TECHNO INDIA – BATANAGAR

(DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING)

QUESTION BANK- 2018

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	4th	ET Theory & Transmission Lines	EC-401	1.Vector Calculus

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
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MCQ: Type-1 (Maximum marks to be allotted =1)

1. When the operator ∇ operates on a vector or on a scalar, it is an operation of
   a) Differentiation b) Integration c) Multiplication d) Division
2. The angle between $\vec{\nabla}\varphi$ and a surface where $\varphi = constant$ is
   a) 0^o b) 45^0 c) 60^o d) 90^o
3. Magnitude of $\vec{\nabla}\varphi$ is equal to the maximum space rate of change of φ in a direction
   a) 60^o with the surface where $\varphi = constant$.
   b) 90^o with the surface where $\varphi = constant$.
   c) 180^o with the surface where $\varphi = constant$
   d) 90^o with the surface where φ can vary from point to point.
4. Flux of a vector field $\vec{E}$ through a surface of area $\vec{a}$ is
   a) $\vec{E}\,X\vec{a}$ b) $\vec{E} + \vec{a}$ c) $\vec{a}\,X\vec{E}$ d) $\vec{a}\,.\vec{E}$
5. Which one of the following is true
   a) Flux is a vector but flux density is a scalar
   b) Flux is a scalar but flux density is a vector
   c) Both are scalar
   d) Both are vector
6. Divergence of a vector field is a
   a) Scalar quantity b) Vector quantity c) Both d) none
7. Curl of a vector field is a
   a) Scalar quantity b) Vector quantity c) Both d) none

Short Question (Type-2): (Maximum marks to be allotted =2)

1. Find out the magnitude of grad of a scalar field .
2. Write down the mathematical expression for the operator “Nabla”
3. When a vector field is called “Solinoidal”
4. When a vector field is called “Conservative”
5. When a vector field is called “Irrotational”
6. Write down the mathematical definition of Laplacian of a vector $\vec{A}$

Subjective Question (Type-3): (Maximum marks to be allotted =3)

1. If a vector field $\vec{A}$ can be expressed as gradient of a scalar field , prove that line integral of that vector field along a closed path is zero.
2. Find the rectangular coordinates of the point $(\rho = 1, \varphi = 1, z = 1)$
3. Find the cylindrical coordinates of the point (x=1, y=1, z=1) given in rectangular coordinates.

4. Consider a vector field defined by the equations A_x=1, A_y=2. Find out the divergence and curl of the vector field. Plot the field.
5. Explain briefly the difference between divergence and curl of a vector field in terms of their physical significance.

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Consider a vector field defined by A_x = y + 10, A_y = 0 . Find out the divergence and curl of that vector field. Map the vector field.
2. Prove that the volume integral of divergence of a vector field $\vec{A}$ over a volume is equal to the surface integral of vector $\vec{A}$ over the surface bounding the volume.
3. Evaluate the amount of maximum line integral at any point in a vector field around a closed curve per unit area basis.
4. Prove that a vector field which is the gradient of something has no curl.
5. Prove that a vector field which is the curl of something has no divergence.
6. Prove that Curl of Curl $\vec{F}$ = grad div $\vec{F}$ - Laplacian $\vec{F}$

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	4th	ET Theory & Transmission Lines	EC-401	2. Electrostatics, Magnetostatics & Electrodynamics

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
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MCQ: Type-1 (Maximum marks to be allotted =1)

