

SECTION C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

- 16. (a) What is a canonical transformation? Show that the transformation

$$Q = \sqrt{2q} e^{\alpha} \cos p$$

$$P = \sqrt{2q} e^{-\alpha} \sin p$$

is canonical.

Or

- (b) Discuss Kepler's problem in action-angle variables.

- 17. (a) Give the theory of a symmetrical top moving under gravity.

Or

- (b) (i) Give the theory of small oscillations.
- (ii) Write a note on the eigen value equation.

- 18. (a) (i) Explain partition functions and bring out their significance.

- (ii) Write a note on M.B. distribution.

Or

- (b) Discuss fully Doppler broadening of spectral lines.

- 19. (a) (i) Explain B.E. distribution.
- (ii) Deduce Planck's law of black body radiation, applying B.E. distribution.

Or

- (b) Applying F.D. statistics, discuss Pauli's theory of Paramagnetism.

- 20. (a) Discuss fully Lagrangian formulation of relativistic mechanics.

Or

- (b) Give brief accounts of

- (i) Covariant Lagrangian formulation and
- (ii) Covariant Hamiltonian formulation.

SECTION D — (2 × 10 = 20 marks)

Answer ALL questions, choosing either (a) or (b).

- 21. (a) Discuss fully the harmonic oscillator problem in Hamilton-Jacobi method.

Or

- (b) Give the theory of determining the normal modes and normal frequencies of a linear triatomic molecule.