 d) F1 & F2 not equal

18. Find the electric field intensity of two charges 2C and -1C separated by distance 1m in air is [b]

a)18X10^9 b)9X10^9 c)36X10^9 d) -18 X 10^9

19. The electric flux density is the…… [a]

a) Product of permittivity and electric field intensity

b) Product of number of flux lines and permittivity

c) Product of permeability and electric field intensity

d) Product of number of flux lines and permeability

20. $\nabla^2 V = 0$ is [a]

a) Lapalacian eq. b. Poisson eq. c. Gauss law d. amperes law

21. Choose the best definition of a dipole. [c]

a) A pair of equal and like charges located at the origin

b) A pair of unequal and like charges located at the origin

c) A pair of equal and unlike charges separated by a small distance
d) A pair of unequal and unlike charges separated by a small distance

22. The cross product of the vectors 3i + 4j – 5k and –i + j – 2k is, [b]
a) 3i – 11j + 7k
b) -3i + 11j + 7k
c) -3i – 11j – 7k
d) -3i + 11j – 7k

23. The del operator is called as [d]
a) Gradient
b) Curl
c) Divergence
d) differential operator

24. The Laplacian operator is actually [b]
a) Grad(Div V)
b) Div(Grad V)
c) Curl(Div V)
d) Div(Curl V)

25. The Cartesian system is also called as [b]
a) Circular coordinate system
b) Rectangular coordinate system
c) Spherical coordinate system
d) Space coordinate system

26. The volume of a parallelepiped in Cartesian is [a]
a) dV = dx dy dz
b) dV = dx dy
c) dV = dy dz
d) dV = dx dz

27. The H quantity is analogous to which component in the following? [c]
a) B
b) D
c) E
d) V

28. Coulomb is the unit of which quantity? [b]
a) Field strength
b) Charge
c) Permittivity
d) Force

29. The cylindrical coordinate system is also referred to as [b]
a) Cartesian system
b) Circular system

c) Spherical system
d) Space system

30. A charge located at point p $(5,30^0,2)$ is said to be in which coordinate system? [b]
a) Cartesian system
b) Cylindrical system
c) Spherical system
d) Space system

31. 7. A vector is said to be solenoidal when its [a]
a) Divergence is zero
b) Divergence is unity
c) Curl is zero
d) Curl is unity

UNIT -2

MAGNETO STATICS

1. Biot Savart law in magnetic field is analogous to which law in electric field?

a) Gauss law

b) Faraday law

c) Coulomb's law

d) Ampere law

Answer: **C**

Explanation: Biot Savart law states that the magnetic flux density $H = I.dl \sin\theta/4\pi r^2$, which is analogous to the electric field $F = q1q2/4\pi\varepsilon r^2$, which is the Coulomb's law.

2. The magnetic field intensity will be zero inside a conductor. State true/false.

a) True

b) False

Answer: **B**

Explanation: Electric field will be zero inside a conductor and magnetic field will be zero outside the conductor. In other words, the conductor boundary, E will be maximum and H will be minimum.

3. The divergence of which quantity will be zero?
   a) E
   b) D
   c) H
   d) B

   Answer: **D**

Explanation: The divergence of the magnetic flux density is always zero. This is because of the non existence of magnetic monopoles in a magnetic field.

4. Find the Maxwell equation derived from Faraday's law.
   a) Div(H) = J
   b) Div(D) = I
   c) Curl(E) = -dB/dt
   d) Curl(B) = -dH/dt

   Answer: **C**

   Explanation: From the Faraday's law and Lenz law, using Stoke's theorem, we get Curl(E) = -dB/dt. This is the Maxwell's first law of electromagnetics.

5. Find the Maxwell law derived from Ampere law.
   a) Div(I) = H
   b) Div(H) = J
   c) Curl(H) = J
   d) Curl(B) = D

Answer: **C**

Explanation: From the current density definition and Ohm's law, the Ampere circuital law Curl(H) = J can be derived. This is Maxwell's second law of electromagnetics.

