	PART-A (2 Mark Questions)
	Unit-I
1.	Prove that the net work done in moving a charge in a closed path in an electric field (E) is zero.
2.	Show that static electric field is conservative (irrotational)field .
3.	Write the Maxwell`s equation for static electric field
4.	Write the expression for continuity equation , and explain its significance
5.	What are the units of E, D and ε?
6.	Define divergence of a vector , write the expression for gradient in different co ordinate systems
7.	Explain the term "conduction current " and convection current
8.	What are the Properties of Electric Flux
9.	Write the expression for Coulombs law in vector form and explain the terms .
10.	What are the limitations of the coulombs law
11.	Define electric potential.
12.	Give the resultant of curl of gradient of any scalar.
13.	Give the resultant of divergence of curl of any vector.
14.	Give the relation between electric field intensity and electric flux density.
15.	What are the limitations of Gauss law.
16.	Relates Gauss law Electric field intensity with volume charge density.
17.	Define point charge
18.	State coulombs law.
19.	Given the vectors $\mathbf{M} = -10\mathbf{a}x + 4\mathbf{a}y - 8\mathbf{a}z$ and $\mathbf{N} = 8\mathbf{a}x + 7\mathbf{a}y - 2\mathbf{a}z$, find the magnitude of 5ax +N− 3M.
20.	A thundercloud above the earth sets up a vertical electric field of 40 V/m. A rain drop of charge 0.1 micro coulomb lies in the field. The electrostatic force exerted on the raindrop will be--------------------
21.	Two infinite uniform sheets of charge, each with density 10nc/m^2 are located at x = $\pm$ 1. determine E in all regions
22.	Two equal positive charges are placed along x axis at +x and –x respectively. The electric field vector at a point P on the y axis will be directed to ------------- direction
23.	The work done in carrying a 2µC charge from (2,1,-1) to (8,2,-1) in the field E = Yax +Xay along the parabola x= $2y^2$ is -28µJ. The work done along the straight line x= 6y-4 will be ------------------------
24.	An infinite sheet of charge in the yz plane causes an electric field of 10V/m at x=10m. At x=20m, E will be -----------------
25.	A line charge with ρ_lC/m lies along x axis. If the electric flux density at (-3, 6,8) is 3nC/m^2 . The value of ρ_l is ----------------
26.	State Maxwell's equations for static electric field.
27.	State continuity equation
	Unit-II
1.	Define magnetic field intensity and magnetic flux density

2.	Explain about Biot- Savarts law
3.	Explain about different types of current distributions.
4.	Define Amperes circuital law.
5.	Is magneto static field is conservative? Explain.
6.	Write the Maxwell equation for magneto static fields.
7.	Write the four Maxwell equation for static electromagnetic fields.
8.	Explain about magnetic vector potential and magnetic scalar potential.
9	Write the expression for Lorentz force equation.
10.	Define inductance? What's the energy stored in a inductor?
11.	What is point form of ohms law?
12.	State Gauss law for magnetic fields.
13.	Define current density.
14.	A filament is formed into a circle of radius a, centered at the origin in the plane z = 0. It carries a current I in the $\mathbf{a}_\phi$ direction. Find **H** at the origin
15.	An infinite filament on the z axis carries 20π mA in the az direction. Three uniform cylindricalcurrent sheets are also present: 400 mA/m at ρ = 1 cm, −250 mA/m at ρ = 2 cm, and −300mA/m at ρ = 3 cm. Calculate Hϕ at ρ = 0.5, and 3.5 cm.
16.	A long straight non-magnetic conductor of 0.2 mm radius carries a uniformly-distributed current of 2 A dc in the a_z direction. Use Ampere's circuital law to find H and B within the conductor
17.	Write Maxwell's equation for static electric field and steady magnetic field, both in point and integral form.
18.	Two identical coaxial circular coils carry the same current I, but in opposite directions. The magnitude of the magnetic field B at a point on the axis midway between the coils is-------
19.	Let A = (3y − z)a_x + 2xza_yWb/m in a certain region of free space.At P(2,−1, 3), find A, B, And H.
20.	Determine the total energy stored in a spherical region 1cm in radius, centered at the origin in free space, in the uniform field of H = −600$\mathbf{a}_y$ A/m.
	Unit-III
1.	Define faradays law and lenz`s law
2.	What is Inconsistency of Amperes law
3.	The magnetic flux through each turn of a 100 turn coil is (t^3-2t) mWb. Find The induced e.m.f at t=2sec
4.	Derive the expression for current through a capacitor
5.	Write the Maxwell equations for time varying fields
6.	Write the Maxwell equations in time harmonic form.
7.	In a certain lossy medium an EM wave travels for a distance of 20m where its amplitude decays to $\frac{1}{e}$ times its initial value. If the phase shift for the same period is 30^0, find the propagation constant of the medium.
8.	What is boundary conditions and write the Boundary conditions for electromagnetic fields
9.	In region 1(z < 0) and region 2(z> 0) , $\sigma_1 = \sigma_2 = 0$, $E_1 = a_x + 2a_y + 3a_z$, find $E_2\ and\ D_2 . \varepsilon_{r1} = 1 , \varepsilon_{r2} = 2$.
10.	What are the boundary conditions on a conducting surface?
11.	Give Faradays law in integral form
12.	Give Amperes circuital law in differential form
13.	Give Maxwells equations for free space
14.	Give Maxwells equations for dielectrics

