**INSTITUTE OF AERONAUTICAL ENGINEERING**
**(Autonomous)**

**ELECTRONICS AND COMMUNICATION ENGINEERING**

## DEFINITIONS AND TERMINOLOGY QUESTION BANK

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| **Course Name** | : | **ELECTROMAGNETIC THEORY AND TRANSMISSION LINES** |
| **Course Code** | : | **AECB13** |
| **Program** | : | **B.Tech** |
| **Semester** | : | **IV** |
| **Branch** | : | **Electronics and Communication Engineering** |
| **Section** | : | **A,B,C,D** |
| **Academic Year** | : | **2019-2020** |
| **Course Faculty** | : | **Dr. P. Ashok Babu, Professor & HOD.**<br>**Mrs. A. Usha Rani, Assistant Professor.**<br>**Mrs.M.Sreevani, Assistant Professor.**<br>**Mrs. K C Koteswaramma, Assistant Professor** |

## OBJECTIVES:

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| I | Understand the 3D vector co-ordinate systems and electromagnetic field concepts. |
| II | Analyze the importance of Maxwell's equations in electromagnetic theory andwave propagation. |
| III | Study the propagation characteristics of electromagnetic waves at boundary. |
| IV | Demonstrate the ability to compute various parameters for transmission lines using smith chart and classical theory. |

## DEFINITIONS AND TERMINOLOGY QUESTION BANK

| S.No | QUESTION | ANSWER | Blooms Level | Course Outcome | CLO | CLO Code |
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| **MODULE-I** | | | | | | |
| 1 | Define Coulomb's law | The force between two very small objects separated in a vacuum or free space by a distance, which is large compared to their size, is proportional to the charge on each and inversely proportional to the square of the distance between them | Remember | CO1 | CLO 1 | AECB13.1 |
| 2 | What is orthogonal system? | It is one in which the coordinates are mutually perpendicular. | Remember | CO1 | CLO 1 | AECB13.1 |
| 3 | What is a point charge? | Point charge is one whose maximum dimension is very small in comparison with any other length. | Remember | CO1 | CLO 1 | AECB13.1 |

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| 4 | What is dot product? | It is defined geometrically as the product of the magnitudes of two vectors and the cosine of the angle between them. | Understand | CO1 | CLO 2 | AECB13.2 |
| 5 | What is the effect of permittivity on the force between two charges? | Increase in permittivity of the medium tends to decrease the force between two charges and decrease in permittivity of the medium tends to increase the force between two charges. | Understand | CO1 | CLO 3 | AECB13.3 |
| 6 | Define Gauss's law. | It states that the total electric flux through any closed surface is equal to the total charge enclosed by that surface. | Understand | CO1 | CLO 1 | AECB13.1 |
| 7 | State applications of Gauss law in electrostatics? | Gauss law is applied to find the electric field intensity from a closed surface. Ex: Electric field can be determined for shell, two concentric shell or cylinders etc | Understand | CO1 | CLO 3 | AECB13.3 |
| 8 | What is electric flux line? | It is an imaginary path or line drawn in such a way that its direction at any point is the direction of the electric field at that point. | Understand | CO1 | CLO 3 | AECB13.3 |
| 9 | Define divergence theorem? | The integral of the normal component of any vector field over a closed surface is equal to the integral of the divergence of this vector field throughout the volume enclosed by the closed surface | Understand | CO1 | CLO 3 | AECB13.3 |
| 10 | What are the significant physical differences between Poisson‘s and laplace’s equations. | When the region of interest contains charges poissons equation can be used to find the potential. When the region is free from charge laplace equation is used to find the potential. | Understand | CO1 | CLO 2 | AECB13.2 |
| 11 | Define current density. | The current density at a given point is the current through a unit normal area at that Point. | Remember | CO1 | CLO 1 | AECB13.1 |
| 12 | Define current. | The current (in amperes) through a given area is the electric charge passing through the area per unit time | Understand | CO1 | CLO 2 | AECB13.2 |
| 13 | Define linear, isotropic, and homogeneous dielectrics | A material is said to be linear, electric flux density varies linearly with electric field strength. Materials for which permittivity | Understand | CO1 | CLO 2 | AECB13.2 |

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| | material | does not vary in the region being considered and is therefore the same at all points are said to be homogeneous. Materials for which electric flux density and electric field strength are in the same direction are said to be isotropic. | | | | |
| 14 | Explain Electromagnetics? | Electromagnetics is a branch of physics or electrical engineering in which electric and magnetic phenomena are studied. | Understand | CO1 | CLO 2 | AECB13.2 |
| 15 | What is Field? | Field is a function that specifies a particular quantity everywhere in a region. | Understand | CO1 | CLO 2 | AECB13.2 |
| 16 | Define scalar and vector field | A scalar field is quantity which has only magnitude. A vector filed is quantity which has both magnitude and dirction. | Understand | CO1 | CLO 2 | AECB13.2 |
| 17 | Define unit vector. | By definition unit vector having unit magnitude, parallel to the coordinate axes, and they point in the direction of increasing coordinate values | Understand | CO1 | CLO 1 | AECB13.1 |
| 18 | Define potential difference | Potential difference is defined as the work done in moving a unit positive charge from one point to another point in an electric field. | Understand | CO1 | CLO 3 | AECB13.2 |
| 19 | Define the conservative property of electric field | The work done in moving a point charge around a closed path in a electric field is zero. Such a field is said to be conservative. | Remember | CO1 | CLO 2 | AECB13.2 |
| 20 | Define permittivity. | It is a universal electric constant which is a generalized, or large-scale, description of electric behavior that does not specify detailed features on the atomic dimension. It is a measure of the relative effectiveness of that substance as an electrical insulator or the extent of reduction of electric fields and consequently reduced strength of electrostatic interactions in a medium. | Remember | CO1 | CLO 3 | AECB13.2 |
| 21 | Define Stokes's theorem. | It states that the circulation of a vector field around a closed path is equal to the surface integral of the curl of vector over the open surface. | Remember | CO1 | CLO 4 | AECB13.2 |
| 22 | What is relaxation time? | It is the lime it takes u charge placed in the interior of a material to drop to 36.8 percent of its initial value | Remember | CO1 | CLO 4 | AECB13.1 |
| 23 | Define electric flux line | electric flux line is an imaginary path or line drawn in such a way that its direction at any point is the direction of the electric field at that point | Remember | CO1 | CLO 1 | AECB13.2 |

