KAYSONS EDUCATION
ENLIGHTENING YOUR FUTURE

MOCK TEST-1

Mechanics
Kaysons Education

Paper Set - 1

Time: **60 Min.**
Max. Marks: **132**

IMPORTANT INSTRUCTIONS

1. The question paper consists of **'36'** objective type questions.

2. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

3. You will be **awarded 4 marks** for each question for wrong answer, **minus one (–1) mark** will be awarded.

4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accord ingly as per instruction 3 above..

5. Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.

Q.1. Given that $Y = a\sin\omega t + bt + ct^2\cos\omega t$. The unit of abc is same as that of

(a) y (b) y/t (c) $(y/t)^2$ (d) $(y/t)^3$

Q.2. Force F is give in terms of time t and distance x by $F = A\sin Ct + B\cos Dx$. Then the dimensions of A/B and C/D are

(a) $[M^0L^0T^0], [M^0L^0T^{-1}$ (b) $[MLT^{-2}], [M^0L^{-1}T^0$

(c) $[M^0L^0T^0], [M^0LT^{-1}$ (d) $[M^0L^1T^{-1}], [M^0L^0T^0$

Q. 3 The dimensional formula for a physical quantity x is $[M^{-1}L^3T^{-2}]$. The errors in measuring the quantities $M, L,$ and T, respectively, are 2%, 3%, and 4%. The maximum percentage of error that occurs in measuring the quantity x is

(a) 9 (b) 10 (c) 14 (d) 19

Q.4. A physical quantity X is represented by $X = (M^xL^{-y}T^{-z})$. The maximum percentage errors in the measurement of M, L and T, respectively, are $a\%, b\%$ and $c\%$. The maximum percentage error in the measurement of X will be

(a) $(ax + by - cz)\%$ (b) $(ax - by - cz)\%$

(c) $(ax + by + cz)\%$ (d) $(ax - by + cz)\%$

Q.5. While measuring the acceleration due to gravity by a simple pendulum, a student makes a positive error of 2% in the length of the pendulum and a negative error of 1% in the value of time period. His actual percentage error in the measurement of the value of g will be

(a) 3% (b) 0% (c) 4% (d) 5%

Q.6. If $X = a + b$, the maximum percentage error in the measurement of X will be

(a) $\left(\frac{\Delta a}{a} + \frac{\Delta b}{b}\right) \times 100\%$ (b) $\left(\frac{\Delta a}{a+b} - \frac{\Delta b}{a+b}\right) \times 100\%$

(c) $\left(\frac{\Delta a}{a+b} + \frac{\Delta b}{a+b}\right) \times 100\%$ (d) $\left(\frac{\Delta a}{a} \times \frac{\Delta b}{b}\right) \times 100\%$

***Question* 7:-** Five equal forces of 10 N each are applied at one point and all are lying in one plane. If the angles between them are equal, the resultant force will be

(a) Zero

(b) 10 N

(c) 20 N

(d) $10\sqrt{2}\ N$

***Question* 8:-** There are two force vectors, one of 5 N and other of 12 N at what angle the two vectors be added to get resultant vector of 17 N, 7 N and 13 N respectively

(a) 0°, 180° and 90°

(b) 0°, 90° and 180°

(c) 0°, 90° and 90°

(d) 180°, 0° and 90°

***Question* 9:-** Two forces of 12 N and 8 N act upon a body. The resultant force on the body has maximum value of [Manipal 2003]

(a) 4 N

(b) 0 N

(c) 20 N

(d) 8 N

***Question* 10:-** A particle leaves the origin with an initial velocity $\vec{v} = (3\hat{i})$ m/s and a constant acceleration $\vec{a} = (-1.0\hat{i} - 0.5\hat{j})\text{m/s}^2$. Its velocity $\vec{V}$ and position vector $\vec{r}$ when it reaches its maximum *x*-co-ordinate are:

(a) The maximum height reached by rocket from ground is 18 km.

(b) The maximum height reached by the rocket from ground is 36 km.

(c) The time from initial in which rocket again at ground is 240 s.