15.	State modified amperes law.
16.	Define displacement current density
17.	Write the expression for transformer emf.
18.	Write the expression for motional emf
19.	The net magnetic flux emerging through any closed surface is -------
20.	Consider the region defined by $\|x\|$, $\|y\|$, and $\|z\| < 1$. Let $\varepsilon_r = 5$, $\mu_r = 4$, and $\sigma = 0$. If $J_d = 20\cos(1.5 \times 108t - bx)a_y\mu A/m^2$, find D.
21.	Region 1 ($x \geq 0$) is a dielectric with $\epsilon r_1 = 2$, while region 2 ($x < 0$) has $\epsilon r_2 = 5$. Let $E_1 = 20ax - 10ay + 50az$ V/m. a) E_{t2} = ----------------------- b) E_{N2}= -----------------
22.	The surface x = 0 separates two perfect dielectrics. For x > 0, let $\epsilon r_1 = 3$, while $\epsilon r_2 = 5$where x < 0. If $E_1 = 80ax - 60ay - 30az$ V/m, find:a) E_{N1}b) E_{T1} c) D_{N2}
23.	Write the boundary conditions between two dielectrics.
24.	Write Maxwell's equations for time varying fields in point form.
25.	Write the boundary condition for conductor dielectric interface
	Unit-IV
1.	What are the properties of uniform plane wave
2.	Define the following a) Linear medium b) Homogenous medium c) Isotropic medium d) Charge free medium e) Current free medium f) Unbounded medium
3.	Define phase velocity and wave length.
4.	What's the velocity of propagation of the wave in free space and ideal dielectrics have dielectric constant (ε_r)
5.	What is loss tangent / dissipation factor? What's the phase difference between the Electric field and Magnetic field in a good conductor
6.	What's the impedance of the wave in free space and in ideal dielectrics have dielectric constant (ε_r)
7.	What's the significance and applications of the poynting theorem?
8.	Define skin depth? What's the expression for the skin depth in a good conductor
9.	Define the polarization of the wave .What is linear , circular and elliptical polarization
10.	What's the condition for maximum and minimum electric fields of a wave And condition for maximum and minimum magnetic fields of a wave
11.	Define poynting theorm
12.	What is the unit for poynting vector?
13.	When voltage standing wave ratio is 3,the magnitude of the reflection coefficient?
14.	What is meant by Brewster angle.
15.	Define uniform plane wave
16.	State Poynting Theorem
17.	What is polarization of a wave?
18.	Write the wave equation for free space in terms of E

19.	The ratio of magnitude of electric field intensity to the magnitude of magnetic field intensity is called -----
20.	Define transmission coefficient of a wave
21.	A 10 MHz plane wave travels in free space and impinges normally on a block of material $\sigma_2=0$, $\varepsilon_2=3\varepsilon_0$, $\mu=10\ \mu_0$. The reflection coefficient is -----------
22.	Find the velocity of plane wave in a loss less medium having relative permeability of 1.2 and a relative permittivity of 4
23.	The electric field intensity of a uniform plane wave in free space is given by E= 94.25cos (ωt + 6z) a_x V/m. Find the velocity of propagation
	Unit-V
1.	Define transmission line? and what are the different types of transmission lines, and applications of transmission lines.
2.	With the equivalent circuit of the transmission line , explain about the primary constants of transmission line.
3.	What is loss less line, write the expressions for the attenuation constant , phase shift constant and characteristic impedance of a loss less line
4.	Define VSWR. What is its significance?
5.	What are the different types of distortions in a transmission line and What's the condition for distortion less transmission?
6.	What is a distortion less transmission line? Is every loss less line is a distortion less line? Justify.
7.	Explain about short circuited and open circuited transmission lines. What's the relationship between the short circuited impedance, open circuited impedance and characteristic impedance?
8.	Define reflection coefficient and VSWR , what is the relationship between them and What's the ranges of the reflection coefficient and standing wave ratio
9.	What is a smith chart, explain the properties of constant R- circles and constant X- circles
10.	What is matched transmission line .Why is matching of load impedance is needed. What are different ways of impedance matching?
11.	Define intrinsic impedance or characteristic impedence of free space.
12.	What is the relation between reflection coefficient and voltage standing wave ratio
13.	Define phase velocity
14.	Define group velocity
15.	What is the condition of loading in transmission lines
16.	What is the value of characteristic impedance of free space.
17.	A transmission line having 50 ohm impedance is terminated in a load of (40+j30) ohm.What is the voltage standing wave ratio .
18.	What is meant by stub matching.
19.	The characteristic impedance of a certain lossless transmission line is 72 Ω. If L = 0.5 µH/m, Find C
20.	The characteristic impedance of a certain lossless transmission line is 72 Ω. The line is terminated with a load of 60 Ω. Find reflection coefficient Γ and standing wave ratio s
21.	Define reflection coefficient
22.	A lossless transmission line has characteristic impedance of 75ohm and phase constant 3 rad/m at

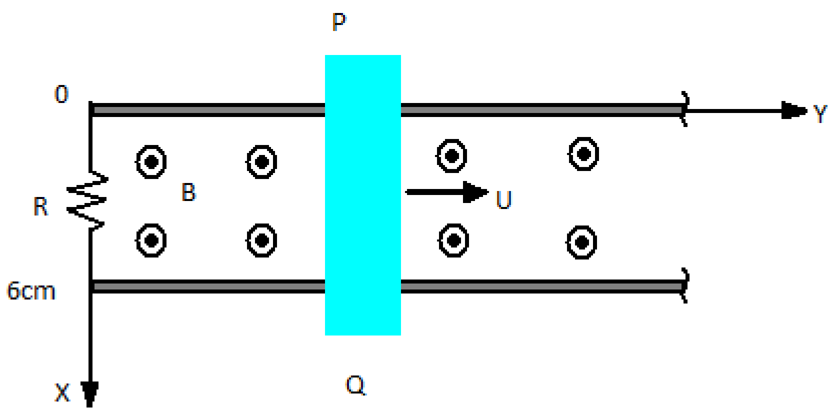
	100MHz. Calculate the capacitance and inductance of the line per meter.
23.	What is short circuited and open circuited lines?
24.	Differentiate between matched and unmatched transmission line
25.	Differentiate between single stub and double stub matching.
26.	Why it is desirable to achieve an impedance match in a transmission line?
27.	Calculate the characteristic impedance of a quarter wave transformer if a 120 ohm load is to be matched to a 75ohm line.
	PART-B (5 Mark Questions)
	Unit-I
1.	a. Find the Electric field intensity due to a finite line charge, from that deduce the expression for semi infinite charge. b. Point Charges Q_1 and Q_2 are respectively located at (4, 0, -3) and (2, 0, 1). If Q_2 = 4nC, find Q_1 such that i. The Electric Field (E) at (5, 0, 6) has no z component. ii. The force on a test charge at (5, 0, 6) has no x component. c. Three infinite sheets of charge density 18 nc/m^2, 9nc/m^2 and -24nc/m^2 . are located at x=4 , y = -3 and z=0 find E at (8,0,6)
2.	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. A point charge 100 pC is located at (4, 1, -3) while the x-axis carries charge 2 nC/m. If the plane z = 3 also carries charge 5nC / m^2, find E at (1, 1, 1). c. A uniform line charge of 2 μC/m is located on the Z- axis . find the electric field intensity E in Cartesian coordinates at P(1,2,3) if the charge extends from i. $Z= -\infty \; to \; Z = \infty$ ii. Z= -4 to Z= 4
3.	a. Prove J =$\rho_v V$ from the fundamentals b. State equation of continuity and prove it. c. If point charge 3 μC is located at the origin. Also there are two more charges -4 μC and 5 μC are located at (2, -1, 3) and (0, 4, -2) respectively. Find potential at (-1, 5, 2) Assume zero potential at infinity.
4.	a. Obtain expression for the capacitance of i. a parallel plate capacitor and ii. a coaxial capacitor. b. A point charge of 5 nC is located at the origin. If V = 2v at (0, 6, -8), find i. The potential at A (-3, 2, 6) ii. The potential at B (1, 5, 7) iii. The potential difference V_{AB}