6. Ampere law states that,

a) Divergence of H is same as the flux

b) Curl of D is same as the current

c) Divergence of E is zero

d) Curl of H is same as the current density

Answer: **D**

Explanation: Ampere circuital law or Ampere law states that the closed integral of the magnetic field intensity is same as the current enclosed by it. It is given by Curl(H) = J.

7. Identify which of the following is the unit of magnetic flux density?

a) Weber

b) Weber/m

c) Tesla

d) $Weber^{-1}$

Answer: **C**

Explanation: The unit of magnetic flux density is $weber/m^2$. It is also called as tesla.

8. The divergence of H will be

a) 1

b) -1

c) ∞

d) 0

Answer: **D**

Explanation: We know that the divergence of B is zero. Also B = μH. Thus divergence of H is also zero

9. If ∫ H.dL = 0, then which statement will be true?
   a) E = -Grad(V)
   b) B = -Grad(D)
   c) H = -Grad(Vm)
   d) D = -Grad(A)

   Answer: **C**

Explanation: The given condition shows that the magnetic field intensity will be the negative gradient of the magnetic vector potential.

10. The magnetic vector potential is a scalar quantity.
    a) True
    b) False

Answer: **B**

Explanation: The magnetic vector potential could be learnt as a scalar. But it is actually a vector quantity, which means it has both magnitude and direction.

11. The value of ∫ H.dL will be
    a) J
    b) I
    c) B
    d) H

    Answer: **B**

Explanation: By Stoke's theorem, ∫ H.dL = ∫ Curl(H).dS and from Ampere's law, Curl(H) = J. Thus ∫ H.dL = ∫ J.dS which is nothing but current I.

12. The magnetic vector potential for a line current will be inversely proportional to
    a) dL
    b) I
    c) J
    d) R

Answer: **D**

Explanation: The magnetic vector potential for the line integral will be $A = \int \mu IdL/4\pi R$. It is clear that the potential is inversely proportional to the distance or radius R.

13. The current element of the magnetic vector potential for a surface current will be

    a) J dS

    b) I dL

    c) K dS

    d) J dV

Answer: **C**

Explanation: The magnetic vector potential for the surface integral is given by $A = \int \mu KdS/4\pi R$. It is clear that the current element is K dS.

14. The energy of a coil depends on the turns. State True/False.

    a) True

    b) False

Answer: **A**

Explanation: The inductance is directly proportional to square of the turns. Since the energy is directly proportional to the inductance, we can say both are dependent on each other.

15. The magneto statics highly relies on which property?

    a) Resistance

    b) Capacitance

    c) Inductance

    d) Moment

Answer: **C**

Explanation: The magneto statics highly relies on the inductance of the magnetic materials, which decides its behavior in the influence of magnetic field.

16. The inductance is the measure of

    a) Electric charges stored by the material

    b) Emf generated by energising the coil

c) Magnetic field stored by the material

d) Magnetization of dipoles

Answer: **B**

Explanation: The inductance is a property of an electric conductor/coil which measures the amount of emf generated by passing current through the coil.

17. Which of the following relation will hold good?

    a) $D = \mu H$

    b) $B = \varepsilon E$

    c) $E = \varepsilon D$

    d) $B = \mu H$

Answer: **D**

Explanation: The magnetic flux density is the product the permeability and the magnetic field intensity. This statement is always true for any material (permeability).

18. Find the force experienced by an electromagnetic wave in a conductor?

    a) Electrostatic force

    b) Magneto static force

    c) Electro motive force

    d) Lorentz force

Answer: **D**

Explanation: The electromagnetic wave experiences Lorentz force which is the combination of the electrostatic force and magneto static force. It is given by $F = QE + Q(V \times B)$.

19. When the electric field travels in +x direction and the EM wave is travelling the –y direction, then the magnetic field will be travelling in which direction?

    a) +z direction

    b) –z direction

    c) Either +z or –z direction

    d) Does not travel

Answer: **C**

Explanation: The electric field and magnetic field will always travel perpendicular to each other and the EM wave will travel perpendicular to both these fields. In the given condition when E travels in +x direction and wave in –y direction, then the H field that is perpendicular to both components will be travelling in either +z or –z direction.

