5. REVIEW QUESTIONS

1. Derive Poisson's and Laplace's equations in cylindrical coordinates directly, using the expressions for the gradient of a scalar function.

2. Under what conditions does Laplace's equation apply?

3. Under what conditions is it necessary to use Poisson's equation for the solution of static fields?

4. State the uniqueness theorem and discuss its importance.

5. All solutions to a specific electrostatic problem, regardless of method of solution must be identical *T/F*.

6. Why can't we use direct integration to solve Laplace's or Poisson's equation for general fields?

7. State the conditions under which Poisson's equation can be integrated directly.

8. Describe the fundamentals of the method of images. What are the basic requirements for the method to be applicable?

9. Which equation does the method of images solve?

10. Is a conducting surface absolutely necessary for the method of images to be applicable? Explain.

11. Discuss superposition of solutions for the method of images. What are the assumptions necessary for superposition to apply?

12. In principle, any electrostatic problem (as well as others) can be solved by the method of images. What are the practical limitations that prevent us from solving many problems using this method?

13. Is the solution obtained using the method of images correct everywhere in space? Explain.

14. How is the uniqueness theorem satisfied when the method of images is applied? Explain.

15. List the salient features of the method of images.

16. List some applications for which the method of images may be used.

17. Review the method of separation of variables for Laplace's equation in Cartesian and cylindrical coordinates.

18. What are the types of problems that can be solved using separation of variables as discussed in this chapter? List and discuss all classes of problems that can be solved in terms of harmonic functions.

19. The general solution to any problem described by Laplace's equation (electrostatic or otherwise) in Cartesian coordinates is given in **Eq. (5.59)** or **(5.60)**. Why then do we need any other method such as those given in **Chapter 4**? Why can't we use this general solution for all problems described by Laplace's equation?

20. Why isn't the method of separation of variables used for solution of Poisson's equation? Explain.