1. Equipotential surfaces about a point charge are in the forms of
   a) Spheres b) Planes c) Cylinders d) Cubes
2. An electric charge Q is placed in a dielectric medium. Which of the following quantities are independent of the dielectric constant ϵ of the medium?
   a) Electric potential V and electric field intensity E
   b) Electric potential V and displacement ψ
   c) Electric field intensity E and displacement density D
   d) Displacement density D and Displacement ψ.
3. For a static electric and magnetic field, which of the following represents the correct form of two of Maxwell's equations?
   a) $\vec{\nabla} X \vec{E} = 0$ & $\vec{\nabla}.\vec{B} = 0$ c) $\vec{\nabla}.\vec{E} = 0$ & $\vec{\nabla}.\vec{B} = 0$
   b) $\vec{\nabla} X \vec{E} = 0$ & $\vec{\nabla} X \vec{B} = 0$ d) $\vec{\nabla}.\vec{E} = 0$ & $\vec{\nabla} X \vec{B} = 0$
4. If any vector field $\vec{B}$ is related to another vector field $\vec{A}$ through $\vec{B} = \vec{\nabla} X \vec{A}$, which of the following is true
   a) $\oint \vec{B}.\overrightarrow{dl} = \oiint \vec{A}.\overrightarrow{ds}$ b) $\oint \vec{A}.\overrightarrow{dl} = \oiint \vec{B}.\overrightarrow{ds}$ c) $\oint \vec{B}.\overrightarrow{dl} = \oiint \vec{A} X.\overrightarrow{ds}$ d) $\oint \vec{A}.\overrightarrow{dl} = \oiint \vec{B}\ X\ \overrightarrow{ds}$
5. Consider a closed surface S surrounding a volume V. If $\vec{r}$ is the position vector of a point inside S, with $\hat{n}$, the unit normal on S , the value of the integral $\oiint 5\vec{r}\ .\hat{n}\ dS$ is
   a) 6V b) 9V c) 15V d) 10V

6. The Maxwell's equation $\vec{\nabla} X \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$ is based on
   a) Coulomb's law b) Gauss's law c) Faraday's law d) Ampere's law
7. The characteristic impedance of free space in ohm is
   a) 300 Ω b) 362 Ω c) 372 Ω d) 377 Ω
8. The value of magnetic vector potential due to an infinitesimally small current element, evaluated at infinite distance from it is
   a) 0 b) 1 c) ∞ d) dependent on the strength of the current element
9. Maxwell inserted the expression for displacement current J_D in Ampere's law to satisfy
   a) Ampere's law for time varying case c) Gauss's Law
   b) Faraday's law d) Continuity equation
10. The cause of polarization in electromagnetic wave is
   a) Refraction b) Reflection c) Longitudinal nature of EM wave d) Transverse nature of EM wave
11. The plane wave $\vec{E} = 50 \sin(10^8 t + 2\, z)\widehat{a_y}$ V/m , (where $\widehat{a_y}$ is the unit vector in y-direction) is travelling along
   a) +y direction b) – y direction c) + z direction d) – z direction

Short Question (Type-2): (Maximum marks to be allotted =2)

1. State & explain Lenz's law.
2. Write down the integral form of Maxwell's equations for static electric and magnetic field.
3. How vector magnetic potential can be defined?
4. Write down the conditions of normal component and tangential component of displacement densities when an EM wave meet a boundary between two different medium.
5. Write down the general E.M wave equation in free space and explain the symbols used.
6. What do you mean by intrinsic impedance of a medium? What is its value in ohm for free space?
7. Express a sinusoidal variation of voltage in phasor form .

Subjective Question (Type-3): (Maximum marks to be allotted =3)

1. What is Displacement current? How the concept of displacement current is introduced in Amperes law in case of time varying field?
2. Show that, in a circuit containing a capacitor, the displacement current flowing between the capacitor plates is exactly the same in magnitude of conduction current flowing through the other part of the circuit.
3. Calculate the ratio of conduction current density to displacement current density in a imperfect conductor having electrical conductivity σ and relative permittivityϵ .
4. What is a uniform plane wave. How do you describe it mathematically?
5. Show it dimensionally that the ratio of $\vec{E}$ & $\vec{H}$ in a uniform plane wave represents an impedance.
6. Prove that in a uniform plane wave, $\vec{E}$ & $\vec{H}$ are always perpendicular to each other.
7. Find out the changed form of wave equation in case of sinusoidal time variation, when the medium is neither perfect dielectric nor perfect conductor.
8. Why the polarization of any electromagnetic wave is defined by the behaviour of the electric vector only? Why the behaviour of H vector is not taken into account?
9. Define loss tangent in a lossy dielectric.