20. The torque expression of a current carrying conductor is

    a) $T = BIA \cos \theta$

    b) $T = BA \cos \theta$

    c) $T = BIA \sin \theta$

    d) $T = BA \sin \theta$

Answer: **C**

Explanation: The torque is given by the product of the flux density, magnetic moment IA and the sine angle of the conductor held by the field. This gives $T = BIA \sin \theta$.

21. In a static magnetic field only magnetic dipoles exist. State True/False.

    a) True

    b) False

Answer: **A**

Explanation: From Gauss law for magnetic field, we get divergence of the magnetic flux density is always zero (ie, Div(B) = 0). This implies the non-existence of magnetic monopole.

22. The time varying electric field E is conservative. State True/False.

    a) True

    b) False

Answer: **B**

Explanation: The time varying electric field E(t) is not a closed path. Thus the curl will be non-zero. This implies E(t) is not conservative and the statement is false.

23. When the conduction current density and displacement current density are same, the dissipation factor will be

    a) Zero

b) Minimum

c) Maximum

d) Unity

Answer: **D**

Explanation: Dissipation factor refers to the tangent of loss angle. It is the ratio of conduction current density to displacement current density. When both are same, the loss tangent or the dissipation factor will be unity.

24. The Ampere law is based on which theorem?

a) Green's theorem

b) Gauss divergence theorem

c) Stoke's theorem

d) Maxwell theorem

Answer: **C**

Explanation: The proof of the Ampere's circuital law is obtained from Stoke's theorem for H and J only.

25. When the rotational path of the magnetic field intensity is zero, then the current in the path will be

a) 1

b) 0

c) ∞

d) 0.5

Answer: **B**

Explanation: By Ampere law, Curl(H) = J. The rotational path of H is zero, implies the curl of H is zero. This shows the current density J is also zero. The current is the product of the current density and area, which is also zero.

26. The torque of a conductor is defined only in the case when

a) The field is perpendicular to the loop

b) The plane of the loop is parallel to the field

c) The plane of the loop is perpendicular to the current direction

d) The field and the current direction are same

Answer: **B**

Explanation: The torque of a conductor is given by T = NBIA. This equation of the conductor is valid only when the plane of the loop is parallel to the magnetic field applied to it.

27. In which of the following forms can Maxwell's equation not be represented?

a) Static

b) Differential

c) Integral

d) Harmonic

Answer: **A**

Explanation: Maxwell equations can be represented in differential/point form and integral form alternatively. Sometimes, it can be represented by time varying fields called harmonic form.

28. The charge build up in the capacitor is due to which quantity?

a) Conduction current

b) Displacement current

c) Convection current

d) Direct current

Answer: **B**

Explanation: The charge in the capacitor is due to displacement current. It is the current in the presence of the dielectric placed between two parallel metal plates.

29. The H quantity is analogous to which component in the following?

a) B

b) D

c) E

d) V

Answer: **C**

Explanation: The H quantity refers to magnetic field intensity in the magnetic field. This is analogous to the electric field intensity E in the electric field.

30. The magnetic flux density is directly proportional to the magnetic field intensity. State True/False.

    a) True

    b) False

Answer: **A**

Explanation: The magnetic field intensity is directly proportional to the magnetic field intensity for a particular material (Permeability). It is given by $B = \mu H$.

31. The divergence of H will be

    a) 1

    b) -1

    c) ∞

    d) 0

Answer: **D**

Explanation: We know that the divergence of B is zero. Also $B = \mu H$. Thus divergence of H is also zero.

32. The magnetic moment and torque are related as follows

    a) T = BM

    b) B = TM

    c) M = TB

    d) T = M

Answer: **A**

Explanation: The torque is defined as the product of the magnetic flux density and the magnetic moment. It is given by T = BM, where M = IA is the magnetic moment.

33. The Laplacian of the magnetic vector potential will be

a) –μ J

b) – μ I

c) –μ B

d) –μ H

Answer: **A**

Explanation: The Laplacian of the magnetic vector potential is given by $Del^2(A) = -\mu J$, where μ is the permeability and J is the current density.

