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## UNIT-III

- 5. (a) Describe the features of second quantization using Schrodinger field as an example.
  - (b) Write down the free scalar field theory Lagrangian and obtain equations of motion. 6,6
- 6. (a) Write down the free classical electromagnetic field Lagrangian and obtain the equations of motion.
  - (b) Write down the free classical Dirac field Lagrangian and obtain the equations of motion. 6,6

## UNIT-IV

- 7. (a) Establish the quantization rules for complex scalar field.
  - (b) What are Feynman diagrams? Draw the Feynman diagram(s) for scattering of photon by an electron and write corresponding amplitudes.

    6,6
- 8. (a) For real scalar field, express momentum operator in terms of number operator.
  - (b) Discuss the Gupta-Bleular formalism for quantizing electromagnetic field. 6,6

## UNIT-V

- 9. Attempt all parts:—
  - (a) Explain optical theorem.
  - (b) State properties of Dirac Gamma matrix.
  - (c) Define helicity operator, show that its eigenvalues are  $\pm 1$ .
  - (d) What is Lamb shift?
    - '(e) What are Feynman rules?
    - (f) What is normal ordered product and time ordered product of operators? 6×2