	c. Find the total charge enclosed in an incremental volume of 10^{-9} m^3 located at the origin , if $D = e^{-x}siny\, a_x - e^{-x}cosy\, a_y + 2z a_z \quad C/m^2$
5.	a. Derive the expressions for the electrostatic energy density b. State and express Gauss law in both integral and differential form c. If D = $(2y^2 + z)a_x + 4xy\, a_y + x\, a_z$ C/m^2, find i. Volume charge density at (-1, 0, 3) ii. The flux through the cube defined by $0 \le x \le 1$, iii. The total charge enclosed by the cube.
6.	a) A charge distribution in free space has ρ_v = 2r nC / m^3 0 < r < 10 m = 0 otherwise. Determine E at r = 2m and r = 12m b) Calculate the net flux leaving the surface ρ =4, 0< ϕ < π , -5 <z< 5 . due to the field D=$5(\rho - 3)^2\, a_\rho$ c) Determine the work necessary to transfer charges Q_1 = 1 mC and Q_2 = -2 mC from infinity to points (-2, 6, 1) and (3, -4, 0) respectively
7.	a. Derive the relation between the potential and the electric field b. Determine the total charge i. On line 0 < x < 5 m if $\rho_L = 2x^2$ mC/m ii. On the cylinder ρ = 3, 0 < z < 4, if $\rho_s = \rho z^2$ nC/m^2 iii. Within the sphere r = 4m, if ρ_v = 10 / (r sinθ) C / m^3 c. Three charges of 2c ,8c, -12c are located at (4,8,3) (2,-1,-3) and (-4,0,1) .calculate the net flux leaving i. the surface enclosed by -5 <x,y,z <5 ii. If the surface is sphere of r=6mts with the centre at the origin iii. If the surface is sphere of r=6mts with the entire at (2,-3,2)
8.	a. Derive poisons and Laplace's equations and mention their applications b. Find out electric flux density in free space if the electric field $E = 6a_x - 2a_y + 3a_z\ V/m$, also find ρ_v . c. A point charge of 30 nC is located at the origin while plane y = 3 carries charge 10 nC / m^2 . Find D at (0, 4, 3)?
9.	a. Find the potential difference between the two point charges. b. Calculate the V at (4,1,0) with reference to the origin due to an E= $ya_x + xa_y$ N/C . c. Calculate the capacitance of a parallel plate capacitor with dielectric, mica filled between plate's εr = 6, the plates of the capacitor are square in shape with a 0.254 cm side. Separation between the two plates is 0.254 cm .
10.	a. By using Laplace's equation ,derive an expression for capacitance of a parallel plate capacitors, make necessary assumptions b. The potential distribution is given as V $= 10y^4 + 20x^3$ if ϵ_0 is the permittivity of the free space find the charge density . c. A volume charge density inside a hallow sphere is $= 10e^{-20r}\, C/m^3$. Find the total charge enclosed within the sphere also find the electric flux density on the surface of the sphere.
11.	Three point charges 2μc,4 μc,8 μc are located at(0,0,0)(0,0,1) and (1,0,0) respectively.Find energy in the system.

