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Lecture Plan-1

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :- Gradient of a scaler field	Time Allotted:-
1.	**Introduction** Gradient is an operation performed on a scaler function which results in a vector function. The magnitude of this vector function at any pt. in the region of scaler field is the max. rate of increase of the scaler function at that pt.and the direction is given by in which the max.rate of increase occurs.	10 min
2	**Division of the Topic** - Gradient of a scaler field	30 min
3.	**Conclusion** It is maximum rate of growth of scaler quantity.	
4	**Question / Answer** Q1.Define gradient of a scaler field. A1.Gradient is the maximum variation of a scaler considering all directions. Q2.Gradient of a scaler field always results into------------ A2.Vector field	5 min 5 min

Assignment to be given:-NIL

Reference Readings:-Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-2

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION A

S. No.	Topic :-Divergence & curl of a vector field	Time Allotted:-
1.	**Introduction** The rate of change of a vector field is complex & is defined by divergence and curl of a vector field. The divergence of a vector field is a scaler quantity. The rate of change of a vector field is called curl which means circular rotation.	10 min
2	**Division of the Topic** -Divergence of a vector field -Curl of a vector field	30 min
3.	**Conclusion** The divergence of a vector field is a scaler quantity. The curl of a vector field results into vector quantity.	5 min
4	**Question / Answer** Q1.The divergence of vector quantity always results into------------ A1.Scaler quantity Q2.The curl of vector quantity always results into------------ A2.Vector quantity	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-3

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :- Coulomb's law & electric displacement (Ψ)	Time Allotted:-
1.	Introduction It is found experimentally that between two charged bodies there exists a force that tends to push them apart or pull them together depending on whether the charges on the bodies are of like or opposite sign. The electric displacement is equal in magnitude to the charge that produces it.	10 min
2	**Division of the Topic** - Coulomb's law & - Electric displacement (Ψ)	30 min
3.	**Conclusion** $F = q_1 q_2 / kr^2$ & $\Psi = Q$ Here F=force , q1& q2 are the net charges of two spheres	5 min
4	**Question / Answer** Q1.The electric displacement is equal to --------quantity. A1.Charge Q2.Define coulomb's law. A2.It states that force is directly proportional to product of two charges & is inversely proportional to the square of the distance between them.	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P S

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Lecture Plan-5

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :- Potential function(V) , divergence theorem , alternative statement of gauss's law , lap lace & poisons equation	Time Allotted:-
1.	Introduction The potential function is a scaler quantity. Divergence theorem relates an integration throughout a volume to an integration over the surface surrounding the volume. There are different forms of divergence theorem. The alternative form of gauss's law can be obtained by applying divergence theorem on gauss's law in integral form. The laplace & poissions can also be obtained from the alternative statement of gauss's law.	10 min
2	**Division of the Topic** **-Potential function(V)** **- Divergence theorem** **-Alternative statement of gauss's law** **- Lap lace & poisons equation**	30 min
3.	**Conclusion** $\nabla . D = \rho$, $\nabla^2 V = -\rho/\epsilon$, $\nabla^2 V = 0$	5 min
4	**Question / Answer** Q1.write laplace equation. A1. $\nabla^2 V = 0$ Q2. Write alternative form of gauss's law. A2. $\nabla . D = \rho$	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-4

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :-Displacement density (D) & gauss's law derivation	Time Allotted:-
1.	Introduction The electric displacement density is defined as electric displacement per unit area. Gauss's law states that the total displacement through any closed surface surrounding charges is equal to the amount of charge enclosed.	10 min
2	**Division of the Topic** -Displacement density (D) & - Gauss's law derivation	30 min
3.	**Conclusion** $D = \Psi/A = q/4\Pi r2$, $\Psi = q$ Here q = amount of charge enclosed	5 min
4	**Question / Answer** Q1.Define electric displacement density. A1. The electric displacement density is defined as electric displacement per unit area Q2.Define gauss's law A2.Gauss's law states that the total displacement through any closed surface surrounding charges is equal to the amount of charge enclosed. .	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-6