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Find out the conditions of four field vectors $\vec{E}$, $\vec{D}$, $\vec{H}$, $\vec{B}$, when they meet a boundary between two media.
2. Derive the general law that electric field vector $\vec{E}$ must obey in an electromagnetic wave in free space condition, when the medium is perfectly dielectric
3. Find out the relation between $\vec{E}$ & $\vec{H}$ in a uniform plane wave in loss less (Perfect) dielectric medium.
4. How do you define propagation constant for a lossy dielectric medium? Find out the expression for the same. How it is related with the intrinsic impedance of the medium?
5. What do you mean by skin depth? The depth of penetration of electromagnetic wave in a medium having conductivity σ at a frequency of 1 MHz is 25 cm. What will be the depth of penetration at a frequency of 4 MHz?
6. The electric field component of an EM wave propagating through a medium (characterized by $\epsilon = 2\epsilon_0, \mu = 8\mu_0, and\ \sigma = 0.05\ S/(m)$) is given by $\vec{E}(z,t) = 10e^{-\alpha z}\cos(2\pi\ X\ 50\ X\ 10^6\ t - \beta z)\ \hat{x}$ V/meter. Compute (i) Propagation constant γ (ii) Attenuation constant, α and Phase constant, β.

QUESTION PAPER DETAILS					
Course	Stream	Semester	Subject	Paper Code	Chapter
B. Tech	ECE	4th	ET Theory & Transmission Lines	EC-401	3. Transmission Lines

Paper Setter Detail			
Name	Designation	Mobile No.	E-mail ID
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MCQ: Type-1 (Maximum marks to be allotted =1)

1. If the load impedance of one half-wavelength is 50 + j 150 Ω , its input impedance is
   a) 50 – j 150 Ω b) 50 + j 150 Ω c) 1+j 200 Ω d) 100 + j 2 Ω
2. A sinusoidal voltage with a wavelength of 100 cm is applied to a transmission line along which the velocity of propagation of the wave is 2.9 X10^8 m/s. The frequency of the source is
   a) 2.9 MHz b) 2.9 GHz c) 0.29 GHz d) 0.29 GHz
3. If the magnitude of the reflection coefficient on a transmission line for a given load is 1/3, VSWR is
   a) 3, b) 2 c) 1.3 d) 0.5
4. A 50Ω transmission line is connected to a load impedance yielding a VSWR of unity, the load impedance is
   a) 50 Ω b) 100 Ω c) 1 Ω d) 0 Ω
5. If the reflection coefficient at a point on a transmission line is -0.5, the transmission coefficient is
   a) 0.5 b) -0.5 c) 1.0 d) 0
6. If maximum and minimum voltages on a transmission line are 4 V and 2V respectively, VSWR is
   a) 0.5 b) 2 c)1 d) 8

7. If the sending voltage and currents on a transmission line are 200V and 2 amp for a given load, the input impedance is
   a) 100 Ω b)∞ c) 0.01 Ω d) 200 Ω
8. A line of length l has characteristic impedance Z_0. The line is cut into half. The value of characteristic impedance becomes
   a) $\frac{Z_0}{2}$ b) $\frac{Z_0}{4}$ c) Z_0 d) $2\,Z_0$
9. When the reflection coefficient equals $1\angle 0^o$, the value of the VSWR will be

Short Question (Type-2): (Maximum marks to be allotted =2)

1. Draw the equivalent circuit of a transmission line and simplify it for radio frequency application.
2. How do you define the characteristic impedance of a transmission line? Write down the expression for characteristic impedance of a loss less transmission line with the meaning of symbols used.
3. A transmission line section shows an input impedance of 36 Ω and 64 Ω respectively, when short circuited and open circuited. What is the characteristic impedance of the transmission line?
4. Why a quarter wave transformer can be used for accurately matching purely resistive loads only?
5. What is SWR in a transmission line? How it is related to the power loss?
6. State the difference between the lumped elements and distributed elements.
7. Why parallel lines are never used in microwave?
8. What is the relation between Neper and dB for attenuation?

Subjective Question (Type-3): (Maximum marks to be allotted =3)

1. Derive the relation between the SWR and Reflection coefficient.
2. Explain with diagram, how non-uniform waves are generated and flows in a coaxial cable transmission line.
3. What are the main features of Loss less transmission line in terms of characteristic impedance and velocity of propagation.

Broad Question (Type-4): (Maximum marks to be allotted =5)

1. Explain qualitatively, how standing wave forms in an un-matched transmission line. Show with diagram how voltage antinode and current node takes place at a distance $\frac{\lambda}{4}$ apart from the load end when short circuited.
2. How propagation constant is defined in a parallel wire transmission line? Derive the expression of propagation constant γ for a lossless transmission line.
3. Find out the value of reflection coefficient, Γ, when load end is short circuited, Open circuited and terminated by a load of double of the line characteristic impedance.