12.	Calculate the potential at Ra=5m with respect to Rb=9m due to a point charge of Q=50nc at the origin and the zero reference at infinity.
13.	The energy stored in free space for the region 0<p<a,0<$\emptyset<\pi$,0<z<2. The potential field V=V0(p/a) a)Find Electric field intensity, b)WE
14.	State Gauss law.Find Electric field intensity due to infinite line charge by using Gauss law.
15.	Calculate Electric field intensity at a pont A(1,2,3) in freespace caused by a charge Q1=5nc at a point p(2,3,5) and another charge Q2=4nc at R(3,0,3)
16.	State coulomb's law of forces.A point charge Q1=300 µc located at (1,-1,-3) experience a force F1=8I-8J+4K due to point charge Q2 at (3,-3,-2)meters.Determine Q2
17.	A copper sphere of radius 4 cm carries a uniformly-distributed total charge of 5 µC in freespace.a) Use Gauss' law to find D external to the sphere:b)Calculate the total energy stored in the electrostatic field
18.	A uniform volume charge density of 80 µC/m3 is present throughout the region 8mm < r <10 mm. Let ρ_v = 0 for 0 < r < 8 mm. Find the total charge inside the spherical surface r = 10 mm
19.	Let a point charge Q_1 of 25 nC be located at *P*1(4*,*−2*,* 7) and a charge *Q*2 = 60 nC be at *P*2(−3*,* 4*,*−2).If ε= ε0, find **E** at *P*3(1*,* 2*,* 3)
20.	A point charge of 20 nC is located at (4,-1,3), and a uniform line charge of -25 nC/m is liesalong the intersection of the planes x = −4 and z = 6. Calculate D at (3,-1,0):
21.	Using Gauss's law, determine electric field intensity at any point due to an infinite sheet of charge having uniform surface charge density ρ_s.
22.	Calculate the divergence of **D** at the pointP(3, 45◦,−45◦) if **D =** 2r sin θ sin ϕ**ar +** r cos θ sin ϕ**aθ +** r cos ϕ**aϕ.**
23.	Explain the terms conduction current, convection current and relaxation time.
24.	An infinite uniform line charge ρ_L = 2 nC/m lies along the x axis in free space, while point chargesof 8 nC each are located at (0,0,1) and (0,0,-1).i) Find **E** at (2,3,-4), ii) To what value should ρ_L be changed to cause **E** to be zero at (0,0,3)?
25.	A parallel-plate capacitor has plates located at z = 0 and z = d. The region between platesis filled with a material containing volume charge of uniform density ρ_0 C/m^3, and which haspermittivity. Both plates are held at ground potential.a) Determine the potential field between platesb) Determine the electric field intensity, E between plates.
26.	Concentric conducting spheres are located at r = 5 mm and r = 20 mm. The region between the spheres is filled with a perfect dielectric. If the inner sphere is at 100 V and the outer sphere at 0 V:a) Find the location of the 20 V equipotential surface, b) Find $E_{r,max}$c) Find $\varepsilon_r$if the surface charge density on the inner sphere is 1.0 µC/m^2
	Unit-II
1.	a. Derive the magnetic field (H), due to a finite length current carrying conductor, deduce for infinite length conductor. b. In a certain conducting medium $H = yz(x^2+y^2)a_x - y^2xz\, a_y + 4x^2y^2a_z$ A/m i. Determine J at (5, 2 , -3) ii. Find the current passing through x = -1 , 0 <y, z < 2

	iii. Show that $\nabla \cdot B = 0$.
2.	a. Derive an expression for magnetic field strength H, due to a current carrying conductor of finite length placed along the y- axis at a point x-z plane and r distantance from the origin. Hence deduce expressions for H due to semi infinite length of the conductor. b. Find the total magnetic flux crossing a surface $\emptyset = \frac{\pi}{2}, 1 \leq \rho \leq 2, and\ 0 \leq z \leq 5$ due to a vector magnetic potential A= $\frac{-\rho^2}{4}\ a_z$ wb/m
3.	a. Obtain an expression for differential magnetic field strength dH due to differential current element Idl at the origin in the positive Z- direction b. Find the magnetic field intensity 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 .
4.	a. State Ampere's circuit law in integral form. b. A long straight radius a has a magnetic field strength H within the conductor and outside the conductor. Also find the current density J in both the regions.
5.	a. Derive the expressions for magnetic field by using Amperes law due to i. Infinite line current ii. Infinite sheet current iii. Infinite long co-axial transmission line b. Find the magnetic field strength, H at the centre of a square conduction loop of side 2a in Z= 0 plane if the loop is carrying a current I, in anti-clock wise direction.
6.	a. Explain the basis for magnetic scalar potential , its utility and limitations b. An 8A current carrying wire lies on the entire +y and +x axis, with the current flowing from y-axis to the x- axis. Calculate the H at (3, 4, 0)
7.	a. What is the force experienced by a charge in a magnetic field and obtain the Lorentz force equation. b. Find the force experienced per unit length by a conductor carrying 5A current in positive z-direction and placed in a magnetic field $B = 3a_x + 4a_y$
8.	a. Derive an expression for energy density in a magnetic field b. Plane y= 0 carries a uniform current density 30a_z mA/m. magnetic field intensity at (1,20,-2)
9.	a. Prove $H = \frac{I}{2\pi\rho}\ a_\phi$ due to an infinitely long current element. b. If H is given by H = ycos2x a_x+(y + e^x) a_z . determine J at the origin
10.	a. Explain the significance of $\nabla \cdot B = 0$. b. For a current distribution in free space , vector potential $A = (2x^2y + yz)a_y - (6xyz - 2x^2y^2)a_z\ wb/m$ i. Calculate magnetic flux density B

	ii. Find the magnetic flux through a loop described by x=1 , 0< y ,z < 2. iii. Show that $\nabla \cdot A = 0 \; and \; \nabla \cdot B = 0$
11.	Find the vector potential and hence the magnetic flux density B due to an infinite wire carrying current at a point a)out side b)inside the wire
12.	Determine H for a solid cylindrical conductor of radius a, where the current I is uniformly distributed over the crossection. Find conversely J from H.
13.	Find H at P(4,6,10) in cartesian coordinates for an infinitely long current filament passing through the origin and point A(0,0,1).The current of 25A is directed from origin to A.
14.	A uniform wire is bent into the form of a square of side 2a and a current I flows round it.Prove that magnetic field strength at a point on the perpendicular to the plane of the square through its centre and distance d from the plane.
15.	Find the expression for the magnetic density B at a point a distance h above the centre of a rectangular loop of wire b meter on one side and a meter on the other side.The loop carries a current of 1 A.
16.	A thin cylindrical conductor of radius a ,infinite in length carries a current I ,calculate H at all points using amperes law
17.	Find the magnetic field and its curl at radius r with in a copper conductor of radius r0>r carrying current uniformly distributed over the crossection.
18.	A filament is formed into a circle of radius a, centered at the origin in the plane z = 0. Itcarries a current I in the aϕ direction. Find H at the origin
19.	Assume that A = $50\rho^2 a_z$Wb/m in a certain region of free space. Find H and B
20.	Explain the concept of scalar and vector magnetic potential.
21.	A current filament on the z axis carries a current of 7 mA in the az direction, and currentsheets of 0.5 az A/m and −0.2 az A/m are located at ρ = 1 cm and ρ = 0.5 cm, respectively. Calculate H at ρ = 0.5 cm
22.	Obtain an expression for magnetic field intensity at a point due to an infinite sheet of current
23.	Calculate the magnetic flux density at the centre of a current carrying loop when the radius of the loop is 2cm, loop current is 1mA and loop is placed in air.
24.	Obtain an expression for magnetic field intensity at a point due to an infinite current carrying filament
25.	Find the flux crossing the plane surface defined by $0.5 \le \rho \le 2$m and $0 \le z \le 3$m if $B=(4/\rho)a_\phi$ Tesla.
26.	Find H for infinitely long coaxial transmission line where central conductor carries current I and outer conductor carries a current –I.
	Unit-III
1.	a. Give the expressions for Maxwell equations in differential, integral forms and also state them. b. A certain material has conductivity σ =0 , and relative permittivity ε_r =1 . if magnetic field intensity $H = 4\sin(10^6 t - 0.01z)\, a_y$ A/m , make use of Maxwell equations to find relative permeability μ_r . also find electric field intensity E(z, t) .
2.	a. What is the inconsistency of Amperes law? How it was corrected. b. Copper wire carries a conduction current of 1.0 Amp at 60 Hz. Determine the