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| 24 | Define capacitance | The capacitance of this two-conductor system as the ratio of the magnitude of the total charge on either conductor to the magnitude of the potential difference between conductors | Understand | CO1 | CLO 2 | AECB13.2 |
| 25 | What meaning would you give to the capacitance of a single conductor? | A single conductor also possesses capacitance. It is a capacitor whose one plate is at infinity. | Understand | CO1 | CLO 2 | AECB13.2 |
| 26 | What is distance vector? | Distance vector is the displacement from one point to another | Understand | CO1 | CLO 2 | AECB13.2 |
| 27 | What is electrostatic force? | The force between any two particles due to existing charges is known as electrostatic force, repulsive for like and attractive for unlike. | Understand | CO1 | CLO 4 | AECB13.1 |
| 28 | Define electric field intensity. | It is force per unit charge when placed in the electric field | Understand | CO1 | CLO 4 | AECB13.2 |
| 29 | Define electrical potential. | It is the amount of work needed to move a unit charge from a reference point to a specific point against an electric field. | Remember | CO1 | CLO 2 | AECB13.1 |
| 30 | Define equipotential surface. | Equipotential surface as a surface composed of all those points having the same value of potential | Remember | CO1 | CLO 2 | AECB13.2 |
| 31 | Define conservative electric field. | Any electric field that satisfies the closed line integral of the field is zero is said to be a conservative electric field | Remember | CO1 | CLO 2 | AECB13.2 |
| 32 | What is the physical significance of divergence of electric flux density? | The divergence of a vector flux density is electric flux per unit volume leaving a small volume. This is equal to the volume charge density. | Understand | CO1 | CLO 4 | AECB13.2 |
| 33 | What is dielectric strength? | It is the maximum electric field that a dielectric can tolerate or withstand without breakdown. | Understand | CO1 | CLO 4 | AECB13.1 |
| 34 | Define electric flux density. | One line of electric flux emanates from +1 C and terminates on - 1 C. Therefore, the electric flux is measured in coulombs. Hence, the vector field D is called the electric flux density and is measured in coulombs per square meter. | Remember | CO1 | CLO 4 | AECB13.2 |
| 35 | What is electric dipole? | An electric dipole is formed when two point charges of equal magnitude but opposite sign are separated by a small distance. | Understand | CO1 | CLO 4 | AECB13.2 |

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| 36 | How is electric energy stored in a capacitor? | In a capacitor, the work done in charging a capacitor is stored in the form of electric energy. | Understand | CO1 | CLO 4 | AECB13.2 |
| 37 | Define metal and insulator. | A material with high conductivity is referred to as a metal whereas one with low conductivity is referred to as an insulator. | Understand | CO1 | CLO 4 | AECB13.2 |
| 38 | Define relative permittivity. | It is the ratio of the permittivity of the dielectric to that of free space | Understand | CO1 | CLO 1 | AECB13.1 |
| 39 | State point form of ohms law | Point form of ohms law states that the field strength within a conductor is proportional to the current density. | Remember | CO1 | CLO 4 | AECB13.2 |
| 40 | Define Point charge | A point charge is an idealized model of a particle which has an electric charge. A point charge is an electric charge at a mathematical point with no dimensions | Remember | CO1 | CLO 4 | AECB13.2 |
| **MODULE** -II | | | | | | |
| 1 | Define Biot-Savart's law | Biot-Savart's law states that the magnetic field intensity dH produced at a point P, by the differential current element idl is proportional to the product idl and the sine of the angle θ between the element and the line joining P to the element and is inversely proportional to the square of the distance K between P and the element. | Remember | CO 2 | CLO 5 | AECB13.5 |
| 2 | Define Ampere's circuit law. | Ampere's circuit law states that the line integral of the tangential component of H around a closed path is the same as the net current enclosed by the path. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 3 | Define magnetic flux density | The magnetic field (B) is defined as the force per unit current element | Remember | CO 2 | CLO 5 | AECB13.5 |
| 4 | What is the magnetic dipole moment? | The magnetic dipole moment is the product of current and area of the loop; its direction is normal to the loop. | Understand | CO 2 | CLO 6 | AECB13.6 |
| 5 | Define magnetic vector potential. | It is defined as that quantity whose curl gives the magnetic flux density | Understand | CO 2 | CLO 6 | AECB13.6 |
| 6 | What is magnetization and its units? | The magnetization M is the magnetic dipolemoment per unit volume. Units are amperes/meter | Understand | CO 2 | CLO 6 | AECB13.6 |
| 7 | What is lorentz force? | Lorentz force is the force experienced by the test charge .It is maximum if the direction of movement of charge is perpendicular to the orientation of | Remember | CO 2 | CLO 8 | AECB13.8 |

