17. (a) Explain the principles involved in central field approximation.

Or

(b) Discuss the coupling schemes.

18. (a) In a Hydrogen like atom, the spin orbit interaction is of the form

$$H' = \frac{ze^2}{zm^2c^2}\frac{1}{r^3}\vec{L}\cdot\vec{S}$$

since $2\vec{L}\cdot\vec{S} = J^2 - L^2 - S^2$, choose a representation in which J^2, L^2 and S^2 are all well defined and calculate the spin orbit correction.

Or

(b) Give a detailed account on hybridisation.

19. (a) Discuss radiation field as an assembly of oscillators. Obtain the selection rules.

Or

(b) Deduce expression for the emission rate and absorption rate.

20. (a) Outline the properties of creation and destruction operators. Describe their commutation relations.

Or

(b) Obtain quantum equation for the field.

SECTION D — ($2 \times 10 = 20$ marks)

21. (a) Obtain expression for the free particle solution using partial wave analysis. Also deduce expression for scattering amplitude.

Or

(b) Describe Born's approximation to calculate the scattering amplitude $f(\theta, \phi)$.

22. (a) Obtain expression for the total energy (symmetric or anticymmetric) for the hydrogen molecule by Heitler London method.

Or

(b) Calculate Einstein Coefficient of induced emission and show that it is equal to Einstein's coefficient absorption from semiclassical theory of radiation.