GRT INSITITUTE OF ENGINEERING AND TECHNOLOGY –TIRUTTANI – 631209

Department of Electronics and Communication Engineering
Second Year / Fourth Semester

EC8451 ELECTROMAGNETIC FIELDS (Regulation 2017)

Multiple Choice Questions

UNIT I INTRODUCTION

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem

S.No.	QUESTIONS WITH ANSWERS
1.	**When two vectors are perpendicular, their**
	a) Dot product is zero b) Cross product is zero c) Both are zero d) Both are not necessarily zero
2.	**The cross product of the vectors 3i + 4j – 5k and –i + j – 2k is,**
	a) 3i – 11j + 7k **b) -3i + 11j + 7k** c) -3i – 11j – 7k d) -3i + 11j – 7k
3.	**Which of the following are not vector functions in Electromagnetics?**
	a) Gradient b) Divergence c) Curl **d) There is no non- vector functions in Electromagnetics**
4.	**The work done of vectors force F and distance d, separated by angle θ can be calculated using,**
	a) Cross product **b) Dot product** c) Addition of two vectors d) Cannot be calculated
5.	**Find whether the vectors are parallel, (-2,1,-1) and (0,3,1)**
	a) Parallel b) Collinearly parallel **c) Not parallel** d) Data insufficient

6.	**The del operator is called as**
	a) Gradient b) Curl c) Divergence **d) Vector differential operator**
7.	**The relation between vector potential and field strength is given by**
	a) Gradient b) Divergence c) Curl d) Del operator
8.	**The Cartesian system is also called as**
	a) Circular coordinate system **b) Rectangular coordinate system** c) Spherical coordinate system d) Space coordinate system
9.	**The volume of a parallelepiped in Cartesian is**
	a) dV = dx dy dz b) dV = dx dy c) dV = dy dz d) dV = dx dz
10.	**The scalar factor of Cartesian system is unity. State True/False.**
	a) True b) False
11.	**Transform the vector A = 3i – 2j – 4k at P(2,3,3) to cylindrical coordinates**
	a) -3.6j – 4k b) -3.6j + 4k c) 3.6j – 4k d) 3.6j + 4k
12.	**The cylindrical coordinate system is also referred to as**
	a) Cartesian system **b) Circular system** c) Spherical system d) Space system
13.	**Convert the point (3,4,5) from Cartesian to spherical coordinates**
	a) (7.07,45º,53º) b) (0.707,45º,53º) c) (7.07,54º,63º) d) (0.707,54º,63º)
14.	**Example of spherical system in the following is**
	a) Charge in space b) Charge in box

	c) Charge in dielectric d) Uncharged system
15.	**The mathematical perception of the gradient is said to be**
	a) Tangent b) Chord **c) Slope** d) Arc
16.	**Gradient of a function is a constant. State True/False.**
	a) True **b) False**
17.	**The divergence of a vector is a scalar. State True/False.**
	a) True b) False
18.	**Which of the following theorem use the curl operation?**
	a) Green's theorem b) Gauss Divergence theorem **c) Stoke's theorem** d) Maxwell equation
19.	**The integral form of potential and field relation is given by line integral. State True/False**
	a) True b) False
20.	**A field in which a test charge around any closed surface in static path is zero is called**
	a) Solenoidal b) Rotational c) Irrotational **d) Conservative**

