BA/B.Sc-III year

① To find the expressions for radial & transverse components of velocity and acceleration of a particle moving along a plane curve $r=f(\theta)$

② A point P moves with a constant angular velocity about O, where O is the pole of the equiangular spiral $r=ae^{\theta}$. Obtained the radial & transverse acceleration of P.

③ A particle describes a curve (for which s and ψ vanish simultaneously) with uniform speed v. If the acceleration at any point s be $\frac{v^2c}{s^2+c^2}$, prove that the curve is a catenary.

④ A particle describes the cycloid $s=4a\sin\psi$ with uniform speed v. Find its acceleration at any point.

⑤ If a curve is an equiangular spiral $r=ae^{\theta\cot\alpha}$ and if the radius vector of the particle has constant ~~and~~ ~~magnitude~~ angular velocity: show that the resultant acceleration of the particle makes an angle 2α with the radius vector and is of magnitude $\frac{v^2}{r}$, where v is the velocity of the particle.

⑥ A particle moves along the curve $x=4t$, $y=6t-t^2$. Find the tangential & normal acceleration at $t=3$.

⑦ If the tangential & normal acceleration component of a particle be equal, prove that the velocity varies as e^{ψ}.

⑧ Prove that acceleration of a point moving in a curve with uniform speed is $p\left(\frac{d\psi}{dt}\right)^2$.
And Also find the difference b/w angular velocity & linear velocity.

(9) Prove that if the tangential and Normal accelerations of a particle describing a plane curve be constant throughout the motion, the angle ψ through which the direction of motion turns is given by $\psi = A \log(1+Bt)$

(10) A particle moves along a circle $r = 2a\cos\theta$ in such a way that its acceleration towards the origin is always zero. Show that the transverse acceleration varies as the fifth power of $\operatorname{cosec}\theta$.

(11) Define angular ~~velocity~~ acceleration along a plane curve.

(12) To find the expressions for tangential and normal components of acceleration of a particle moving along a plane curve.

(13) To a man going on a bicycle at 10 km/hr due east, the wind seems to blow from a direction 60° south of west at 6 km/hr. Find the direction and velocity of the wind.

(14) To a person travelling due east, the wind appears to come from the north east, but when he doubles his speed, it appears to come from a direction $\tan^{-1}\frac{2}{3}$ north of east. Find the direction of the wind.

(15) A person travelling towards north east, finds that the wind appears to blow from the north but when he doubles his speed, it seems to come from a direction inclined at an angle $\cot^{-1}2$ from the east of north. Prove that the direction of the wind towards east.

(16) To a passenger in an open car travelling at 20 km/hr, the wind appears to come from a direction 60° to the right and from ahead at 4 km/hr. What is the true direction and velocity of wind.

(17) Two particles A and B are moving along concentric circles of radii 2 m & 8 m respectively with constant angular velocities of 4 radian/sec and 2 radian/sec. Obtain their relative acceleration when their angular distance apart is $\frac{2\pi}{3}$.

(18) A particle moves in a straight line such that its acceleration is always directed towards a fixed point in the line & is proportional to the distance of the particle from the fixed point. Discuss the motion.

(19) The acceleration of a particle, moving with S.H.M is $2 m/sec^2$ when its distance from the mean position is $\frac{1}{2}$ m. Find the amplitude and the time of an oscillation if the max. velocity is 4 m/sec. Also find the velocity of the particle when it is at a distance of the half the amplitude.

(20) A passenger travelling in a train with velocity 90 km/hr on a straight level track observes that another train which is 180 m long and moving constantly in the same direction takes 4 second to pass by. What is the velocity of passing train.

(21) Show that if the displacement of a particle moving in a straight line is expressed by the eqn. $x = a\cos nt + b\sin nt$, then it describes a simple harmonic motion whose amplitude is $\sqrt{a^2+b^2}$ & period is $\frac{2\pi}{n}$.

(22) A particle moving with S.H.M of period 12 second travels 10cm from the position of rest in 2 second. Find the amplitude, the maximum vel. and the velocity at the end of 2 seconds.

(23) Find the amplitude of a S.H.M of period 12 sec. which travels 15 cm from rest in 2 sec.

(24) A particle describes S.H.M of period T along a line. If v be its speed at a distance x from the mean position & 'a' is the amplitude, show that $v^2T^2 = 4\pi^2(a^2-x^2)$

(25) Find the time period of an oscillation of S.H.M.

(26) At the end of three successive seconds, the distance of moving point with SH.M from the mean position measured in the same direction are 1, 5 and 5, Show that the time of one oscillation is $\frac{2\pi}{\theta}$; where $\cos\theta = \frac{3}{5}$

(27) Define S.H.M and its amplitude.

(28) To obtain the expression for velocity and position of a particle executing S.H.M.

(29) A Particle moves in a straight line with S.H.M of period 2 sec. If it starts from rest at a distance of 13 cm from the centre of its path, show that the greatest vel. & velo acquired by when it has described