	Displacement current in the wire? Assume "$\varepsilon_{cu} = \varepsilon_0$; $\mu_{cu} = \mu_0$; $\sigma = 5.8*10^7$ mhos/m.
3.	a. Verify that the displacement current in the parallel plate capacitor is the same as the conduction current in the connection wires. b. Consider the region defined by $\lvert X\rvert, \lvert Y\rvert, \lvert Z\rvert \le 1$. $\varepsilon_r=5$, $\mu_r=4$, $\sigma=0$, if $J_d = 20\cos(1.5*10^8 t - bx)\, a_y \mu A/m^2$ i. Find D and E ii. Use the point form of faradays law and an integration with respect to time to find B and H iii. Use $\nabla \times H = J_d + J$ to find J_d iv. What is the numerical value of b?
4.	a. Write Maxwell equations in their general integral form. derive the corresponding equations for fields varying harmonically with time b. A circular loop conductor having radium of 0.2m is placed in XY plane. The loop consists of a resistance of 10Ω. If the magnetic field is $B = sin10^4 t$ a_z, find the current flowing in the loop.
5.	a. State and explain the Maxwell equations obtained from faradays and amperes laws. b. If $E = 2\cos(\omega t - \beta z)a_x$ and $H = \frac{2}{\eta}\cos(\omega t - \beta z)a_y$, find η in terms of μ_0, ε_0 so that the fields satisfy all Maxwell equations c. A conducting bar can slide freely over two conducting rails as shown in Figure. Calculate the induced voltage in the bar i. If the bar is stationed at by y = 8 cm and B = 4cos106t a_z mWb/m^2 ii. If the bar slides at a velocity u = 20a_y m/s and B = 4a_z mWb/m^2 iii. If the bar slides at a velocity u = 20a_y m/s and B = 4cos(106t - y)a_z mWb/m^2 
6.	a. In free space $D = D_m \sin(\omega t + \beta z)\, a_x$, use Maxwell equation to find B. b. Medium 1 has the electrical permittivity $\epsilon_1 = 1.5\epsilon_0$ F/m , and occupies the region to the left of x=0 plane . Medium 2 has the electrical permittivity $\epsilon_2 = 2.5\epsilon_0$ F/m and occupies the region to the right of x=0 plane. if E_1 in medium 1 is

	$E_1 = 2a_x - 3a_y - 1a_z \frac{volt}{m}$ then find E_2 .
7.	a. Write the Maxwell equation, and explain the significance of each equation. b. Z< 0 defines region 1 and Z > 0 defines region 2. And region 1 is characterized by μ_{r1} =2 and region 2 is characterized by μ_{r2}= 4. If the magnetic field in region 1 is given by $H_1 = 4a_x + 1.5a_y - 3a_z\ A/m$ find H_2 .
8.	a. Apply Gauss law to derive the boundary conditions at a conductor – dielectric interface b. Interface of two regions of two magnetic materials is current-free the region 1, for which relative permeability μ_{r1} =2 is defined by z< 0 , and region 2 , z > 0 has μ_{r2} =1 .if B=$12a_x + 0.8a_y + 0.4a_y\ T$ then find H_2
9.	a. A parallel plate air filled capacitor has plate area of 10^{-4} m^2 and plate separation of 10^{-3}m. it is connected to a 0.5v, 3.6Ghz source .Find the magnitude of the displacement current. b. find J_d in a metallic conductor at 50Hz, if $\varepsilon_r = 1,\ \mu_r = 1,$ $\sigma = 5.8 * 10^7 mho/m$ and J= sin(377t-117z)a_x mA/m^2
10.	a. The electric field on the surface of a perfect conductor is 2v/m. the conductor is immersed in water with $\epsilon = \epsilon_0$. Find the surface charge density on the conductor. b. In a cylindrical conductor of radius 2mm, the current density varies with distance from the axis according to $J = 10^3 e^{-400r}\ A/m^2$. find the total current
11.	In free space E=20cos(wt-50x) ay V/m .Calculate a)Jd b)H C)We
12.	A parallel plate capacitor with plate area of 5cm^2 and plate separation of 3 mm has a voltage 50sin10^3 V applied to its plates.Caculate the displacement current assuming $\varepsilon = 2\varepsilon 0$.
13.	In a medium characterized by σ=0,μ=μ0,ε0 and E=20 sin(10^{8}t-βz)ay V/m ,calculate β and H.
14.	A medium is charecterised by σ=0,μ=2μ0 and ε=5ε0,if H=2 cos(wt-3y)az A/m ,calculate W and E.
15.	In the material for which σ=5 s /m and εr=1 the electric field is 100sin 10^{8}t V/m .Find conduction current density,Displacement current density.
16.	Explain modified Ampheres law in time varying fields.
17.	Magnetic flux density B=2*10^{-4}cos(10^{6}t)sin(.01x)az T,FIND magnetic flux passing through the surface z=0,0≤x≤20m ,0<y<3 at t=1μsec. b) E.dl around perimeter of the surface specified above at t=1μ sec
18.	Jd=5cos(2*10^{8}t-kz) ax μA/m^2 in a material for which σ=0, ε=5ε0, μ=4μ0,Find a)D b)E c)B d)H e)K
19.	Compare the magnitude of the conduction and displacement current densities in a good conductor for which σ=10^7 mho/m, , εr=1 when electric field intensity is expressed by sin120πt
20.	Explain the concept of displacement current density
21.	Obtain the boundary condition for two dielectric interface
22.	Obtain boundary condition for a conductor- dielectric interface
23.	Give the word statements of Maxwell's equation for time varying field
24.	Region 1 (x ≥ 0) is a dielectric with ε_{r1} = 2, while region 2 (x < 0) has ε_{r2} = 5. LetE_1 = 20ax − 10ay + 50az V/m.a) Find D_2
25.	Show that for a Sinusoidally varying field the conduction current and displacement currents are