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| | | field lines. | | | | |
| 8 | State Lenz's law. | Lenz's law states that the induced emf in a circuit produces a current which opposes the change in magnetic flux producing it. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 9 | Define transformer emf. | The emf induced by the time-varying current (producing the time-varying B field) in a stationary loop is often referred to as transformer emf in power analysis. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 10 | What is time-harmonic field? | A time-harmonic field is one that varies periodically or sinusoidally with time. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 11 | Define the magnetic boundary conditions between two media | The normal components of flux density B is continuous across the boundary.The tangential component of field intensity is continuous across the boundary. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 12 | What is conduction current density? | It is the amount of current (charges) flowing on the surface of a conductor (conduction band) in a time t. This surface is always parallel to the current flow. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 13 | What is displacement current density? | It is defined as the time rate of change of electric flux density. | Understand | CO 2 | CLO 6 | AECB13.6 |
| 14 | What is main cause of eddy current? | The main cause of eddy current is that it produces ohmic power loss and causes local heating. | Remember | CO 2 | CLO 5 | AECB13.5 |
| 15 | Define inductance | It may be defined from the circuit that has the ratio of the magnetic flux linkage to the current. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 16 | Define self inductance | Self inductance is defined as the rate of total magnetic flux linkage to the current through the coil. | Remember | CO 2 | CLO 8 | AECB13.8 |
| 17 | What is Solenoid? | An inductor coil consisting of multiple turns of wire wound in a helical geometry around a cylindrical core is called as solenoid. | Remember | CO 2 | CLO 5 | AECB13.5 |
| 18 | Distinguish between solenoid and toroid. | Solenoid is a cylindrically shaped coil consisting of a large number of closely spaced turns of insulated wire wound usually on a non magnetic frame. If a long slender solenoid is bent into the form of a ring and thereby closed on itself it becomes a toroid. | Remember | CO 2 | CLO 8 | AECB13.8 |

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| 19 | Define magnetic flux line | The magnetic flux line is the path to which the magnetic flux density is tangential at every point in a magnetic field | Understand | CO 2 | CLO 8 | AECB13.8 |
| 20 | What is a magnetic dipole? | A bar magnet or a small filamentary current loop is usually referred to as a magnetic dipole. | Understand | CO 2 | CLO 8 | AECB13.8 |
| 21 | What is relative permeability? | It is the ratio of the permeability of a given material to that of free space and is known as the relative permeability of the material. It is the dimensionless quantity. | Understand | CO 2 | CLO 8 | AECB13.8 |
| 22 | What are ferromagnetic materials? | Ferromagnetism occurs in materials whose atoms have relatively large permanent magnetic moment. They are called ferromagnetic materials because the best known member is iron. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 23 | Define Faraday's law? | Faraday's law states that the emf in any closed circuit is equal to the time rate of change of the magnetic flux linkage by the circuit. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 24 | Define motional emf. | In a conducting loop, moving with uniform velocity u as consisting of a large number of free electrons, the emf induced in the loop, such type of emf is called motional emf or flux-cutting emf because it is due to motional action. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 25 | Define Ampere's force law. | Ampere's Force Law states that the force of attraction or repulsion between two wires carrying currents is proportional to their lengths and the intensities of current passing through them. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 26 | What is the significance of displacement current? | The concept of displacement current was introduced to justify the production of magnetic field in empty space. It signifies that a changing electric field induces a magnetic field .In empty space the conduction current is zero and the magnetic fields are entirely due to displacement current. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 27 | Define Magnetic force | Magnetic force, attraction or repulsion that arises between electrically charged particles because of their motion. | Remember | CO 2 | CLO 8 | AECB13.8 |
| 28 | Define Magnetic field | A magnetic field is a vector field that describes the magnetic influence of electric charges in relative motion | Understand | CO 2 | CLO 7 | AECB13.7 |

