(e) What do you mean by renormalization?

(f) Show that $\gamma_\mu \gamma^\nu \gamma^\mu = -2\gamma^\nu$.

(g) Write down the Feynman function for scalar field.

(h) What do you mean by normal order product of operators and fields?

(i) What is the charge of the particles associated with real and complex scalar field?

(j) State Wick's theorem.

2. (a) Derive the Klein-Gordon equation for a relativistic particle with zero spin. Discuss the probability density and continuity equation. 8

(b) Discuss the drawbacks of Klein-Gordon equation. 2

3. (a) Solve the Dirac equation for a free particle in motion. 8

(b) Discuss the properties of the Dirac matrices. 2

4. (a) What are bilinear covariants? Show how the vector and axial vector transform under proper orthochronous Lorentz transformation and space inversion. 7

(b) Show that the particle described by the Dirac equation corresponds to a spin ½ particle. 3

5. (a) Discuss what happens to the Lagrange equation and quantization conditions on going from a discrete to a continuous system. 3

(b) State Noether's theorem. Find the conserved quantities arising out of rotational invariance. 7

6. (a) Quantize the complex Klein-Gordon field and find the momentum and charge of the field. 7

(b) Discuss the time-ordered product of operators. 3

7. (a) Quantize the Dirac field and find the momentum, energy and charge of the field. 7

(b) Discuss the photon propagator for real Dirac field. 3