	always displaced by 90 degrees in phase.
	Unit-IV
1.	a. Explain about uniform plane waves b. Find all the relations between E and H in a uniform plane wave. Find the value of intrinsic impedance of free space. c. The H field of a plane wave propagation in free space in $H=\frac{5\sqrt{3}}{\eta_0}\cos(wt-\beta z)a_x+\frac{5}{\eta_0}\sin\left(wt-\beta z+\frac{\pi}{2}\right)a_y$. Find the time average power flow density.
2.	a. Shows that E and H are perpendicular to each other and the ratio of their magnitudes is a constant for a uniform plane wave b. In a very good conductor the skin depth of an EM wave of 200khz frequency is 4μm . calculate i) velocity ii) velocity of the EM wave if the frequency is increased by 4 times iii) conductivity and propagation constant. c. If $H= 0.1\sin(10^8\pi t+\beta y)\ a_x$ for a plane wave propagation in free space , then find the time average poynting vector .
3.	a. Derive the expression for attenuation and phase constants of uniform plane wave b. A plane sinusoidal electromagnetic wave travelling in space has E max = 1500μV/m i. Find the accompanying Hmax ii. The average power transmitted c. A uniform plane wave at a frequency of 1GHz is travelling in a large block of Teflon (ε_r=2.1 ,μ_r= 1 , σ =0) determine γ, η, β and λ .
4.	a. Explain the propagation of wave in a lossless medium b. For good dielectrics derive the expression for α, β, γ and η c. given that $H= 0.5e^{-0.1x}\sin(10^6t-2x)a_z$,find i. velocity of the wave ii. propagation constant iii. direction of the propagation iv. direction polarization of the wave
5.	a. Explain wave propagation in a conducting medium b. From the Maxwell curl equations, derive the wave equations for a plane wave travelling in the positive X- direction in a medium with constants μ, ε and σ. c. The electric field in free space is given by $E=50\cos(10^8t+\beta x)\ a_y\ V/m$, i. Find the direction of propagation ii. Calculate b and the time it takes to travel a distance of $\frac{\lambda}{2}$ iii. Sketch the wave at t=0 , $\frac{T}{2},\ and\ \ \frac{T}{4}$
6.	a. Distinguish between good conductors and good dielectrics. Explain the wave propagation in good dielectrics. b. A perpendicularly polarized wave is incident at an angle of 15^0. It is propagating from medium 1 to medium 2. Medium 1 is defined by ε_{r1}=8.5, μ_{r1}=1, and σ1= 0 and medium 2 is

	free space. If Ei =1.0mV/m, determine Er , Hi ,Hr , Et and Ht .
7.	a. What is skin effect? What is skin depth? What is its relation with attenuation constant, conductivity and frequency? Derive the expression for skin depth? b. Determine the phase velocity of propagation , attenuation constant, phase constant and intrinsic impedance for a forward travelling wave in a large block of copper at 1 MHz (σ =5.8* 10^7 μ_0, ε_0) . Determine the distance that the wave must travel to be attenuated by a factor of 100. c. Evaluate the units of i. $\frac{\varepsilon}{\sigma}$ ii. $\frac{\sigma}{\omega\varepsilon}$ iii. $\sqrt{\frac{2}{\omega\mu\sigma}}$
8.	a. The electric field intensity associated with a plane wave travelling in a perfect dielectric medium is given by E(z, t) = 10cos(2π* 10^7t-0.1πz) V/m . b. What is meant by polarization of wave? when is the wave linearly polarized and circularly polarized c. A travelling wave has two linearly polarized components Ex = 2coswt and Ey = 3cos(wt + 90) 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
9.	a. Explain the significances of poynting theorem and poynting vector b. A y- polarized uniform plane wave with fields (Ei ,Hi) and a frequency of 100MHz propagates in air in the + X direction and impinges normally on a perfectly conducting plane at X=0 , assuming the amplitudes of Ei to be 6 mV/m . write the phasor and instantaneous expression for i. Ei and Hi of the incident wave ii. Er and Hr of the reflected wave iii. Et and Ht of the wave iv. Determine the location nearest to the conduction plane where Et and Ht are zero
10.	a. Explain the reflection of uniform plane wave with normal incidence at plane dielectric boundary b. Determine the resultant electric and magnetic fields of plane wave when it is incident on a perfect conductor normally. c. A uniform plane wave in air with electric field intensity $E = 8\cos(\omega t - 4x - 3y)\, a_y$ V/m . is incident on dielectric slab (Z >0) with μ_r =1 ε_r =2.5 , σ =0 find i. The polarization of the wave ii. The angle of incidence iii. The reflected E field