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| | | and magnetized materials. | | | | |
| 29 | What are the units for magnetic field strength(H)? | In the International System of Units, H, magnetic field strength, is measured in the SI base units of ampere per meter | Remember | CO 2 | CLO 7 | AECB13.7 |
| 30 | Define Permeability | A quantity measuring the influence of a substance on the magnetic flux in the region it occupies. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 31 | Define Inverse square law | The inverse-square law, in physics, is any physical law stating that a specified physical quantity or intensity is inversely proportional to the square of the distance from the source of that physical quantity. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 32 | Define Ampere's force law | In magnetostatics, the force of attraction or repulsion between two current-carrying wires (see first figure below) is often called Ampère's force law. | Remember | CO 2 | CLO 7 | AECB13.7 |
| 33 | Define Magnetic moment | The magnetic moment is the magnetic strength and orientation of a magnet or other object that produces a magnetic field. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 34 | What is the effect of magnetic field? | The effects of magnetic fields are commonly seen in permanent magnets, which pull on magnetic materials and attract or repel other magnets. | Understand | CO 2 | CLO 7 | AECB13.7 |
| 35 | What are the units for magnetic flux density(B)? | The magnetic flux density is measured in tesla (in SI base units: kilogram per second$^2$ per ampere),[4] which is equivalent to newton per meter per ampere. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 36 | What is a Magnetic monopole? | A magnetic monopole is a hypothetical particle (or class of particles) that has, as its name suggests, only one magnetic pole (either a north pole or a south pole) | Remember | CO 2 | CLO 6 | AECB13.6 |
| 37 | Define Gauss's law for magnetism | It states that the magnetic field **B** has divergence equal to zero. | Understand | CO 2 | CLO 6 | AECB13.6 |
| 38 | Define Magnetic quadrupole | A quadrupole or quadrapole is one of a sequence of configurations of things like electric charge or current, or gravitational mass that can exist in ideal form, but it is usually just part of a multipole expansion of a more complex structure reflecting various orders of complexity. | Remember | CO 2 | CLO 6 | AECB13.6 |
| 39 | Define the electric dipole moment | The electric dipole moment is a measure of the separation of positive and negative electrical charges within | Remember | CO 2 | CLO 6 | AECB13.6 |

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| | | a system, that is, a measure of the system's overall polarity. | | | | |
| 40 | Define Permeability | A quantity measuring the influence of a substance on the magnetic flux in the region it occupies. | Remember | CO 2 | CLO 6 | AECB13.6 |
| **MODULE** –III | | | | | | |
| 1 | Define a wave. | If a physical phenomenon that occurs at one place at a given time is reproduced at other places at later times , the time delay being proportional to the space separation from the first location then the group of phenomena constitutes a wave. | Understand | CO 3 | CLO 9 | AECB13.9 |
| 2 | What is plane wave? | An EM wave originates from a point in free space, spread out uniformly in all directions and it forms a spherical wave. To an observer at a great distance it appears to him as plane wave. | Understand | CO 3 | CLO 9 | AECB13.9 |
| 3 | Define uniform plane wave. | Uniform plane wave, in which both fields, E and H, lie in the transverse plane—that is, the plane whose normal is the direction of propagation | Understand | CO 3 | CLO 11 | AECB13.11 |
| 4 | Define wave number in free space. | It is the ratio of angular frequency to the free space velocity. The units are rad/m | Remember | CO 3 | CLO 11 | AECB13.11 |
| 5 | How to differentiate good dielectric and good conductor | If the dissipation factor value is >>1 that material is good conductor and if the dissipation factor value is <<1 that material is good dielectric. | Remember | CO 3 | CLO 11 | AECB13.11 |
| 6 | Define skin depth | The skin depth is a measure of the depth to which an EM wave can penetrate the medium. | Understand | CO 3 | CLO 10 | AECB13.10 |
| 7 | Define oblique incidence. | When a uniform plane wave incidences obliquely (with some angle other than $90^0$) to the boundary between the two medium, and it is known as oblique incidence. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 8 | What is transmission coefficient of EM wave in a medium | Transmission coefficient is defined as the ratio of the magnitude of the transmitted field to that of incident field. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 9 | What is plane of incidence? | Plane which contains incident ray and normal to the boundary between two media is known as plane of incidence. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 10 | Describe linear polarization | LP is accomplished when the electric field vector possesses, only one component or two orthogonal linear | Remember | CO 3 | CLO 10 | AECB13.10 |

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| | | components that are in the time phase or $180^0$ out of phase. | | | | |
| 11 | Define wavelength | The wavelength in free space is the distance over which the spatial phase shifts by $2\pi$ radians | Remember | CO 3 | CLO 11 | AECB13.11 |
| 12 | Mention the properties of uniform plane wave. | i) At every point in space, the electric field E and magnetic field H are perpendicular to each other. The fields vary harmonically with time and at the same frequency everywhere in space. | Remember | CO 3 | CLO 9 | AECB13.9 |
| 13 | Define intrinsic impedance or characteristic impedance. | It is the ratio of electric field to magnetic field or It is the ratio of square root of permeability to permittivity of medium. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 14 | Define propagation constant of an EM wave. | Propagation constant is the summation of attenuation constant and phase constant. Propagation constant is a complex number $\gamma = \alpha + j\beta$ where $\alpha$ -is attenuation constant $\beta$- is phase constant. In free space $\gamma = j\omega\mu(\sigma + j\omega\varepsilon)$ | Understand | CO 3 | CLO 11 | AECB13.11 |
| 15 | What is surface impedance? | It is defined as the ratio of the tangential electric field Et to the linear current density Js which flows due to the electric filed. | Remember | CO 3 | CLO 12 | AECB13.12 |
| 16 | Define poynting vector | The vector product of electric field intensity and magnetic field intensity at a point is a measure of the rate of energy flow per unit area at that point. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 17 | What is poynting theorem? | The vector product of electric field intensity E and magnetic field intensity H at any point is a measure of the rate of energy flow per unit area at that point. The direction of power flow is perpendicular to E and H in the direction of the vector E x H. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 18 | Describe elliptical polarization | Field must have two components are not of same magnitude and time phase difference between the two components must not be $0^0$ or multiples of $180^0$ | Understand | CO 3 | CLO 10 | AECB13.10 |
| 19 | Define critical angle. | It is the incidence angle, defined by Snell's law, where the incident wave is totally reflected at the interface of two different dielectric media. | Understand | CO 3 | CLO 10 | AECB13.10 |
| 20 | Define Snell's | It is the law that gives the angles | Understand | CO 3 | CLO 11 | AECB13.11 |

