UNIT- III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS

1. **Discuss briefly about nature of dielectric materials.**
2. **Obtain the expression for the inductance of a toroid.**
3. **Obtain the boundary relations which hold good for the interface of two different magnetic materials.**
4. **Derive an expression for the capacitance of a parallel plate capacitor with two dielectric media.**
5. **Derive an expression for inductance of a solenoid with 'N' turns and 'l' metre length carrying a current of 'I' amperes.**
6. **List out the properties of dielectric materials.**
7. **A cylindrical capacitor consists of an inner conductor of radius 'a' and an outer conductor whose inner radius is'b'. The space between the conductors is filled with a dielectric of permittivity ε, and the length of the capacitor is L. Determine the capacitance of this capacitor.**
8. **A spherical capacitor consists of an inner conducting sphere of radius R_i and an outer conductor with a spherical inner wall of radius R_o .The space in between is filled with a dielectric of permittivity ε. Determine the capacitance.**
9. **An air coaxial transmission line has a solid inner conductor of radius 'a' and a very thin outer conductor of inner radius 'b'. Determine the inductance per unit length of the line.**
10. **Calculate the internal and external inductances per unit length of a transmission line consisting of two long parallel conducting wires of radius 'a' that carry currents in opposite directions. The axes of the wires are separated by a distance'd', which is much larger than 'a'.**
11. **What are the general statements about electromagnetic boundary conditions?**
12. **Write down the boundary conditions between a dielectric (medium 1) and a perfect Conductor (medium 2) for time varying case.**
13. **Deduce an expression for a joint capacitance of two capacitors C_1 and C_2 in series and in parallel.**
14. **Define polarization of ferro-electric material.**

15. **Obtain a relationship between polarization and electric field intensity of ferro-magnetic material.**

16. **What is a toroidal solenoid? Calculate the inductance and flux density inside the solenoid.**

17. **Derive an expression for the energy stored in the magnetic field of a coil possessing an inductance of 'L' Henry when the current in the coil is 'I' amps.**

18. **A very long wire transmission line each wire of radius 'a' separated by a distance of 'd' is supported at a height 'h' above a flat conducting ground. Assuming both 'd' and 'h' to be much longer than 'a', find the capacitance per unit length of the line.**

19. **Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics.**

20. **Explain in detail the principle of torque on a solenoid situated in a uniform magnetic field.**

21. **Derive expressions for magnetic flux density (B) at any point along the axis of the solenoid. Draw the variations of flux density (B) along tha axis.**

22. **Describe the magnetization and its effect in a uniformly magnetized rod with an equivalent air filled solenoid.**

23. **Determine the expressions for the energy density in an inductor.**

24. **Explain Poisson's and Laplace equations.**

25. **Derive equation of continuity of current.**

26. **The plates of a parallel plate capacitor are separated by a distance 'd' along the z-axis. The lower and upper plates are maintained at potentials 0 volts and Vo volts respectively. Determine (1) the potential at any point between the plates (2) the surface charge densities on the plates and (3) the capacitance.**

26. **Derive an expression for the energy density of the magnetic field of a toroidal solenoid.**

27. **Show that the inductance of the cable** $L = \frac{\mu l}{2\pi} \ln\left(\frac{b}{a}\right) \text{Henry}$