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :-Boundary conditions in electric field , method of electrical images	Time Allotted:-
1.	Introduction Boundary conditions say that normal component of D is continuous at the boundary & tangential component of E is continuous at the boundary. These conditions are used to solve problems involving dielectrics. It is commonly used to determine V,D,E due to charges in presence of conductors. Here we transform the conducting surface into equivalent equipotential surface & solve the problems.	10 min
2	**Division of the Topic** -Boundary conditions in electric field - Method of electrical images	30 min
3.	**Conclusion** $D_{n1} = D_{n2}$, $E_{t1} = E_{t2}$	5 min
4	**Question / Answer** Q1Write down the boundary conditions. A1. $D_{n1} = D_{n2}$, $E_{t1} = E_{t2}$ Q2.Which surface is taken while drawing images of pt. charges. A2.Equipotential surface	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

Lecture Plan-7

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :- Direc delta representation for a point charge	Time Allotted:-
1.	Introduction The delta function behaves as a sharped peak function of unit area .It is used for representing line , charge & sheet distributions ,poission's equations ,green's function etc.	10 min
2	**Division of the Topic** -Direc delta representation for a point charge -Direc delta properties	30 min
3.	**Conclusion** Direc delta is a pulse of high amplitude & unit area.	5 min
4	**Question / Answer** Q1.Define direc delta . A1.It is a pulse of high amplitude & unit area. Q2.Direc delta representation is used for -------------------- A2.Point charges & electric dipoles	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-8

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	Topic :- State & prove uniqueness theorem	Time Allotted:-
1.	**Introduction** It is a fundamental theorem of potential theory.It states that a potential which satisties Poisson’s equation or laplace equation as well as boundary conditions in a particular field is the only possible solution.	10 min
2	**Division of the Topic** -Statement of uniqueness theorem -Proof of uniqueness theorem	30 min
3.	**Conclusion** It satisfies laplace or poission’s equation as well as boundary conditions.	5 min
4	**Question / Answer** Q1.Define uniqueness theorem. A1. It states that a potential which satisties Poisson’s equation or laplace equation as well as boundary conditions in a particular field is the only possible solution. Q2.Define dirichlet condition. A2.If the value of some scaler potential V on the closed surface is specified then it is called dirichlet condition	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-9

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION A

S. No.	**Topic :- Derivation of electrostatic energy .**	**Time Allotted:-**
1.	Introduction When a test charge is moved from a point of lower potential to a point of higher potential in an electric field, the external agent moving the charge has to do work .	10 min
2	**Division of the Topic** -Derivation of electrostatic energy	30 min
3.	**Conclusion** The potential energy can be positive or negative depending upon whether the work is done on the system or by the system.	5 min
4	**Question / Answer** Q.What is the unit of energy density. A.Joule/m^3	5 min

Assignment to be given:-
Q1.Calculate the capacitance for concentric spheres, coaxial cable.
Q2.Explain the direc delta representation for an infinite small dipole.

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad , Elements of electromagnetic fields by S P Seth

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Lecture Plan-10

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION B

S. No.	Topic :-Faraday's law of electromagnetic induction & ampere's law in vector differential form	Time Allotted:-
1.	Introduction Acc to faraday's laws the EMF induced in the circuit is equal to time rate of decrease of integral magnetic flux linking in the circuit. Amperes work law states that the magnetomotive force around a closed path is equal to the current enclosed by the path.	10 min
2	**Division of the Topic** **-Faraday's law of electromagnetic induction &** **- Ampere's law in vector differential form**	30 min
3.	**Conclusion** Magnetic flux through the loop is the total time of voltage induced in the loop throughout the interval during which the magnetic field is established .it is also the surface integral of normal component of B.	5 min
4	**Question / Answer** Q1-State ampere's work law. A1 It states that the magnetomotive force around a closed path is equal to the current enclosed by the path. Q2-what is induction equation? A2- $\nabla \times E = -\partial B / \partial T$	5 min