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| | Law. | of reflection and refraction of a plane electromagnetic wave when the wave is incident on a boundary between two media. | | | | |
| 21 | Define index of refraction | a parameter of a medium equal to the ratio of the velocity of propagation in free space to the velocity of propagation in the medium. | Remember | CO 3 | CLO 12 | AECB13.12 |
| 22 | What is characteristic impedance of free space? | It is the square root of ratio of $\varepsilon_0$ and $\mu_0$ and its value is 377 Ω or $120\pi$. | Remember | CO 3 | CLO 11 | AECB13.11 |
| 23 | Define loss tangent. | Loss tangent is the ratio of the magnitude of conduction current density to displacement current density of the medium. Tan $\delta = \sigma / \omega\varepsilon$ | Remember | CO 3 | CLO 10 | AECB13.10 |
| 24 | Define lossy dielectric medium | A lossy dielectric is a medium in which an EM wave loses power as it propagates due to poor conduction. | Remember | CO 3 | CLO 11 | AECB13.11 |
| 25 | Define normal incidence. | When a uniform plane wave incidences normally to the boundary between the two media, then it is called normal incidence. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 26 | What is reflection coefficient of EM wave in a medium | Reflection coefficient is defined as the ratio of the magnitude of the reflected field to that of the incident field. | Remember | CO 3 | CLO 12 | AECB13.12 |
| 27 | Define perpendicular and parallel polarization. | In oblique incidence, if Electric filed component is perpendicular to POI, that is called perpendicular polarization and parallel to POI is called parallel polarization. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 28 | Define brewster angle. | It is the angle of incident wave at which no reflection takes place, i.e entire signal transmitted into material. This angle exit only for parallel or vertical polarization. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 29 | Define polarization. | The polarization of a uniform plane wave defines the shape traced by the tip of the electric field vector as the wave propagates. | Remember | CO 3 | CLO 11 | AECB13.11 |
| 30 | Describe circular polarization | Filed must have two orthogonal components, two components must have the same magnitude and the two components must have a phase difference of odd multiples of $90^0$. | Remember | CO 3 | CLO 11 | AECB13.11 |
| 31 | What is Forward Wave? | The forward wave, which travels from the transmitter to the aerial; | Remember | CO 3 | CLO 11 | AECB13.11 |

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| 32 | What is electromagnetic wave | A wave in which the electric and magnetic variables are solutions of the Maxwell–Heaviside equations. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 33 | Define Reflection | Reflection is the abrupt change in the direction of propagation of a wave that strikes the boundary between two different media. | Remember | CO 3 | CLO 12 | AECB13.12 |
| 34 | Define Refraction | Refraction is the change in direction of propagation of a wave when the wave passes from one medium into another, and changes its speed. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 35 | Define Scattering | The process in which energy is removed from a beam of electromagnetic radiation and reemitted with a change in direction, phase, or wavelength. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 36 | Define Wave impedance | The wave impedance of an electromagnetic wave is the ratio of the transverse components of the electric and magnetic fields | Understand | CO 3 | CLO 11 | AECB13.11 |
| 37 | Define Electrical conductivity | Conductivity is a measure of how easily electric current can flow through a given material. That is, for a given Electric Field in a material, a higher conductivity material will produce more current flow than a low conductivity material. | Remember | CO 3 | CLO 12 | AECB13.12 |
| 38 | Define Electrical resistivity | The electrical resistivity of a material is also known as its specific electrical resistance. It is a measure of how strongly a material opposes the flow of electric current. | Understand | CO 3 | CLO 11 | AECB13.11 |
| 39 | What is Reflected Wave? | The reflected wave, which travels back to the transmitter from the aerial. | Understand | CO 3 | CLO 12 | AECB13.12 |
| 40 | Define depolarization. | It is the change of the polarization state of a wave propagating through an anisotropic medium. | Remember | CO 3 | CLO 11 | AECB13.11 |
| **MODULE -IV** | | | | | | |
| 1 | Define capacitance in a transmission line. | is defined as the loop capacitance per unit length of the wire. Its unit is Farad/Km | Understand | CO 4 | CLO 14 | AECB13.14 |
| 2 | Define conductance in a transmission line. | Conductance (G) is defined as the loop conductance per unit length of the wire. Its unit is mho/Km | Understand | CO 4 | CLO 13 | AECB13.13 |
| 3 | What are primary and secondary constants of a | The primary constants of transmission lines are R, L, C, G. These are the distributed parameters of a transmission line. The secondary | Understand | CO 4 | CLO 13 | AECB13.13 |

