Model Question

54 B.Sc. Sem- IV Paper - C9
(Mechanics).

Short answer type Question.

1) Find the necessary and sufficient conditions for a system of a coplanar forces to be in equilibrium.

2) Three forces P, Q, R act along the sides of the triangle formed by the lines $x+y=1$, $y-x=1$ and $y=2$. Find the equation of the line of action of the resultant.

3) Forces P, Q, R act along the lines $x=0$, $y=0$ and $x\cos\alpha + y\sin\alpha = p$ Find the magnitude of the resultant and the equation of its line of action.

4) A body moves from rest from a point O so that its accleration is $\frac{1}{(t+1)^2}$, where, t is the time taken in seconds from O. Find the distance moved in 9 seconds and its velocity then.

5) a) State Hooke's law.
b) Define Impulse
c) The principle of conservation of linear momentum.
d) angular velocity.
e) angular acceleration.

6). Expression for velocity of a particle in polar coordinates.

7) Expression for acceleration of a particle in polar coordinates.

8) Motion under inverse square law.

9). A particle starts from the origin and the components of its velocity parallel to the axes of coordinates at time t are $2t+3$ and $4t$. Find the path.

10) A particle moves in a plane under a constant acceleration μa parallel to OX and an acceleration $-2\mu y$ parallel to OY, where OX and OY are rectangular axes. If the particle starts from rest at a point $(0, a)$, find the path.

Long answer type Question.

1) Prove that any system of coplanar forces acting upon a rigid body can be ~~expressed~~ reduced to a single force acting at an arbitrarily chosen point together with a couple.

2). Find the equation of the line of action of the resultant of a system of coplanar forces acting upon a rigid body.

3). A solid cone of height h and semi-vertical angle α is placed with its base against a smooth vertical wall and is supported by a string attached to its vertex and to a point in the wall.
Show that the greatest length of the string is

$$h\sqrt{1+\frac{16}{9}\tan^2\alpha}.$$

4). A square of side 2a is placed with its plane vertical between two smooth pegs which are in the same horizontal line and at a distance c, show that it will be in equilibrium when the inclination of one of its edges to the horizon is either $\frac{\pi}{4}$ or $\frac{1}{2}\sin^{-1}\frac{a^2-c^2}{c^2}$.

5) A particle starts from rest and moves along a straight line with an acceleration which is always directed towards a fixed point and varies as the distance from the fixed point. Discuss the motion. (Define a Simple Harmonic motion. Find its periodic time, amplitude & frequency).

6). A particle whose mass is m, is acted upon by a force $m\mu\left(x+\frac{a^4}{x^2}\right)$ towards the origin, if it starts from rest at a distance a, show that it will arrive at the origin in time $\frac{\pi}{4\sqrt{\mu}}$.

7) A point moves in a straight line towards a centre of force $\left\{\frac{\mu}{(\text{distance})^3}\right\}$ starting from rest at a distance a from the centre of force. Show that the time of reaching a point distant b from the centre of force is $\frac{a}{\sqrt{\mu}}\sqrt{a^2-b^2}$. and its velocity then is $\frac{\sqrt{\mu}}{ab}\sqrt{a^2-b^2}$.

Also show that the time to reach the origin is $\frac{a^2}{\sqrt{\mu}}$.

8) Prove that the work done against the tension in stretching a light elastic string is equal to the product of its

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5) ~~Define a simple Harmonic motion.~~

extension and the mean of the initial and final tensions.

a) Horizontal Elastic string.

b) Heavy Elastic string.