34. The relation between flux density and vector potential is

a) B = Curl(A)

b) A = Curl(B)

c) B = Div(A)

d) A = Div(B)

Answer: **A**

Explanation: The magnetic flux density B can be expressed as the space derivative of the magnetic vector potential A. Thus B = Curl(A).

35. Using Maxwell equation which of the following cannot be calculated directly?

a) B

b) D

c) A

d) H

Answer: **C**

Explanation: The Maxwell equations can be used to compute E,H,D,B and J directly. It is not possible to find the magnetic vector potential A directly.

36. In a magnetic material, always there exist magnetic dipoles as well as monopoles. State True/False.

a) True

b) False

Answer: **B**

Explanation: A magnetic material possesses only magnetic dipoles. The absence of magnetic monopoles is indicated by the equation Div(B) = 0.

37. Identify the devices that do not use electromagnetic energy.

a) Television

b) Washing machine

c) Microwave oven

d) Mobile phones

Answer: **B**

Explanation: Television and mobile phones use the electromagnetic waves as signals. Microwave ovens generate electromagnetic waves (microwaves) for heating the food. Washing machine does not use any EM wave for its operation.

38. Which type of flux will increase the inductance?

a) Series aiding

b) Series opposing

c) Shunt aiding

d) Shunt opposing

Answer: **A**

Explanation: The series aiding flux will give maximum inductance to a circuit compared to any other fluxing techniques. This is because all the individual and mutual inductances will get added.

39. When currents are moving in the same direction in two conductors, then the force will be

a) Attractive

b) Repulsive

c) Retracting

d) Opposing

Answer: **A**

Explanation: When two conductors are having currents moving in the same direction then the forces of the two conductors will be moving towards each other or attractive.

40. The magnetic force impacts the energy of the field. State True/false.

a) True

b) False

Answer: **A**

Explanation: The magnetic force depends on the flux density of a material and the flux density is in turn dependent on the energy of the material. It can be shown that $F = q(v \times B)$ and $E = 0.5 \times B^2/\mu$. It is clear that B and F are related.

41. Which of the following is true regarding magnetic lines of force?

a) Real

b) Imaginary

c) Does not exist

d) Parallel to field

Answer: **B**

Explanation: Magnetic Lines of Force is a an imaginary line representing the direction of magnetic field such that the tangent at any point is the direction of the field vector at that point.

42. The induced emf in a material opposes the flux producing it. This is

a) Faraday law

b) Ampere law

c) Lenz law

d) Curie law

Answer: **C**

Explanation: The induced emf in a material under the influence of a magnetic field will oppose the flux that produces it. This is indicated by a negative sign in the emf equation. This phenomenon is called Lenz law.

43. The energy in a magnetic material is due to which process?

a) Emf

b) Magnetization

c) Magnetostriction

d) Polarization

Answer: **B**

Explanation: The energy in a magnetic material is due to the formation of magnetic dipoles which are held together due to magnetic force. This gives energy to the material. Hence it is due to magnetization process.

44. The line integral of the magnetic field intensity is given by

a) Turns

b) Flux density

c) MMF

d) Current element

Answer: **D**

Explanation: The line integral of H is given by $\int H.\ dl$. From Ampere law it can be related to the current density and hence the current element NI for a coil of N turns. Thus, $\int H.\ dl = NI$.

45. The expression for the inductance in terms of turns, flux and current is given by

a) $L = N\ d\varphi/di$

b) $L = -N\ d\varphi/di$

c) $L = Ni\varphi$

d) $L = N\varphi/i$

Answer: **A**

Explanation: We know that $e = -N\ d\varphi/dt$ and also $e = -L\ di/dt$. On equating both we get, $L = Nd\varphi/di$ is the expression for inductance.