UNIT II ELECTROSTATICS

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law

S.No.	QUESTIONS WITH ANSWERS
1.	**Coulomb is the unit of which quantity?**
	a) Field strength **b) Charge**

	c) Permittivity d) Force
2.	**Coulomb law is employed in**
	a) Electrostatics b) Magnetostatics c) Electromagnetics d) Maxwell theory
3.	**For a charge Q1, the effect of charge Q2 on Q1 will be,**
	a) F1 = F2 **b) F1 = -F2** c) F1 = F2 = 0 d) F1 and F2 are not equal
4.	**The electric field intensity is defined as**
	a) Force per unit charge b) Force on a test charge **c) Force per unit charge on a test charge** d) Product of force and charge
5.	**What is the electric field intensity at a distance of 20cm from a charge 2 X 10^{-6} C in vacuum?**
	a) 250,000 b) 350,000 **c) 450,000** d) 550,000
6.	**For a test charge placed at infinity, the electric field will be**
	a) Unity b) $+\infty$ **c) Zero** d) $-\infty$
7.	**The lines of force are said to be**
	a) Real b) Imaginary **c) Drawn to trace the direction** d) Not significant
8.	**Electric flux density in electric field is referred to as**
	a) Number of flux lines **b) Ratio of flux lines crossing a surface and the surface area** c) Direction of flux at a point d) Flux lines per unit area
9.	**The Gaussian surface for a line charge will be**
	a) Sphere **b) Cylinder** c) Cube

	d) Cuboid
10.	**The Gaussian surface for a point charge will be**
	a) Cube b) Cylinder **c) Sphere** d) Cuboid
11.	**Gauss law can be used to compute which of the following?**
	a) Permittivity b) Permeability **c) Radius of Gaussian surface** d) Electric potential
12.	**The electrostatic energy in an electric field does not depend on which of the following?**
	a) Magnitude of charges b) Permittivity **c) Applied electric field** d) Flux lines
13.	**Calculate the energy in an electric field with flux density 6 units and field intensity of 4 units.**
	a) 12 b) 24 c) 36 d) 48
14.	**The permittivity is also called**
	a) Electrostatic energy **b) Dielectric constant** c) Dipole moment d) Susceptibility
15.	**Insulators perform which of the following functions?**
	a) Conduction b) Convection **c) Provide electrical insulation** d) Allows current leakage at interfaces
16.	**A dielectric is always an insulator. But an insulator is not necessarily a dielectric. State True/False.**
	a) True b) False
17.	**A dielectric can be made a conductor by**
	a) Compression **b) Heating** c) Doping d) Freezing

18.	**The continuity equation is a combination of which of the two laws?**
	a) Ohm's law and Gauss law **b) Ampere law and Gauss law** c) Ohm's law and Ampere law d) Maxwell law and Ampere law
19.	**Find the electron density when convection current density is 120 units and the velocity is 5m/s.**
	a) 12 b) 600 **c) 24** d) 720
20.	**The potential taken between two points across a resistor will be**
	a) Positive **b) Negative** c) Zero d) Infinity

UNIT III MAGNETOSTATICS

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques

S.No.	QUESTIONS WITH ANSWERS
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
2.	**Which of the following cannot be computed using the Biot Savart law?**
	a) Magnetic field intensity b) Magnetic flux density **c) Electric field intensity** d) Permeability
3.	**Find the magnetic field of a finite current element with 2A current and height $1/2\pi$ is**
	a) 1 b) 2 c) 1/2 d) 1/4

4.	**The magnetic field intensity will be zero inside a conductor. State true/false.**
	a) True **b) False**
5.	**The point form of Ampere law is given by**
	a) Curl(B) = I b) Curl(D) = J c) Curl(V) = I **d) Curl(H) = J**
6.	**The Ampere law is based on which theorem?**
	a) Green's theorem b) Gauss divergence theorem **c) Stoke's theorem** d) Maxwell theorem
7.	**Electric field will be maximum outside the conductor and magnetic field will be maximum inside the conductor. State True/False.**
	a) True b) False
8.	**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
9.	**The H quantity is analogous to which component in the following?**
	a) B b) D **c) E** d) V
10.	**The magnetic flux density is directly proportional to the magnetic field intensity. State True/False.**
	a) True b) False
11.	**Find the magnetic field intensity due to a solenoid of length 12cm having 30 turns and current of 1.5A.**
	a) 250 b) 325 c) 175 **d) 375**
12.	**The magnetic vector potential is a scalar quantity.**
	a) True **b) False**
13.	**The value of ∫ H.dL will be**

