Section – A

1. a) A particle describes an angular spiral $r = \alpha e^{\theta}$ while moving with constant angular speed w about the origin o. Find the radial and transverse components of acceleration of the particle. 5

b) Find the Tangential and Normal components of the acceleration of a point describing the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$ with uniform speed v, when the particle is at (0, b). 5

2. a) Find an expression for the distance travelled by a particle in the nth second of its rectilinear motion with uniform acceleration. 5

b) A particle is projected vertically upwards with a velocity $\sqrt{2gh}$and another let fall from a height h at the same time. Find the height of the point where they meet each other. 5

3. a) A man cycling east at 13 km/hr feels that the wind appears to blow directly from the North. On doubling his speed it appears to below from N.E. Find the actual velocity of the wind. 5

b) Discuss the motion of a particle moving in a Straight line at distance "a" from some point o and moves with an acceleration equal to μ times its distance from o. 5

4. a) A particle is projected in a vertical plane with velocity $v_o$making an angle α with horizontal line. Find the maximum range of projectile and the time of flight on an inclined plane, making an angle β (β < α) with the horizontal line. 5

b) The range of a rifle bullet is 1200 yards when α is the elevation of projection. Show that, if the riffle is fired from the same elevation from a car travelling at 10 miles per hour towards the target. The range will be increased by $220\sqrt{\tan\alpha}_{ft}$ 5

5. a) Show that the force $\vec{F}$ given by $\vec{F}$ = yzi + zx $\hat{j}$ + xyk is conservative. 5

b) A gun of mass M fires a shell of mass m horizontally and the energy of explosion is such as would be sufficient to project the shell vertically to a height h. Show that the velocity of the recoil is

$\sqrt{\frac{2m^2gh}{M(m+M)}}$ 5

Section – B

6. a) Find the roots of $x^3 - 5x^2 - 29 = 0$ correct to 4 decimal places by simple iteration method. 5

b) Apply any Numerical method to calculate the square root of 3. 5

7. a) Use Newton Raphson method to evaluate the root of $e^x - 3x = 0$ which lie between 0 and 1 5

b) Find the positive root of Sin x - $\frac{x}{2} = 0$ using secant method. 5

8. Evaluate the integral

a) $\int_0^1 \frac{dx}{1+10x^2}$ by Simpso's Rule for n = 4 5

b) $\int_1^2 \frac{dx}{x}$ by Trapezium Rule 5