UNIT-3

Maxwell's Equations for Time - Varying Fields

1) _____ law is in any closed circuits is equal to the time rate of change of the magnetic flux linkage by the circuit.

a. Gauss Law
b. Faraday's Law
c. Lenz's Law
d. Kirchoff Law

2) **According to Maxwell's first equation in a point form for the static field, the electric flux per unit volume by leaving a small value is equal to _____**

a. Zero
b. Current density
c. **Volume charge density**
d. Magnetic field intensity

3) _____ law is the direction of current flow in the circuit such that the induced magnetic field produced by the induced current will oppose the change in original magnetic field

a. Gauss Law
b. Faraday's Law
c. Lenz's Law
d. Kirchoff Law

4) Maxwell's equation for time varying field in Transformer EMF is _____

a. $\nabla \times E = 0$
b. $\nabla \times E = -\partial B/\partial t$
c. $\nabla \times E = \partial B/\partial t$
d. $\nabla \times E = \partial B * \partial t$

5) If the medium is different than air, then what would be the equation of capacitance for a co-axial cable capacitor?

a. $C = \varepsilon_0 \varepsilon_r A / d$
b. $C = 4\pi \varepsilon_0 \varepsilon_r [ab / a - b]$
c. $\mathbf{C = 2\pi \varepsilon_0 \varepsilon_r L / \ln (b/a)}$
d. $C = 2\pi \varepsilon_0 \varepsilon_r R$

6) **For motional EMF of moving loop in static B field is _____**

a. $\mathbf{\nabla \times Em = \nabla \times (u \times B)}$
b. $\nabla \times Em = \nabla . (u \times B)$
c. $\nabla \times Em = \nabla . (u . B)$
d. $\nabla \times Em = \nabla \times (u . B)$

7) **Which type of capacitor possesses magnitude of flux density equivalent to its surface charge density?**

   a. **Parallel Plate capacitor**
   b. Spherical Capacitor
   c. Co-axial cable capacitor
   d. None of the above

8) **Maxwell's equation for a time varying field based on Amphere's circuit law is ____**
   a. $\blacktriangledown \times H = 0$
   b. $\blacktriangledown \times H = J + \partial B/\partial t$
   c. $\blacktriangledown \times H = J + \partial D/\partial t$
   d. $\blacktriangledown \times H = \partial D/\partial t$

9) **Basically, the flux lines which are represented by the lines of force are regarded as _____**

   a. Branch lines
   b. Node lines
   c. **Stream lines**
   d. Loop lines

10) **Consider the equation given below. What does it represent from the following?**
Equation: $\blacktriangledown . D = (\partial D_x / \partial x) + (\partial D_y / \partial y) + (\partial D_z / \partial z)$

   a. **Divergence in Cartesian system**
   b. Divergence in Cylindrical system
   c. Divergence in Spherical system
   d. None of the above

11) **Which form of Gauss's law is regarded as Maxwell's first equation?**

   a. **Point form**
   b. Line form
   c. Angular form
   d. Exponential form

12) **Maxwell's second equation of static field is a point form of _____**

   a. **Ampere's circuital law**
   b. Guass's law
   c. Lenz law
   d. Biot Savart law

13) **Which form of Maxwell's equation specifies the fundamental relationship between the electric and magnetic fields in time varying field?**

a. Point form
b. Integral form
c. Exponential form
d. None of the above

14) **In Ampere's circuital law, what is the purpose of an 'Amperian Path'?**

a. **Computation of magnetic field intensity**
b. Determination of differential element of path length
c. Estimation of electric flux density
d. Detection of loop in a constant plane

15) **What is the direction of magnetic field intensity vector due to infinite long straight filament?**

a. Radial
b. Elliptical
c. Parabolic
d. Circumferential

16) **If the volume charge density is found to be zero, then what would be the transformed type of Poisson's equation especially due to presence of line, point or surface charge?**

a. $\nabla^2 V = -(\rho_v / \varepsilon)$
b. $\nabla^2 V = -\rho_v$
c. $\nabla^2 V = 1$
d. $\nabla^2 V = 0$

17) **Poisson's equation is derived from _____**

a. Laplace equation
b. **Guass law**
c. Thevenin's theorem
d. Kirchoff's law

18) **The field is said to have zero divergence, if the number of field lines arriving are _____ to/than the number of field lines departing the volume**

a. Less
b. Greater
c. **Equal**

d. None of the above

19) **What does Maxwell's equation derived from Faraday's law, known as?**

a. Motional Induction
b. Stationary Induction
c. **Transformer Induction**
d. Transistor Induction