	iv. The transmitted H field
11.	A uniform plane wave is normally incident from air on an infinitely thick magnetic material with relative pearmability 100 and relative pemitivity 4.The wave has electric field of 1V/m.Find incident power,average pointing vector inside the material.
12.	In the free space E(Z,T)=10^3Sin(WT-Bz)ay V/m,Find H(z,t),intrinsic impedance.
13.	A plane wave travelling in free space is incident normally on a medium having εr=4,find a)reflection coefficient b)fraction of power transmitted in to the medium.
14.	Given a non magnetic material having εr=2.25 and σ=10^{-4} mho/m ,find numerical values of at 2.5 MHZ for a)loss tangent b)attenuation constant
15.	The wave is travelling in air and incident on boundary between air and dielectric having pearmibility= μ=μ0 and permittivity= ε=5ε0 find a)transmission coefficient b)average power incident
16.	Electric field in free space is given by E=50cos(10^8t+ Bx)ay V/m a)find direction of wave propagation b)calculate B and time it takes to travel a distance of λ/2 c) sketch the wave at t=0,t/4 and t/2 .
17.	A lossy dielectric has an intrinsic impedance of 200∟30^0 ohms at a particular radian frequency w,if at that frequency the plane wave propagating through the dielectric has the magnetic field component H=10$e^{-x\alpha}$cos(wt-1/2x)ay A/m.Find E and α,determine skin depth and wave polarization.
18.	A lossless dielectric for which η=60π,μr=1,H=-0.1cos(wt-z)ax+0.5w(wt-z)ay A/m calculate εr,w,μ,E.
19.	A uniform plane wave propagating in a medium has E=2$e^{-z\alpha}$sin(10^8t-βz)ay V/m.If the medium is charecterised by εr=1, μr=20 and σ=3 S/m find α,β and H.
20.	A uniform plane wave of 200MHz travelling in free space impinges normally on a large block of material having ε_r=4, μ_r=9 and σ =0. Calculate transmission and reflection coefficient at the interface
21.	A uniform plane wave is incident from air on to glass at an angle from the normal of 30 degree. Determine the fraction of the incident power that is reflected for perpendicular polarization. Glass has refractive index n_2=1.45
22.	The electric field intensity of a uniform plane wave in free space is given by E= 94.25cos (ωt + 6z) a_x V/m. Find the velocity of propagation. Determine wave frequency, wavelength and the magnetic field intensity.
23.	Explain the wave motion in free space.
24.	Explain the wave motion in perfect dielectrics
25.	Explain the wave motion in good conductors.
26.	A uniform plane wave travelling along positive z direction in air is incident at an angle of 30 degrees with the normal to the plane surface of a dielectric medium. The x-z plane is the plane of incidence. Amplitude of the electric field intensity of the wave is 20V/m and frequency of wave is 10MHz. a) Obtain expressions for instantaneous electric and magnetic field intensities of the wave b) Find phase velocities of the wave along x and z directions.
27.	Explain perpendicular polarization with respect to the plane of incidence.
28.	Explain parallel polarization with respect to the plane of incidence.
29.	A plane electromagnetic wave incident normally on the surface of a perfect conductor gets totally reflected. Explain why the electric field intensity gets reflected with change of sign whereas the magnetic field intensity gets reflected with the same sign.
Unit-V	
1.	a. Starting from the equivalent circuit, derive the transmission line equations for V and I, in terms

of the source parameters.

b. At 8 MHz the characteristic impedance of transmission line is (40- j2) Ω and the propagation constant is (0.01+j0.18) per meter. Find the primary constants.

c. A dipole antenna is fed by a transmission line having Zo =60Ω . the source impedance is 600 Ω. If the length of the line is 10λ , determine antenna impedance .

2\.

a. Consider the two port network shown in fig-1. the relation between the input and output variables can be written in matrix form as

$$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix} \qquad \begin{bmatrix} cosh\gamma l & Z_0 sinh\gamma l \\ \frac{1}{Z_0} sinh\gamma l & cosh\gamma l \end{bmatrix}$$

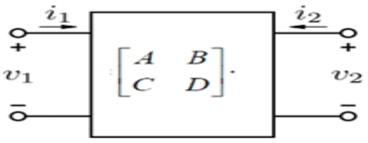


fig-1

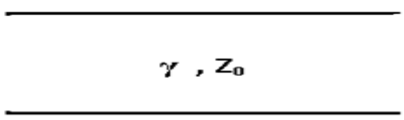


fig-2

b. A transmission line operating at 500Hz has Zo= 80 Ω ,$\alpha = 0.04\,Np/m$

$\beta = 1.5 rad/m$. Find the line parameters R, L, G and C.

c. Find the characteristic impedance of a line at 1600Hz if the following measurements have made on the line at 1600 Hz, Zoc =750Ω and Zsc= 500Ω.

3\.

a. From the fundamental voltage & current equations of transmission line, derive Expression for input impedance Zin of the line. Modify the expression for lossy & lossless cases.

b. Two successive minima's were formed at 17 cm and 27 cm along the length of the line where the VSWR is 5. calculate the reflection coefficient on the load

c. A transmission line is short circuited at one end and has an electrical path length of $\frac{\pi}{4}$. if the input impudence is j60Ω , its characteristic impedance is

4\.

a. Explain the principal of impedance matching with quarter wave transformer

b. A transmission line has primary constants R=0.1Ω/m , G= 0.01mho/m , L=0.01µH/m C=100pF/m . if the line is connected to a load impedance of (10+j20) Ω , find the reflection coefficient at the

i. Load end
ii. 20cm from load

c. A loss less transmission line has 75 Ω characteristic impedance. the line is terminated in a load impedance of 50-j100 Ω. The maximum voltage measured on the line is 100V. Find the maximum current and minimum voltage on the line.

5\.

a. What are the different distortions on a line and derive the conditions for distortion less transmission.

b. A transmission line with air as dielectric has Zo= 50 Ω , and a phase constant of 3 rad/m at 10MHz. find the inductance and capacitance per unit length of the line

c. a transmission line of length 0.4λ has a characteristic impedance of 100Ω and is terminated by a load impedance of 200+j180 Ω , by using smith chart find

i. voltage reflection coefficient
ii. VSWR
iii. Input impedance of the line

6\.