Assignment to be given:-NIL

Reference Reading:-Electromagnetic waves & radiating systems by Jordan Balman

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Lecture Plan-11

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION B

S. No.	Topic :- Equation of continuity for static and time-varying fields	Time Allotted:-
1.	Introduction The equation of continuity for static fields can be obtained by taking the divergence of unmodified form of ampere's law & for time-varying fields can be obtained from the concept of conservation of charge.	10 min
2	**Division of the Topic** -Equation of continuity for static and - Equation of continuity for time-varying fields	30 min
3.	**Conclusion** $\nabla \cdot J = 0$ & $\nabla \cdot J = -\partial\rho/\partial t$	5 min
4	**Question / Answer** Q1.Write equation of continuity for static field. A1.$\nabla \cdot J = 0$ Q2.Write equation of continuity for time-varying field. A2. $\nabla \cdot J = -\partial\rho/\partial t$	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

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Lecture Plan-12

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION B

S. No.	Topic :- Ampere's law for a current element & ampere's force law.	Time Allotted:-
1.	**Introduction** The quantity Ids is called current element. It is a vector quantity having the direction of current. The amperes law is defined for this current element. Ampere's experiments on the forces between current carrying loops of thin wire.	10 min
2	**Division of the Topic** -Ampere's current law & - Ampere's force law.	30 min
3.	**Conclusion** The current element is a vector quantity.	5 min
4	**Question / Answer** Q.Is current element a vector or scaler quantity. A.Vector quantity	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

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Lecture Plan-13

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION B

S. No.	Topic : -Magnetic vector potential (A)	Time Allotted:-
1.	**Introduction** The space derivative of B or H gives the magnetic vector potential .As the magnetic field is a vector quantity, the curl is the only space – derivative operation which can be used.	10 min
2	**Division of the Topic** -Magnetic vector potential	30 min
3.	**Conclusion** H = ▼* A or B = ▼* A	5 min
4	**Question / Answer** Q. Is magnetic vector potential a vector or scaler quantity. A.Vector quantity.	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

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Lecture Plan-15

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION B

S. No.	Topic :- Far field concept of charge distribution	Time Allotted:-
1.	**Introduction** In the derivation of the electric dipole field it was found that field expressions became relatively simple at observation points far from dipole .Far field approximations are frequently used.	10 min
2	**Division of the Topic** -Far field concept of charge distribution	30 min
3.	**Conclusion** The far field is not valid for time-varying charges which produce radiation fields.	5 min
4	**Question / Answer** Q.The far field concept is not valid for----------------- A.Time-varying charges which produce radiation fields	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

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Lecture Plan-16

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION B

S. No.	Topic :- Far fields of current distribution & vector potential (alternative derivation)	Time Allotted:-
1	**Introduction** If point of observation is far from the current distribution it is possible to approximate using 1/R expansion. The use of the vector potential is a great convenience in finding the magnetic field due to a given current.	10min
. 2.	**Division of the Topic** -Far fields of current distribution -Vector potential (alternative derivation)	30min
3.	**Conclusion** The far field is always given by first non zero term & this far field expansion is not valid for time varying charges which produce radiation field. The use of the vector potential is a great convenience in finding the magnetic field due to a given current.	5min
4	**Question / Answer** Q.For which quantities far field concept is used? A.Current & charge.	5min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balm

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Lecture Plan-17

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION C

S. No.	**Topic :-Maxwell's equations in differential as well as integral form & word statement of Maxwell's equations**	**Time Allotted:-**
1.	**Introduction** The electromagnetic equations are known as Maxwell's equations since Maxwell's contributed to their development & established them as a self-consistent set. The integral form of Maxwell's equations can be obtained by applying stokes & divergence theorem on differential form.	10 min
2	**Division of the Topic** - Maxwell's equations in differential as well as integral form - Word statement of Maxwell's equations	30 min
3.	**Conclusion** ▼*E is a measurement of $-\partial B/\partial t$. -if ▼*E =0, then the system is said to be irrotational. -if ▼. B=0 then the lines of magnetic flux are continuous.	5 min
4	**Question / Answer** Q.How we can convert the Maxwell's differential form into integral form? A. By using stokes & divergence theorem.	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad

