1. Let $\vec{F}_1 = x^2\hat{z}$ and $\vec{F}_2 = x\hat{x} + y\hat{y} + z\hat{z}$. Calculate the divergence and curl of $\vec{F}_1$ and $\vec{F}_2$.

2. State and explain Gauss's law. Is it valid for electrodynamics?

3. Does $\vec{E} = k[xy\hat{x} + 2yz\hat{y} + 3xz\hat{z}]$ represent an electrostatic field? Explain.

4. State and discuss Biot-Savart Law.

5. Given an Electric field $\vec{E} = \mu[xy\hat{\imath} + 2yz\hat{\jmath} + 3xz\hat{k}]$, calculate the charge density at the point $(1, 1, 1)$.

6. Draw the equipotential surfaces for a system of two positive charges of equal magnitude separated at a distance d.

7. Calculate the net dipole moment of a charge distribution consists of three charges q_1, q_2 and q_3 placed at the vertices of an equilateral triangle of arm length a.

8. Calculate the work done by a magnetic force in translating an electric charge of strength q from point A to B.

9. Derive the form of Gauss's law inside a dielectric medium. What are the characteristics of linear dielectrics?

10. Physically interpret bound surface charge density (σ_b) and volume charge density (ρ_b).

11. Define displacement current. What is the physical interpretation of displacement current?

12. Write Lorentz force law. Hence calculate the force per unit length between two parallel wires at a distance d apart, carrying I_1 and I_2 amount of currents respectively. Note that currents are flowing in opposite direction in two wires.

13. Define self inductance of a circuit. Find out the dimension of inductance.

14. Explain the significance of Maxwell's second law : $\vec{\nabla}.\vec{B} = 0$. How does it help to define vector potential?

15. Calculate the impedance of an LC. circuit.

16. Why series LCR circuit is called filter circuit?

17. State Ampere's circuital law.

18. Using Ampere's law calculate the magnetic field of a very long solenoid, consisting of n closely wound turns per unit length on a cylinder of radius R and carrying steady current I. Clearly explain existence or non-existence of different components of magnetic field.

19. A current distribution gives rise to the magnetic vector potential $\vec{A}(x, y, z) = A_0(x^2 y\hat{x} + y^2 x\hat{y} + xyz\hat{z})$. Find the corresponding magnetic field $\vec{B}$ at $(-1, 2, 5)$. Use Ampere's law to calculate current density $\vec{J}$ at the same point.