8. REVIEW QUESTIONS

1. A steady current generates a magnetic field. Does a magnetic field also generate a steady current? Explain.

2. The static magnetic field may be viewed as a force field in a manner similar to the electric field. Discuss this statement in terms of known phenomena such as permanent magnets.

3. How do we know that the Biot–Savart law is correct?

4. The magnetic field intensity is always perpendicular to the direction of current that produces it *T/F*.

5. The use of the Biot–Savart law for distributed currents assumes, implicitly, that all relations are linear. Why is this assumption necessary?

6. State Ampere's law and discuss its implications.

7. What are the special conditions needed for Ampere's law to apply? Do these conditions also need to be satisfied when applying the Biot–Savart law? Can you conclude from these relations which of the laws is more fundamental? Explain.

8. Define magnetic flux. What does it represent?

9. What are lines of magnetic field? What do they signify?

10. State and discuss the postulates of the static magnetic field.

11. What is the implication of $\nabla \cdot \mathbf{B} = 0$? Explain.

12. The following vector fields are given. Which of these can represent magnetic fields and why?

(a) $\mathbf{F} = \hat{\mathbf{x}}5x + \hat{\mathbf{y}}(2x + z)$

(b) $\mathbf{F} = \hat{\mathbf{x}}5$

(c) $\mathbf{F} = \hat{\boldsymbol{\phi}}2rz$

(d) $\mathbf{J} = \hat{\mathbf{x}}a$

(e) $\mathbf{F} = \hat{\mathbf{R}}2\phi\cos\theta + \hat{\boldsymbol{\theta}}R\sin\theta$

13. What is a scalar and a vector potential function? How are the two defined?

14. Describe why the magnetic vector potential is convenient to use in conjunction with the magnetic field.

15. Under what conditions does the magnetic scalar potential represent the magnetic field? Give an important application in which it does and one in which it does not.

16. In general, scalar potentials may be used in current-free regions, whereas magnetic potentials must be used in regions that contain currents *T/F*. Explain.

17. The general magnetic flux density may be represented by (mark all correct statements):

(a) The magnetic vector potential **A**
(b) The magnetic scalar potential Ψ
(c) The electric scalar potential V
(d) The electric current density **J**

18. Discuss the relation $\mathbf{B} = \mu\mathbf{H}$. What do you consider the most important implications of this relation?