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| | transmission line? | constants are characteristic impedance and propagation constants | | | | |
| 4 | Define attenuation | Attenuation in electromagnetic systems is due to conductor and dielectric losses. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 5 | Define Delay transmission line. | It is a transmission line of the appropriate length to result in a specific time delay. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 6 | What is coaxial cable? | A transmission line formed by two concentric conductors separated by a dielectric designed to confine the fields and their energy in the medium between said conductors. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 7 | Define propagation constant. | The transmission line which has attenuation constant (α) and phase constant (β) is called the propagation constant of the transmission line. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 8 | Define phase distortion. | For an applied voice-voltage wave the received waveform may not be identical with the input waveform at the sending end, since some frequency components will be delayed more than those of other frequencies. This phenomenon is known as delay or phase distortion. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 9 | What is distortion less transmission line? | A distortionless line is one in which the attenuation constant is frequency independent while the phase constant is linearly dependent on frequency. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 10 | Define characteristic impedance. | Characteristic impedance is the impedance looking into an infinite length of the line. It is also, the ratio of the voltage applied to the current flowing will give input impedance of an infinite line. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 11 | Define transmission line? What are the different types of transmission lines? | A transmission line is a system of conductors that transfers electrical signals from one place to another. Different types are1.Coaxial line2. Parallel Plate or planar lines 3. Strip lines 4. microstrip Lines. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 12 | Define line parameters of a transmission line. | The performance of transmission line depends on the parameters of the line. The transmission line has mainly four parameters, resistance, inductance, and capacitance and shunt conductance. These | Understand | CO 4 | CLO 13 | AECB13.13 |

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| | | parameters are uniformly distributed along the line. Hence, it is also called the distributed parameter of the transmission line. | | | | |
| 13 | Define resistance in a transmission line. | It is defined as the loop resistance per unit length of the wire. Its unit is ohm/Km | Remember | CO 4 | CLO 14 | AECB13.14 |
| 14 | Define frequency distortion. | A complex (voice) voltage transmitted on a transmission line will not attenuated equally and the received waveform will not be identical with the input waveform at the transmitting end. This variation is known as frequency distortion. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 15 | What is the condition for a distortion less line? | The condition for a distortion less line is RC=LG. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 16 | What are loaded lines? | It is increase L/C ratio to achieve distortionless condition in a transmission line. This can be done by increasing the inductance of a transmission line. Increasing inductance by inserting inductance in series with transmission line is termed as loading and such lines are called as loaded lines. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 17 | Define phase velocity | The phase velocity of a wave is the rate at which the phase of the wave propagates in space. This is the velocity at which the phase of any one frequency component of the wave travels. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 18 | Describe infinite transmission line. | If a line of infinite length is considered, then all the power fed into it will be absorbed. The reason is as we move away from the input terminals towards load, the current and voltages will decrease along the line and becomes zero at an infinite distance. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 19 | What is lumped loading? | In lumped loading, loading is introduced at uniform intervals. It may be noted that hysteresis and eddy current losses are introduced by loading and hence design should be optimal. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 20 | Why line parameters are | Due to transit time effect the whole line inductance or | Understand | CO 4 | CLO 14 | AECB13.14 |

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| | called distributed paprameters? | capacitance cannot be assumed to be located at a particular point in space. The inductance and capacitance are distributed throughout the length of the line. These are therefore called the 'Distributed Parameters' of the line | | | | |
| 21 | Define inductance in a transmission line. | is defined as the loop inductance per unit length of the wire. Its unit is Henry/Km | Remember | CO 4 | CLO 14 | AECB13.14 |
| 22 | Define conductance in a transmission line. | Conductance (G) is defined as the loop conductance per unit length of the wire. Its unit is mho/Km | Understand | CO 4 | CLO 14 | AECB13.14 |
| 23 | What are primary and secondary constants of a transmission line? | The primary constants of transmission lines are R, L, C, G. These are the distributed parameters of a transmission line. The secondary constants arecharacteristic impedance and propagation constants | Understand | CO 4 | CLO 14 | AECB13.14 |
| 24 | Define Wavefront. | For an electromagnetic wave, the wavefront is represented as a surface of identical phase. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 25 | What is coaxial cable? | A transmission line formed by two concentric conductors separated by a dielectric designed to confine the fields and their energy in the medium between said conductors. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 26 | What is dispersion of a transmission line? | Dispersion means the propagation velocity on the line is not constant with frequency. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 27 | What is lossless transmission line? | A transmission line is said to be lossless if the conductors of the line are perfect and the dielectric medium separating them is lossless. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 28 | Define group velocity. | The group velocity of a wave is the velocity with which the overall shape of the wave's amplitudes known as the modulation or envelope of the wave propagates through space. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 29 | Define characteristics impedance. | Characteristic impedance is the impedance looking into an infinite length of the line. It is also, the ratio of the voltage applied to the current flowing will give input impedance of an infinite line. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 30 | Define E-plane. | It is defined as “the plane containing the electric field vector and the direction of maximum radiation,” | Remember | CO 4 | CLO 14 | AECB13.14 |