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Lecture Plan-18

Semester:- IV　　　Class:- EEE　　　Course Code:- EE-208-F

Subject:- Electromagnetic Theory　　　SECTION C

S. No.	Topic :- The equation of continuity for time-varying fields	Time Allotted:-
1.	**Introduction** Since the current is simply charge in motion, the total current flowing out some volume must be equal to rate of decrease of charge within the volume ,assuming that charge cannot be created or destroyed .This concept is essential in understanding why current flows in the leads to a capacitor during charge or discharge when no current flows between the capacitor plates.	10 min
2	**Division of the Topic** -The equation of continuity for time-varying fields	30 min
3.	**Conclusion** $\nabla \cdot J = -\partial\rho/\partial t$	5 min
4	**Question / Answer** Q. Write down equation of continuity for time-varying fields. A. $\nabla \cdot J = -\partial\rho/\partial t$	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad

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Lecture Plan-19

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION C

S. No.	Topic :- Inconsistency of ampere's law	Time Allotted:-
1.	**Introduction** Taking the divergence of ampere's law yields the equation of continuity for steady currents. Thus ampere's law is not consistent with time-varying equation of continuity. This difficulty may have been one of the factors which led James Clerk Maxwell in the mid-1860's to seek a modification to ampere's law.	10 min
2	**Division of the Topic** -Inconsistency of ampere's law	30 min
3.	**Conclusion** ▼* H=J gets modified to ▼* H=J + D	5 min
4	**Question / Answer** Q1.Write the modified form of ampere's law. A1. ▼* H=J + D Q2.Write ampere's law. A2. ▼* H=J	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad ,

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Lecture Plan-20

Semester:- IV　　Class:- EEE　　Course Code:- EE-208-F

Subject:- Electromagnetic Theory　　SECTION C

S. No.	Topic :-Electromagnetic waves in a homogeneous medium & solution for free-space conditions	Time Allotted:-
1.	**Introduction** A homogenous medium is one for which the quantities ϵ, μ & σ are constant throughout the medium. For free space J=0 & σ =0.The Maxwell's equations gets modified accordingly.	10 min
2	**Division of the Topic** -Electromagnetic waves in a homogeneous medium & - Solution for free- space conditions	30 min
3.	**Conclusion** $\nabla^2 E=\mu\epsilon\ddot{E}$ & the same relation is satisfied for the magnetic field H.	5 min
4	**Question / Answer** Q1.Define homogenous medium. A1. A medium for which the quantities ϵ, μ & σ are constant throughout the medium. Q2.For free-space which quantities are zero. A2.Current density (J) & conductivity(σ).	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-21

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION D

S. No.	Topic :- **Uniform plane waves**	**Time Allotted:-**
1.	**Introduction** If a wave is traveling in x direction then the electric & magnetic field will be independent of y & z & is a function of x & t only. Such a wave is called uniform plane wave. A uniform plane wave progressing in the x direction has no x component of E & H.Therefore uniform plane waves are transverse in nature & have component of E & H only in directions perpendicular to the direction of propagation. It is a special case of electromagnetic wave propagation & is practically important.	10 min
2	**Division of the Topic** **-**Uniform plane wave	30 min
3.	**Conclusion** Uniform plane waves are transverse in nature & have component of E & H only in directions perpendicular to the direction of propagation.	5 min
4	**Question / Answer** Q1What is uniform plane wave? A1. If a wave is traveling in x direction then the electric & magnetic field will be independent of y & z & is a function of x & t only. Such a wave is called uniform plane wave. Q2.Are uniform plane waves transverse in nature? A2.Yes	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-22

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION BI

S. No.	Topic :- Relation between E & H in a uniform plane wave , wave equations for a conducting medium	Time Allotted:-
1.	**Introduction** For a uniform plane wave traveling in the x direction E & H are both independent of y & z .Also E & H have no x component.	10 min
2	**Division of the Topic** -Relation between E & H in a uniform plane wave - Wave equations for a conducting medium	30 min
3.	**Conclusion** $E/H=(\mu/\epsilon)^{1/2}$, $(\mu/\epsilon)^{1/2} = 120\Pi = 377$ ohms	5 min
4	**Question / Answer** Q1.What is the relation between E & H? A1. $E/H=(\mu/\epsilon)^{1/2}$, $(\mu/\epsilon)^{1/2} = 120\Pi = 377$ ohms Q2.What is the value of intrinsic impedance in free space? A2.377 ohms.	5 min