20) **According to Biot-Savart law, which parameter/s exhibit/s an/the inverse relationship to the differential magnetic field intensity (dH)?**

a. Current
b. Magnitude of differential length
c. Sine of angle between filament & line connecting differential length to point
d. Square of the distance from differential element to point

21) **In magnetism, Biot-Savart law is well-known as _____ law of current element**

a. **Ampere's**
b. Coulomb's
c. Joule's
d. Ohm's

22) **What does the constant 'μ' indicate, while specifying the relation between magnetic flux density (B) and magnetic field intensity (H)?**

a. Persistivity
b. Permittivity
c. Permissibility
d. **Permeability**

23) 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

24) If a moving loop is kept in static B field, the emf induced is

a) Convection **b) Motional**
c) Transformer d) both b and c

25) If a stationary loop is kept in a time-varying B field, the emf induced is
a) Motional **b) Transformer**
c) Conduction d) Convection

26) In which of the following cases is the induced emf zero
a) Moving loop in static field **b) Stationary loop in static field**
c) Moving loop in time-varying field d) Stationary loop in time-varying field

27) The direction of induced emf is given by
a) Lenz's law b) Ampere's law
c) Coulomb's law d) Ohm's law

28) The direction of induced emf is opposite to the direction of its cause. This statement is given by
a) Lenz's law b) Ampere's law
c) Coulomb's law d) Ohm's law

29) Time varying magnetic fields can be produced by
a) permanent magnets b) direct current
c) static charges **d) charges under acceleration**

30) One of the following produce time-varying electric fields
a) moving charges b) direct current
c) rotating magnet **d) time-varying magnetic fields**

31) Faraday's law of electromagnetic induction can be expressed mathematically as
a) $-\partial/\partial t \int B.dS = emf$ b) $-\int(\partial B/\partial S) \cdot dS = emf$
c) $\oint(uXB)\cdot dl = emf$ d) $\nabla \cdot B = 0$

32) The equation $\nabla XH = J_c$ should be modified for time -varying fields as
a) $\nabla XH = 0$ b) $\nabla XH = J_D$
c) $\nabla XH = J_c + \partial D/\partial t$ d) $\nabla XH = J_c + \varepsilon (\partial D/\partial t)\, a_r$

33) Displacement current density is given by
a) $J_c = \sigma E$ **b) $J_d = \partial D/\partial t$**
c) $\nabla \cdot J = - \partial \rho/\partial t$ d) $\nabla XH = J_c + J_d$

34) The divergence of the curl of any vector field is identically
a) 1 b) not defined
c) 0 d) non-zero

35) The concept of displacement current was a major contribution attributed to
a) Faraday b) Lenz
c) Lorenz **d) Maxwell**

