paper-1 mechanics

Time Allowed : 3 hrs Max. Marks - 33

Attempt all five questions

Q.1. (a) Define Inertial and non- Inertial frame of reference.

(b) Define ~~Coriolis force~~. Foucalt Pendulum.

(c) Write down the Work- energy theorem.

(d) Define precession motion with suitable example.

(e) Write Kepler laws of planetary motion.

(f) Define ~~driven~~ coupled simple harmonic Oscillations.

Q.2. (a) Define Coriolis force. Find the effect of coriolis force on a freely falling body.

(b) Prove that Central forces are Conservative forces.

Or

(b) Prove that for Conservative force

(i) $\vec{F} = -\vec{\nabla} U$

(ii) $\nabla \times \vec{F} = 0$

Q.3 (a) Prove that angular momentum of a system of particle about a certain point O is the vector sum of the angular momentum of Centre of mass about that point and the angular momentum of the system of particles about the centre of mass.

(b) Describe the principle of rocket. Prove that final velocity achieved by rocket is $V = V_0 + V_r \log\left(\frac{M_0}{M}\right) - gt$

Or

(b) What are inertial coefficient ? Derive the expression for these inertia coefficients.

Q.4 (a) Define Rutherford scattering. Deduce the relation between scattering angle and impact parameter of α- scattering.

(b) ~~100~~ gm When a body of mass 100 gm is suspended from a spring it stretches the spring by 2 cm. if relaxation time for the spring is 1 second, then determine the time period of damped oscillator.

Or

(b) If the average distance of mass from sun is 1.524 times the distance from earth to sun and then determine the time period of mars moving round the sun.

Q.5. (a) Establish the differential equation for a force harmon oscillator and solve it. Discuss the different cases including resonance.

(b) In LCR circuit $L = 2mH$, $C = 2\mu F$ and $R = 0.2$ ohm Calculate the frequency and quality factor of the circuit.

Or

(b) Define the transient behaviour of coupled harmonic oscill