Assignment to be given:-NIL

Reference Readings:- :- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-23

Semester:- IV　　Class:- EEE　　Course Code:- EE-208-F

Subject:- Electromagnetic Theory　　SECTION C

S. No.	Topic :- Maxwell's equations using phasor notation & wave equations in a conducting medium	Time Allotted:-
1.	**Introduction** The Maxwell's equations can be represented in the phasor form using sinusoidal time variations .e.g. the time varying field $\tilde{E}(r,t)$ may be expressed in terms of the corresponding phasor quantity $E(r)$ as $\tilde{E}(r,t) = \mathrm{Re}\{E(r)e^{jwt}\}$ For regions in which the conductivity is not zero & conduction currents may exist, the more general solution must be obtained.	10 min
2	**Division of the Topic** -Maxwell's equations using phasor notation & -Wave equations in a conducting medium	30 min
3.	**Conclusion]** Sinusoidal time variations are used for representing the Maxwell's equations in phasor form	5 min
4	**Question / Answer** Q1.Why sinusoidal time variations are used? A1.For representing the Maxwell's equations in the phasor form. Q2.Which quantity is not zero for a conducting medium? A2.Conductivity.	5 min

Assignment to be given:-NIL

Reference Readings:- :- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-24

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION C

S. No.	Topic :- Wave propagation in good dielectrics	Time Allotted:-
1.	**Introduction** In electromagnetic, materials are divided into conductors & dielectrics .The dividing lines between the two classes is not sharp. $\sigma/\omega\epsilon = 1$ ca be considered to mark the dividing line between conductors & dielectrics .For good dielectrics $\sigma/\omega\epsilon$ is very much less than unity in the radio frequency range.	10 min
2	**Division of the Topic** **-** Wave propagation in good dielectrics	30 min
3.	**Conclusion** For good dielectrics $\sigma/\omega\epsilon$ is very much less than unity in the radio frequency range.	5 min
4	**Question / Answer** Q1.What is the unit of the ratio $\sigma/\omega\epsilon$? A1.Dimensionless ratio Q2.For good dielectrics the ratio $\sigma/\omega\epsilon$ is-------------- A2.Very much less than unity	5 min

Assignment to be given:-NIL

Reference Readings:- :- Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-25

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION C

S. No.	Topic :- Depth of penetration (δ)	Time Allotted:-
1.	**Introduction** It is defined as the depth in which the wave has been attenuated to 1/e or approximately 37% of the original value.	10 min
2	**Division of the Topic** - Depth of penetration (δ) -Depth of penetration expression for good conductors & dielectrics -Phase velocity	30 min
3.	**Conclusion** $\delta=1/\alpha$ & for good conductor depth of penetration is given by $\delta = (2/f\mu\sigma\Pi)^{1/2}$	5 min
4	**Question / Answer** Q. Define the term depth of penetration. A. It is defined as the depth in which the wave has been attenuated to 1/e or approximately 37% of the original value.	5 min

Assignment to be given:-
Q.What do you understand by polarization & explain different types of polarization?

Reference Readings:-Electromagnetic waves & radiating systems by Jordan Balman , Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-26

Semester:- IV　　Class:- EEE　　Course Code:- EE-208-F

Subject:- Electromagnetic Theory　　SECTION D

S. No.	Topic :- Introduction to transmission lines	Time Allotted:-
1.	**Introduction** Transmission lines are a means to convey electrical signals or power between two points separated appreciably in distance .The simplest type of transmission line is a pair of parallel wires insulated from each. It is also known as two-wire balanced transmission line.	10 min
2	**Division of the Topic** **--** Introduction to transmission lines	30 min
3.	**Conclusion** In transmission lines the electrical parameters are assumed to be lumped.	5 min
4	**Question / Answer** Q1.In transmission lines electrical parameters are lumped or uniformly & continuously distributed. A1.Lumped Q2.The simplest transmission line is -------------------- A2.Two-wire balanced transmission line.	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-27