UNIT-4

EM Wave Characteristics

1. E and H are out of phase by an angle ____ at any instant of time in lossy dielectrics

a) θ_η b) θ

c) 90^o d) π

2. In good conductors

a) $\sigma/\omega>>1$ **b) $\sigma/\omega\varepsilon>>1$**

c) $\sigma/\omega\varepsilon<<1$ d) $\sigma/\omega\varepsilon=1$

3. If $\sigma/\omega\varepsilon<<1$, the materials are said to be

a) good conductors b) metals

c) quasi conductors **d) good dielectrics**

4. In lossless dielectrics, attenuation constant α is equal to

a) infinity **b) 0**

c) 127π d) 377

5. E and H will be in time phase with each other in

a) lossless dielectrics b) lossy dielectrics

c) good conductors d) lossy conductors

6. EM waves travel in free space at a speed of

a) $30X10^8$m/s b) $3X10^{12}$m/s

c) $3X10^8$ m/s d) 300m/s

7. The intrinsic impedance of free space of

a) 377Ω b) 120Ω

c) $377\pi\Omega$ d) 0Ω

8. If E points in the direction of x, H points in the direction of y, then the wave propagates in the

a) x direction **b) z direction**

c) y direction d) xy plane

9. In good conductors E leads H by

a) 90^o b) 180^o

c) 45^o d) 0^o

10. ____ is a measure of the depth to which an EM wave can penetrate the medium

a) skin depth b) surface depth

c) skin resistance d) attenuation constant

11. The phenomenon where by field intensity in a conductor rapidly decreases is known as

a) peel effect **b) skin effect**

c) doppler effect d) phase effect

12. Poynting vector β is measured in

a) Wm^2 b) W

c) W/m^3 **d) W/m^2**

13. ____ theorem states that the net power flowing out of a given volume is equal to the time rate of decrease in the energy stored within the volume minus the ohmic losses

a) Stokes b) Greens

c) Poynting d) Divergence

14. Polarization of EM wave is along the direction of the

a) **E** b) H

c) P d) K

15. ___ is defined by the locus traced by the tip of the E field vector as time flows

a) Magnetization **b) Polarization**

c) Dispersion d) divergence

16. If two linearly polarized waves of equal amplitude polarized in different directions that oscillate π/2 radians out of phase are combined, the result is a

a) elliptically polarized wave b) linearly polarized wave

c) circularly polarized wave d) triangularly polarized wave

17. The ratio of tangential component of electric field to the surface current density at the conductor surface is called

a) skin impedance
b) DC resistance
c) surface impedance
d) AC resistance

18. For good conductors

a) $Z_s = 0$
b) $Z_s = \eta$
c) $Z_s = 377\Omega$
d) $Z_s = \pi$

19. The incident angle at which the reflection coefficient is equal to zero is called

a) Brewster angle
b) critical angle
c) acute angle
d) obtuse angle

20. The angle of incidence at which total internal reflection takes place is called

a) Brewster angle
b) critical angle
c) acute angle
d) obtuse angle

21) **How is the relation between energy transfer and the electric and magnetic fields specified?**

a. By Poynting theorem
b. By Stoke's theorem
c. By Helmholtz theorem
d. By Lagrange's theorem

22) **If the material is isotropic and linear, what would be the direction of electric field intensity and the polarization at each point?**

a. **Parallel**
b. Perpendicular
c. Both a and b
d. None of the above

23) **Which consequence/s is/are likely to occur due to polarization?**

a. **Increase in electric flux density**
b. Decrease in electric flux density
c. Stability in electric flux density
d. None of the above

24) **Consider the statements related to the case of boundary between two conductors. Which among them is/are incorrect?**

a. **Electric field must be parallel to the surface of good conductor**
b. Static electric field inside the conductor is always zero
c. Surface of conductor is always an equipotential surface
d. All of the above

25) **Which among the following is not a boundary condition between the conductor and the dielectric ($\varepsilon = \varepsilon_0 \varepsilon_r$)?**

a. $E_t = 0$
b. **$D_t = 1$**
c. $D_N = \rho_s$
d. $EN = \rho_s / \varepsilon_0\varepsilon_r$

26) For normal incidence of the wave on perfect conductor

i. Surface current doesn't exist
ii. **surface exists**
iii. conducting current exiasts
iv. free charge exists on the surface

27) Electric and magnetic fields which are parallel

i. Constitute power flow
ii. constitue infinite power flow
iii. constitute unit magnitude power flow
iv. **no power flow**.

28) What is the major factor for determining whether a medium is free space, lossless dielectric, lossy dielectric, or good conductor?

1. Attenuation constant
2. Constitutive parameters (σ,μ,ε)
3. **Loss tangent**
4. Reflection coefficient

Unit-5

Transmission Lines

1. The ratio of the positively traveling voltage wave to the current wave at any point on the line is called

a) characteristic impedance b) propagation constant

c) surface resistance d) AC impedance

2. The secondary constants of a transmission line are

a) **Z_o & γ** b) Z_o & η

c) γ & η d) R & G

3. The necessary conditions for a transmission line to be lossless are

a) R=L=0 **b) R=G=0**

c) L=C=0 d) G=C=0

4. The condition for distortion less line is

a) R/C = G/L **b) R/L = G/C**

c) RL=GC d) RG=LC

5. If attenuation constant is frequency independent and if the phase constant linearly depends on frequency, then the transmission line is called