	a) J **b) I** c) B d) H
14.	**Given the vector potential is 16 – 12sin y j. Find the field intensity at the origin.**
	a) 28 b) 16 **c) 12** d) 4
15.	**Find the induced EMF in an inductor of 2mH and the current rate is 2000 units.**
	a) 4 **b) -4** c) 1 d) -1
16.	**Find the work done in an inductor of 4H when a current 8A is passed through it?**
	a) 256 **b) 128** c) 64 d) 512
17.	**Calculate the magnetic energy when the magnetic flux density is given by 32 units(in 10^8 order)**
	a) 4.07 b) 7.4 c) 0.47 d) 7.04
18.	**The magnetostatics highly relies on which property?**
	a) Resistance b) Capacitance **c) Inductance** d) Moment
19.	**Find the total flux in a coil of magnetic flux density 12 units and area 7 units.**
	a) 0.84 b) 0.96 c) 8.4 d) 9.6
20.	**Find the Lorentz force of a charge 2.5C having an electric field of 5 units and magnetic field of 7.25 units with a velocity 1.5m/s.**
	a) 39.68 b) 68.39 c) 86.93 d) 93.68

UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields

S.No.	QUESTIONS WITH ANSWERS
1.	**For time varying currents, the field or waves will be**
	a) Electrostatic b) Magneto static **c) Electromagnetic** d) Electrical
2.	**According to Faraday's law, EMF stands for**
	a) Electromagnetic field b) Electromagnetic force c) Electromagnetic friction **d) Electromotive force**
3.	**The induced voltage will oppose the flux producing it. State True/False.**
	a) True b) False
4.	**Find the displacement current when the flux density is given by t^3 at 2 seconds.**
	a) 3 b) 6 **c) 12** d) 27
5.	**Which of the following statements is true?**
	a) E is the cross product of v and B b) B is the cross product of v and E c) E is the dot product of v and B d) B is the dot product of v and E
6.	**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
7.	**Find the Maxwell law derived from Ampere law.**
	a) Div(I) = H b) Div(H) = J **c) Curl(H) = J** d) Curl(B) = D

8.	**The Faraday's law states about which type of EMF?**
	a) Transformer EMF b) Back EMF c) Generator EMF d) Secondary EMF
9.	**In which of the following forms can Maxwell's equation not be represented?**
	a) Static b) Differential c) Integral d) Harmonic
10.	**The first Maxwell law is based on which law?**
	a) Ampere law b) Faraday law c) Lenz law **d) Faraday and Lenz law**
11.	**The benefit of Maxwell equation is that**
	a) Any parameter can be calculated b) Antenna can be designed c) Polarisation of the wave can be calculated d) Transmission line constants can be found
12.	**When the Maxwell equation is expressed in frequency domain, then which substitution is possible?**
	a) d/dt = w/j b) d/dt = j/w **c) d/dt = jw** d) Expression in frequency domain is not possible
13.	**Maxwell second equation is based on which law?**
	a) Ampere law b) Faraday law c) Lenz law d) Coulomb law
14.	**The Maxwell second equation that is valid in any conductor is**
	a) Curl(H) = Jc b) Curl(E) = Jc c) Curl(E) = Jd d) Curl(H) = Jd
15.	**Find the displacement current density of a material with flux density of 5sin t**
	a) 2.5cos t b) 2.5sin t **c) 5cos t** d) 5sin t