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :- Derivation of basic transmission line equations	Time Allotted:-
1.	**Introduction** The transmission lines can be analyzed in terms of voltage & current. The voltage and current expressions can be obtained in both exponential & hyperbolic form.	10 min
2	**Division of the Topic** -Derivation of basic transmission line equations	30 min
3.	**Conclusion** $V=V_S \cosh Px - I_S Z_0 \sinh Px$ $I = I_S \cosh Px - V_S/Z_0 \sinh Px$	5 min
4	**Question / Answer** Q1.Write the voltage & current equation in exponential form? A1. $V=V_S \cosh Px - I_S Z_0 \sinh Px$ $I = I_S \cosh Px - V_S/Z_0 \sinh Px$ Q2.Wht are the assumptions made while calculating current and voltage? A2.Voltage is assumed constant while calculating current & vice-versa .	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

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Lecture Plan-28

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :- Primary constants of a transmission line	Time Allotted:-
1.	**Introduction** The four parameters e.g. R , L , G , C , are referred to as primary constants of the transmission line but in general they vary with frequency .However for transmission line theory they are assumed to be constant . R is the resistance per unit length. L is the inductance per unit length. G is the conductance per unit length & C is the capacitance per unit length.	10 min
2	**Division of the Topic** -Primary constants of a transmission line	30 min
3.	**Conclusion** The primary constants varies with frequency & are assumed to be constant.	5 min
4	**Question / Answer** Q .List the four primary constants of the transmission line. A. R , L , G , C	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

Lecture Plan-30

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	**Topic :- Transmission line equations in hyperbolic form , input impedance of a transmission line terminated with Z_R**	**Time Allotted:-**
1.	**Introduction** The general solution of a transmission line can also be obtained in alternative form i.e hyperbolic form. The input impedance of a finite transmission line terminated in its characteristic impedance Z_O is the characteristic impedance of the line .	10 min
2	**Division of the Topic** - Transmission line equations in hyperbolic form - Input impedance of a transmission line terminated with Z_R	30 min
3.	**Conclusion** General solution in hyperbolic form is obtained. The input impedance of a finite transmission line terminated in its characteristic impedance Z_O is the characteristic impedance of the line.	5 min
4	**Question / Answer** Q.Define characteristic impedance Z_O in case of finite transmission line. A. The input impedance of a finite transmission line terminated in its characteristic impedance Z_O is the characteristic impedance of the line.	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

Doc. No.: DCE/0/15
Revision :00

Lecture Plan-31

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :-Infinite transmission line , An infinite transmission is equivalent to a finite line terminated in its characteristic impedance	Time Allotted:-
1.	**Introduction** If a line of infinite length is considered then all the power fed into it will be absorbed . As the input impedance of a finite terminated in its characteristic impedance Z_O is the characteristic impedance of the line Also the inputI impedance of an infinite line is called characteristic impedance. Hence, a finite transmission line terminated in its characteristic impedance is equivalent to an infinite line.	10 min
2	**Division of the Topic** - Infinite transmission line - An infinite transmission is equivalent to a finite line terminated in its characteristic impedance	30 min
3.	**Conclusion** A finite transmission line terminated in its characteristic impedance Z_O is equivalent to an infinite line.	5 min
4	**Question / Answer** Q1. Define characteristic impedance Z_O in case of infinite transmission line. A1.Input impedance of infinite transmission line is called characteristic impedance. Q2.Define infinite transmission line. A2.A line whose length is infinite & no power will be absorbed is called infinite transmission line	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

Doc. No.: DCE/0/15
Revision :00

Lecture Plan-32

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :- Surge impedance (Z_O) , Reflection , Voltage standing wave ratio (VSWR)	Time Allotted:-
1.	**Introduction** Characteristic impedance is nothing but the input impedance of the infinite transmission line. At radio frequencies, this impedance is resistive in nature. The reflection occurs due to improper termination .The voltage standing wave ratio is defined as the ratio of maximum to minimum voltage on a line having standing waves.	10 min
2	**Division of the Topic** -Surge impedance (Z_O) - Reflection - Voltage standing wave ratio (VSWR)	30 min
3.	**Conclusion** At radio frequencies, this impedance is resistive in nature. The reflection occurs due to improper termination. Low value of VSWR is always desirable.	5 min
4	**Question / Answer** Q.Define VSWR. A.It is defined as the ratio of maximum to minimum voltage on a line having standing waves.	5 min

Assignment to be given:-NIL

Reference Readings:- Antenna & wave propagation by K.D. Prasad .