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| 31 | Define H-plane. | It is defined as "the plane containing the magnetic-field vector and the direction of maximum radiation." | Understand | CO 4 | CLO 13 | AECB13.13 |
| 32 | Define One radian. | It is defined as the plane angle with its vertex at the center of a circle of radius r that is subtended by an arc whose length is r. | Understand | CO 4 | CLO 13 | AECB13.13 |
| 33 | Define One steradian. | It is defined as the solid angle with its vertex at the center of a sphere of radius r that is subtended by a spherical surface area equal to that of a square with each side of length r. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 34 | Define Polarization of a radiated wave. | It is defined as "that property of an electromagnetic wave describing the time-varying direction and relative magnitude of the electric-field vector; | Understand | CO 4 | CLO 13 | AECB13.13 |
| 35 | Define conduction-dielectric efficiency $e_{cd}$. | It is defined as the ratio of the power delivered to the radiation resistance $R_r$ to the power delivered to $R_r$ and $R_L$. | Understand | CO 4 | CLO 14 | AECB13.14 |
| 36 | Define refractive index | Refractive index of ionosphere is defined as the ratio of phase velocity of a wave in vacuum to the velocity. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 37 | Define Directivity. | It is a measure of how focused an antenna coverage pattern is in a given direction. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 38 | Define Dynamic Range. | It is the range of power between the maximum signal and minimum signal that can be measured. | Remember | CO 4 | CLO 14 | AECB13.14 |
| 39 | Define Far Field. | The far field corresponds to an RF source-to-measurement antenna distance great enough that energy radiates from the source only in a radial direction. | Remember | CO 4 | CLO 13 | AECB13.13 |
| 40 | Define front-to-back ratio. | It is the ratio of the gain in the maximum direction to that in the opposite direction | Remember | CO 4 | CLO 13 | AECB13.13 |
| **UNIT-V** | | | | | | |
| 1 | What is OC transmission line? | When a transmission line is terminated with infinity load impedance that line is called OC line. | Remember | CO 5 | CLO 16 | AECB13.14 |
| 2 | What is SC transmission line? | When line is terminated with zero load impedance that line is called SC line. | Remember | CO 5 | CLO 16 | AECB13.13 |
| 3 | What is the use of impedance transformer? | It is also called quarter wave transformer. It is impedance inverter, which inverts impedance low to high or high to low. For example, a 120 Ω load is to be matched to a 75Ω line, the quarter wave transformer must have a $Z_0$ of 95 ohms. This 95Ω quarter wave transformer will match a | Remember | CO 5 | CLO 16 | AECB13.13 |

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| | | 75Ω load to a 120 Ω line. | | | | |
| 4 | What are the limits of reflection coefficient and VSWR? | The limits of reflection coefficient are from -1 to 1 and the limits of VSWR are from 1 to infinity. | Understand | CO 5 | CLO 16 | AECB13.13 |
| 5 | What is stub matching? | Stubs can be used to match load impedance to the transmission line characteristic impedance. The stub is positioned a distance from the load. This distance is chosen so that at that point the resistive part of the load impedance is made equal to the resistive part of the characteristic impedance by impedance transformer action of the length of the main line. The length of the stub is chosen so that it exactly cancels the reactive part of the presented impedance. | Understand | CO 5 | CLO 16 | AECB13.13 |
| 6 | Why double stub matching preferred over is single stub? | (a). Single stub matching is useful for a fixed frequency .So as frequency changes the location of single stub will have to be changed. (b). The single stub matching system is based on the measurement of voltage minimum .Hence for coaxial line it is very difficult to get such voltage minimum, without using slotted line section. | Remember | CO 5 | CLO 15 | AECB13.14 |
| 7 | What is reflection | The phenomenon of setting up a reflected wave at the load due to improper termination or due to impedance irregularity in a line is known as reflection | Remember | CO 5 | CLO 15 | AECB13.14 |
| 8 | Define the term insertion loss | It is the ratio of current flowing in the load without insertion of the network to the current flowing in the load with insertion of the network | Understand | CO 5 | CLO 15 | AECB13.14 |
| 9 | Why OC stubs are preferred over short stub lines? | A short circuited stub is less prone to leakage of electromagnetic radiation and is somewhat easier to realize. On the other hand, an open circuited stub may be more practical for certain types of transmission lines, for example microstrips where one would have to drill the insulating substrate to short circuit the two conductors of the line. | Understand | CO 5 | CLO 16 | AECB13.14 |
| 10 | What are two design parameters | The location of the stub with reference to the load $d_{stub}$. The | Understand | CO 5 | CLO 16 | AECB13.14 |

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| | of single stub matching | length of the stub line $L_{stub}$ | | | | |
| 11 | State the use of half wave line. | To find unknown impedances half wave (λ/2) transmission line. When unknown load is connected to half wave line, it values is known by input impedance of half wave line | Understand | CO 5 | CLO 17 | AECB13.14 |
| 12 | What is matched transmission line? | When a transmission line is terminated with characteristic impedance that is line is called perfectly matched line. | Understand | CO 5 | CLO 16 | AECB13.13 |
| 13 | Define reflection coefficient. | Reflection coefficient is the ratio of the reflected voltage to the incident voltage. | Remember | CO 5 | CLO 15 | AECB13.14 |
| 14 | What is standing wave? Define VSWR. | If there is impedance mismatch on a line, reflected waves are formed and these are combined with incident waves forms a standing wave. Voltage standing wave ratio is ratio of maximum voltage to minimum voltage in standing wave. | Remember | CO 5 | CLO 15 | AECB13.13 |
| 15 | When a transmission line is considered as series and parallel resonant circuit? | A transmission line of λ/2 length and it is short circuited at load end, that line act as series resonant. If line open circuited at load end act as parallel resonant circuit. | Remember | CO 5 | CLO 15 | AECB13.13 |
| 16 | What is the smith chart? | It is a polar plot of the complex reflection coefficient. It is the transformation of complex impedance into reflection coefficient plane. | Understand | CO 5 | CLO 16 | AECB13.14 |
| 17 | What are the applications of smith chart? | (a) Measurement of VSWR (b)Measurement of Reflection coefficient (c) Measurement of Input impedance of line (d) Impedance to admittance conversion (e) For designing of stubs. | Understand | CO 5 | CLO 16 | AECB13.14 |
| 18 | What is Pseudo-Brewster angle | The magnitude reaches a minimum and the phase goes through -90 degree at an angle known as Pseudo-Brewster angle. | Remember | CO 5 | CLO 15 | AECB13.14 |
| 19 | Define Diffraction | Due to its high frequency signal bends around the edge of the object and tends to make the borders of it lighter. | Remember | CO 5 | CLO 16 | AECB13.13 |
| 20 | What is Pseudo-Brewster angle | The magnitude reaches a minimum and the phase goes through -90 degree at an angle known as Pseudo-Brewster angle. | Remember | CO 5 | CLO 15 | AECB13.13 |