16.	**For a solenoidal field, the surface integral of D will be,**
	a) 0 b) 1 c) 2 d) 3
17.	**Which quantity is solenoidal in the electromagnetic theory?**
	a) Electric field intensity b) Electric flux density c) Magnetic field intensity **d) Magnetic flux density**
18.	**Find the sequence to find B when E is given.**
	a) E-D-H-B b) B-E-D c) H-B-E-D d) V-E-B
19.	**The Gauss law for magnetic field is valid in**
	a) Air b) Conductor c) Dielectric **d) All cases**
20.	**Which equation will hold good for a magnetic material?**
	a) Line integral of H is zero b) Surface integral of H is zero c) Line integral of B is zero **d) Surface integral of B is zero**

UNIT V PLANE ELECTROMAGNETIC WAVES 12

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

S.No.	QUESTIONS WITH ANSWERS
1.	**For a dielectric, the condition to be satisfied is**
	a) $\sigma/\omega\varepsilon > 1$ **b) $\sigma/\omega\varepsilon < 1$** c) $\sigma = \omega\varepsilon$ d) $\omega\varepsilon = 1$

2.	**For a perfect dielectric, which parameter will be zero?**
	a) Conductivity b) Frequency c) Permittivity d) Permeability
3.	**Calculate the phase constant of a wave with frequency 12 rad/s and velocity 3×10^{8} m/s(in 10^{-8} order)**
	a) 0.5 b) 72 **c) 4** d) 36
4.	**For a lossless dielectric, the attenuation will be**
	a) 1 **b) 0** c) -1 d) Infinity
5.	**Calculate the velocity of a wave with frequency 2 $x10^{9}$ rad/s and phase constant of 4 x 10^{8} units.**
	a) 0.5 **b) 5** c) 0.2 d) 2
6.	**Which of the following is the correct relation between wavelength and the phase constant of a wave?**
	a) Phase constant = 2π/wavelength b) Phase constant = 2π x wavelength c) Phase constant = 1/(2π x wavelength) d) Phase constant = wavelength/2π
7.	**In lossy dielectric, the phase difference between the electric field E and the magnetic field H is**
	a) 90 b) 60 c) 45 **d) 0**
8.	**The intrinsic impedance is the ratio of square root of**
	a) Permittivity to permeability **b) Permeability to permittivity** c) Phase constant to wavelength d) Wavelength to phase constant
9.	**Calculate the skin depth of a material with attenuation constant of 2 units.**
	a) 2 b) 1 **c) 0.5** d) 4

10.	**Calculate the phase constant of a wave with skin depth of 2.5 units.**
	a) 5/2 b) 5 c) 2 **d) 2/5**
11.	**An example for lossless propagation is**
	a) Dielectric waveguide propagation b) Conductor propagation c) Cavity resonator propagation **d) It is not possible**
12.	**Skin depth phenomenon is found in which materials?**
	a) Insulators b) Dielectrics **c) Conductors** d) Semiconductors
13.	**In free space, the charge carriers will be**
	a) 0 b) 1 c) 100 d) Infinity
14.	**The total power of a wave with average power 15 units in a surface density of 0.5 units is**
	a) 15 b) 30 **c) 7.5** d) 0.75
15.	**Find the power of an EM wave, given that the cross product of the E and H component is 2 + 3j.**
	a) 2 **b) 1** c) 4 d) 8
16.	**The power in a wave given that H component is 0.82 units in air.**
	a) 126.74 b) 621.47 c) 216.47 d) 745.62
17.	**Find the power of a wave given that the RMS value of E and H are 6 and 4.5 respectively.**
	a) 6 **b) 1** c) 5 d) 8

18.	**The Poynting vector is the power component that is calculated by the**
	a) Product of E and H b) Ratio of E and H c) Dot product of E and H **d) Cross product of E and H**
19.	**For conductors, the loss tangent will be**
	a) Zero b) Unity **c) Maximum** d) Minimum
20.	**The expression for velocity of a wave in the conductor is**
	a) V = $\sqrt{(2\omega/\mu\sigma)}$ b) V = $\sqrt{(2\omega\mu\sigma)}$ c) V = $(2\omega/\mu\sigma)$ d) V = $(2\omega\mu\sigma)$