Doc. No.: DCE/0/15
Revision :00

Lecture Plan33

Semester:- IV   Class:- EEE   Course Code:- EE-208-F

Subject:- Electromagnetic Theory   SECTION D

S. No.	Topic :- Introduction to reflection & reflection in case of perfect conductor	Time Allotted:-
1.	**Introduction** When an electromagneticm wave traveling in one medium impinges upon a second medium a different dielectric constant, permeability or conductivity, it is partially transmitted & partially reflected.	10 min
2	**Division of the Topic** -Introduction to reflection & -Reflection in case of perfect conductor -Normal incidence -Oblique incidence	30 min
3.	**Conclusion** Whenever a wave is incident obliquely on the interface between two medium it is necessary to consider separately cases i.e. when electric vector is parallel to boundary surface or perpendicular to plane of incidence called horizontal polarization & vice versa is vertical polarization.	5 min
4	**Question / Answer** Q1 What is vertical polarization? A1.If magnetic vector is parallel to boundary surface & electric vector is parallel to plane of incidence. Q2-What type of waves are formed due to reflection? A2.-Standing waves	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

Doc. No.: DCE/0/15
Revision :00

Lecture Plan-34

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic:- Reflection in case of perfect dielectric	Time Allotted:-
1.	**Introduction** When an electromagnetic wave is incident normally on the surface of a perfect dielectric part of energy is transmitted & a part of energy is reflected ..A perfect dielectric is one which has zero conductivity.	10 min
2	**Division of the Topic** -Reflection in case of perfect dielectric - Normal incidence -Oblique incidence	30 min
3.	**Conclusion** If a plane wave is incident upon a boundary surface that is not parallel to the plane containing E & H the boundary conditions are same,a part of wave is reflected & other is transmitted but in refracted the direction of propagation is altered.	5 min
4	Question / Answer Q1.What is vertical polarization? A1. If magnetic vector is parallel to boundary surface & electric vector is parallel to plane of incidence. Q2. What type of waves is formed due to reflection? A2. Standing waves	5 min

Assignment to be given:-NIL

Reference Readings:- Electromagnetic waves & radiating systems by Jordan Balman

Doc. No.: DCE/0/15
Revision :00

Lecture Plan-35

Semester:- IV Class:- EEE Course Code:- EE-208-F

Subject:- Electromagnetic Theory SECTION D

S. No.	Topic :-Surface impedance (Z_S) & poynting theorem	Time Allotted:-
1.	**Introduction** At higher frequencies the current is confined almost entirely to a very thin sheet at the surface of the conductor .The surface impedance is given by $Z_S = E_{tan}/J_S$ Here E_{tan} is the electric field strength parallel to & at the surface of the conductor and J_S is the linear current density Poynting theorem states that the vector product of E & H at any pt. is a measure of rate of energy flow per unit area at that pt.	10 min
2	**Division of the Topic** -Surface impedance (Z_S) & -Poynting theorem -	30 min
3.	**Conclusion** The surface impedance is given by $Z_S = E_{tan}/J_{S.}$The direction of power flow is perpendicular to E & H in the direction of the vector E*H.	5 min
4	**Question / Answer** Q1.Give the formula of surface impedance. A1. $Z_S = E_{tan}/J_S$ Q2.State pointing theorem A2. It states that the vector product of E & H at any pt. is a measure of rate of energy flow per unit area at that pt.	5 min

Assignment to be given:-NIL

Reference Readings:-Electromagnetic waves & radiating systems by Jordan Balman