a. What is a standing wave? Define standing wave ratio? what is its relationship with the reflection

	coefficient b. A load Impedance of 90-j25 Ω is to be matched to a 50Ω line using single Stub matching. Find the length and position of the stub. c. Calculate the characteristic impedance, the attenuation constant and phase constant of a transmission line if the following measurements have been made on the line Zoc =550 Ω, and Zsc =660Ω.
7.	a. Explain the meaning of the terms characteristic impedance and propagation constant of a uniform transmission line and obtain the expressions for them in terms of parameters of line. b. A 50Ω loss less line connects a signal of 50khz to a load of 140 Ω. the load power is75mW .calculate i. Voltage reflection coefficient ii. VSWR iii. Position of Vmax , I max , Vmin and I min . c. If the reflection coefficient at the load is $0.6e^{j60}$, the reflection coefficient at the distance of $\frac{\lambda}{8}$ from the load is
8.	a. What is loading? explain the different types of loading in transmission lines b. A line with Zo =100 Ω, is connected to an impedance Z_L=300+j200 Ω find the following using smith chart i. The line length d required to transform this load to a pure resistance ii. The impedance of a $\frac{\lambda}{4}$ line required for a match iii. VSWR on the d line and VSWR on $\frac{\lambda}{4}$ line. c. A transmission line is terminated in a load impedance Z_L=73+j42.5 Ω , the frequency f=10^7Hz , line length =10m, the inductance L=10^{-6} H/m , C= $\frac{1}{9}\ 10^{-10} F/m$, find Z.
9.	a. A low transmission line of 100 Ω characteristic impedance is connected to a load of 300 Ω. Calculate the reflection coefficient and standing wave ratio. Derive the relationships used. b. A loss less transmission line has 75 Ω characteristic impedance. the line is terminated in a load impedance of 50-j100 Ω. The maximum voltage measured on the line is 100V. Find the maximum current and minimum voltage on the line. c. in its characteristic impedance and a potential difference of 2.1V having a frequency of 1khz , is applied at the sending end , calculate i. The characteristic impedance ii. Wave length iii. The velocity of propagation
10.	a. Describe how matching is achieved using single stub matching. What are the advantage and disadvantages when compared to double stub matching? b. What is the significance of the standing wave ration in a transmission line? calculate the reflection coefficient and VSWR for a 50Ω lines, terminated with i. Matched load ii. Short circuit iii. +j50Ω iv. –j50Ω c. A transmission line of characteristic impedance 50Ω is terminated in a load impedance Z_L The VSWR of the line is measured as 5 and the first of the voltage maxima in the line is observed at a distance of $\frac{\lambda}{4}$ from the load. the value of Z_L is

11.	An radio frequency line of characteristic impedance 600 ohm is terminated in an impedance of 400+j200 ohm. Find a)Reflection coefficient b)VSWR
12.	A certain transmission line 2m long operating at $w=10^6$ rad/sec has α=8db/m, β=1 rad/m and z0=60+j40 ohm. If the heline line is connected to a source of 10 V.Zg=40 ohm and terminated by a load of 20+j50 ohm. Determine a)input impedance b)sending end current c)the current at the middle of the line.
13.	A lossless transmission line with Z0=50 ohms is 30 m long and operates at 2 mhz. The line is terminated with a load ZL=60+j40 ohms .If u=0.6c on the line ,Find a)Reflection coefficient b)standing wave ratio c)input impedance
14.	At 1200 cycles the Z0 and y are given as Z0=650-j150 ohms, Y=0.05+j.007 mhos for an open wire transmission line. Calculate the distributed parameters of the line.
15.	Find the reflection coefficient and transmission coefficient of an electric field wave travelling in air and incident normally on a boundary between air and a dielectric having apermeability=μ0 and permittivity εr=4.74.
16.	The primary constants of a cable are R=80 ohm/km, L=2 mH/km, $G=0.3*10^{-6}$ mho/km, C=0.07Mf/km. Calculate the characteristic constants of the line at 500c/sec
17.	Find the voltage standing wave ratio for given a)Z0=40 ohm, Zl=70 ohm b)Zo=50 ohm, Zl=80 ohm
18.	A transmission line with a characteristic impedance of 300 ohm is terminated by a purely resistive load. While making SWR measurements ,the meter reads maximum voltage of 7.5µv and a minimum of 5µv.What should be the load resistance.
19.	An air line has characteristic impedence of 65 0hms and phase constant of 5 rad/m at 120 mhz. Calculate the capacitance and inductance of the line/meter.
20.	The parallel branches of a 2 wire transmission line are terminated in 100 ohm and 200 ohm resistor. The characteristic impedance of the line is z0=50 ohm and each section has a length of λ/4.Find a)zin b)voltage reflection coefficient c)power reflection coefficient at the input.
21.	The parameters of a certain transmission line operating at 6 × 108 rad/s are L = 0.4 µH/m,C = 40 pF/m, G = 80 µS/m, and R = 20 Ω/m. Find γ, α , β, λ, and Z_0
22.	Two characteristics of a certain lossless transmission line are Z_0 = 50 Ω and the propagation constant γ = 0+j0.2π m^{-1}at f = 60 MHz. Find L and C for the line
23.	The propagation constant of a lossy transmission line is 1 + j2 m^{-1}, and its characteristic impedance is 20 + j0Ω at ω = 1 Mrad/s. Find L, C, R, and G for the line
24.	A 300 ohm transmission line is 0.8 m long and is terminated with a short circuit. The line isoperating in air with a wavelength of 0.3 m and is lossless. If the input voltage amplitude is 10V, what is the maximum voltage amplitude at any point on the line?
25.	A lossless line having an air dielectric has a characteristic impedance of 400 Ω. The line isoperating at 200 MHz and Z_{in} = 200 − j200 Ω. Use the Smith chart , find: (a) s; (b) Z_L if the line is 1 m long; (c) the distance from the load to the nearest voltage maximum
26.	Differentiate between travelling waves and standing waves
27.	A lossless line of characteristic impedance is 100 ohm is terminated by a load which gives VSWR =3 operating at 300MHz frequency. During the measurements the first voltage maximum of 10 v appeared at a distance of 3.2m from the termination. Determine the load impedance and power delivered to the load.
28.	The terminating load of transmission line Z_0=5<0 ohm working at 300MHzis 50+j50 ohm. Calculate VSWR and reflection coefficient
29.	Derive equations for the length and the location of the single stub matching device in terms of the reflection coefficient of the transmission line
30.	Explain the applications of Smith chart