a) loss less b) lossy

c) distortion less d) distorted

6. The characteristic impedance of a loss less transmission line is

a) $\sqrt{(L/C)}$ b) $\sqrt{(LC)}$

c) $\sqrt{R/G}$ d) RC

7. The electrical length of a transmission line is

a) $\alpha\beta$ **b) βl**

c) αl d) $\beta\eta$

8. The ratio of reflected voltage wave to that of the incident voltage wave is called

a) current reflection coefficient b) transmission coefficient

c) voltage reflection coefficient d) standing wave ratio

9. Combination of incident and reflected waves gives rise

a) standing waves b) transverse waves

c) longitudinal waves d) plane waves

10. The ratio of voltage maxima to voltage minima is called

a) reflection coefficient b) transmission coefficient

c) standing waves ratio d) dissipation factor

11. For a matched line SWR is equal to

a) 0 b) α

c) 10 **d) 1**

12. For a shorted line input impedance is

a) purely resistive **b) purely reactive**

c) purely capacitive d) susceptive

13. The most commonly used transmission lines in microwave integrated circuits are

a) Microstrip lines b) coaxial lines

c) two wire lines d) planar lines

14. Smith chart is constructed within circle of ____ radius.

a) infinite **b) unit**

c) 10 cm d) 10mm

15. Constant resistance circles have their centers at

a) (0, r/r+1) b) (0,0)

c){ (r/(r+1)), 0} d) (0,1)

16. Constant reactance circles have their centers at

a) (1, 1/x) b) (0, 1/x)

c) (0,0) d) (1,1)

17. A complete revolution of 360^o around the smith chart represents a distance of ____ on the line

a) λ/4 b) λ

c) 2λ **d) λ/2**

18. **What would be the Standing Wave Ratio (SWR) for a line with reflection coefficient equal to 0.49?**

a. 0.01
b. 2.12
c. **2.921**
d. 3.545

19. **How does the short-circuited line behave for the first λ/4 distance if input impedance is purely reactive?**

e. **As an inductance**
f. As a resistance
g. As a capacitance
h. As a conductance

20. **Which operation is performed over the in phase incident and reflected waves in order to obtain maximum voltage of SWR?**

i. **Addition**
j. Subtraction
k. Differentiation
l. Integration

21. **Which primary constant of transmission line is exhibits its dependency of value on the cross-sectional area of conductors?**

m. **Resistance (R)**
n. Inductance (I)
o. Conductance (G)
p. Capacitance (C)

22. **By which phenomenon does the energy transmission take place between the walls of the tube in waveguides?**

q. **Reflection**
r. Refraction
s. Dispersion
t. Absorption

23. **Which type of transmission line/s exhibit/s less capacitance in comparison to underground cables?**

u. Open-wire
v. Co-axial cables
w. Waveguides
x. All of the above

24. 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**.

25. The range of reflection coefficient is
e) 0 to 1
f) 0 to infinity
g) -1 to 1
h) 1 to infinity

26. If the reflection coefficient is -1/2 then the swr is

i) Zero
j) One
k) 1/3
l) **3**

27. For a lossy transmission line, the characteristic impedance does not depend on
(a) The operating frequency of the line
(b) The length of the line
(c) The load terminating the line
(d) The conductivity of the conductors

28. Which of the following statements are not true of the line parameters R, L, G, and C?
(e) R and L are series elements.
(f) G and C are shunt elements.
(g) G = 1/R

(h) LC = με and RG = σε.

29. A lossless transmission line of length 5 cm with L = 10 μH/m, C = 40 pF/m is operated

30. **at 30 MHz. Its electrical length is**

(i) 20λ

(j) 0.2λ

(k) 108°

(l) 40Π

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

(m) shortened because of the Doppler effect

(n) the same as in free space

(o) greater than in the actual direction of propagation

(p) same as the wavelength perpendicular to the wall

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

(q) more difficult to make and connect

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

(s) liable to radiate

(t) incapable of giving a full range of reactances