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| 21 | Define Radiation intensity. | It is defined the power radiated from an antenna per unit solid angle in a given direction" | Understand | CO 5 | CLO 15 | AECB13.13 |
| 22 | Define field pattern in linear scale. | field pattern(in linear scale) typically represents a plot of the magnitude of the electric or magnetic field as a function of the angular space. | Remember | CO 5 | CLO 15 | AECB13.13 |
| 23 | Define power pattern in linear scale. | power pattern(in linear scale) typically represents a plot of the square of the magnitude of the electric or magnetic field as a function of the angular space. | Remember | CO 5 | CLO 16 | AECB13.14 |
| 24 | Define power pattern in dB. | power pattern(in dB) represents the magnitude of the electric or magnetic field, indecibels, as a functionof the angular space. | Remember | CO 5 | CLO 15 | AECB13.14 |
| 25 | What is dispersion of a transmission line? | Dispersion means the propagation velocity on the line is not constant with frequency. | Remember | CO 5 | CLO 17 | AECB13.14 |
| 26 | What is lossless transmission line? | A transmission line is said to be lossless if the conductors of the line are perfect and the dielectric medium separating them is lossless. | Understand | CO 5 | CLO 17 | AECB13.14 |
| 27 | Define group velocity. | The group velocity of a wave is the velocity with which the overall shape of the wave's amplitudes known as the modulation or envelope of the wave propagates through space. | Understand | CO 5 | CLO 15 | AECB13.14 |
| 28 | Define characteristics impedance. | Characteristic impedance is the impedance looking into an infinite length of the line. It is also, the ratio of the voltage applied to the current flowing will give input impedance of an infinite line. | Understand | CO 5 | CLO 17 | AECB13.14 |
| 29 | Define E-plane. | It is defined as "the plane containing the electric field vector and the direction of maximum radiation," | Understand | CO 5 | CLO 16 | AECB13.13 |
| 30 | Define H-plane. | It is defined as "the plane containing the magnetic-field vector and the direction of maximum radiation." | Remember | CO 5 | CLO 15 | AECB13.14 |
| 31 | Define One radian. | It is defined as the plane angle with its vertex at the center of a circle of radius r that is subtended by an arc whose length is r. | Understand | CO 5 | CLO 16 | AECB13.14 |
| 32 | Define One steradian. | It is defined as the solid angle with its vertex at the center of a sphere of radius r that is subtended by a spherical surface area equal to that of a square with each side of length r. | Understand | CO 5 | CLO 16 | AECB13.13 |
| 33 | Define Polarization of a | It is defined as "that property of an electromagnetic wave describing the | Understand | CO 5 | CLO 17 | AECB13.13 |

| S.No | QUESTION | ANSWER | Blooms Level | Course Outcome | CLO | CLO Code |
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| | radiated wave. | time-varying direction and relative magnitude of the electric-field vector; | | | | |
| 34 | Define conduction-dielectric efficiency $e_{cd}$. | It is defined as the ratio of the power delivered to the radiation resistance $R_r$ to the power delivered to $R_r$ and $R_L$. | Understand | CO 5 | CLO 17 | AECB13.13 |
| 35 | Define refractive index | Refractive index of ionosphere is defined as the ratio of phase velocity of a wave in vacuum to the velocity. | Understand | CO 5 | CLO 17 | AECB13.13 |
| 36 | Define line parameters of a transmission line. | The performance of transmission line depends on the parameters of the line. The transmission line has mainly four parameters, resistance, inductance, and capacitance and shunt conductance. These parameters are uniformly distributed along the line. Hence, it is also called the distributed parameter of the transmission line. | Understand | CO 5 | CLO 17 | AECB13.14 |
| 37 | Define half power beam width. | In a radio antenna pattern, the half power beam width is the angle between the half-power (-3 dB) points of the main lobe, when referenced to the peak effective radiated power of the main lobe. | Understand | CO 5 | CLO 17 | AECB13.13 |
| 38 | Define **B**andwidth. | A band of frequencies in a wavelength, specified for the particular communication, is known as bandwidth. | Understand | CO 5 | CLO 17 | AECB13.13 |
| 39 | Define First-Null beamwidth | It is Angular separation between the first nulls of the pattern | Understand | CO 5 | CLO 17 | AECB13.14 |
| 40 | Define beam efficiency. | It is defined as the ratio of power transmitted (received) within cone angle to the power transmitted (received) by the antenna. | Remember | CO 5 | CLO 16 | AECB13.14 |

**Signature of the Faculty** **HOD ECE**