(d) The time from initial in which rocket again at ground is $(120 + 60\sqrt{2})s$

***Question* 11:-** A particle has initial velocity 10 m/s. It moves due to constant retarding force along the line of velocity which produces a retarding of $5\ m/s^2$. Then

(a) 2.62 m/s

(b) 4.6 m/s

(c) 3.57 m/s

(d) 1.414 m/s

***Question* 12:-** A car moves rectilinearly from station A to the next station B (rest to rest) with an acceleration varying according to the law f = (a – bx), where a and bare constants and x is the distance from the station A. The distance between the two stations and the maximum velocity are:

(a) [A – p q r] [B – p q r] [C – p] [D – s]

(b) [A – p r] [B – p q] [C – p] [D – s p]

(c) [A –q r] [B – p r] [C – p] [D – s r]

(d) [A –r] [B – p] [C – p] [D – s q]

***Question* 13:-** Two projectiles are thrown at the same time from two different points. The projectile thrown from the origin has initial velocity $3\hat{\imath} + 3\hat{\jmath}$ with respect to earth. The projectile has initial velocity $a\hat{\imath} + b\hat{\jmath}$ with respect to earth thrown from the point (10, 5). ($\hat{\imath}$ is a unit vector along horizontal, $\hat{\jmath}$ along vertical). If the projectiles collide after two second, then the

(a) Value of a is –2

(b) Value of a is $\frac{1}{2}$

(c) Value of b is $\frac{1}{2}$

(d) Value of b is –2

***Question* 14:-** A ball is thrown from a point on ground at some angle of projection. At the same time a bird starts from a point directly above this point of projection at a height h horizontally with speed u. Given that in its flight ball just touches the bird at one point. Find the distance on ground where ball strikes

(a) $2u\sqrt{\frac{h}{g}}$

(b) $u\sqrt{\frac{2h}{g}}$

(c) $2u\sqrt{\frac{2h}{g}}$

(d) $u\sqrt{\frac{h}{g}}$

***Question* 15:-** A particle is projected from a horizontal plane (x-z plane) such that its velocity vector at time t is given by $\vec{V} = a\hat{\imath} + (b - ct)\hat{\jmath}$. Its range on the horizontal plane is given by:

(a) $\frac{ba}{c}$

(b) $\frac{2ba}{c}$

(c) $\frac{3ba}{c}$

(d) None of these

***Question* 16:-** Two particles positioned at $A(5, 3)$ and $B(7, 3)$ are moving with constant velocity $2\hat{i} + 3\hat{j}$ and $x\hat{i} + y\hat{j}$ respectively. After 2*s* they collide, then the values of *x* and *y* are respectively

(a) 2, 2

(b) 1, 3

(c) 3, 2

(d) 1, 1

***Question* 17:-** The distance between two moving cars A and B at a particular time is d. Their relative velocity is V with the component along AB being u and perpendicular to AB being v. The time that elapses before they arrive at their nearest distance is

(a) $\frac{du}{V^2}$

(b) $\frac{dv}{V^2}$

(c) $\frac{d(u+v)}{V^2}$

(d) $\frac{dV}{(u+v)^2}$

***Question* 18:-** A stone is released from an elevator going up with an upward acceleration a. The acceleration of the stone after the release is:

(a) A upwards

(b) (g – a) upwards

(c) (g + a) downwards

(d) g downwards

Question 19:- 1 A particle of mass m is moving in a horizontal circle of radius r, under

a centripetal force $F = \frac{k}{r^2}$, where k is a constant.

(a) The potential energy of the particle is zero

(b) The potential energy of the particle is

(c) The total energy of the particle is $-\frac{k}{2r}$

(d) The kinetic energy of the particle is $-\frac{k}{r}$

Question 20:- A wheel completes 2000 revolutions to cover the 9.5 km distance, then the diameter of the wheel is

(a) 1.5 m (b) 1.5 cm

(c) 7.5 cm (d) 7.5 m

Question 21:- If KE of the particle of mass m performing UCM in a circle of radius r is E. find the acceleration of the particle.

(a) $\frac{2E}{mr}$ (b) $\left(\frac{2E}{mr}\right)^2$

(c) $2Emr$ (d) $\frac{4E}{mr}$

***Question* 22:-** A stationary body of mass *m* is slowly lowered on to a massive platform (*M* >> *m*) moving at a speed v_0. If μ is the co-efficient of friction between the body and the platform, the distance travelled by the body before it stops sliding, is

(a) $\frac{v_0^2}{2\mu g}$

(b) $\frac{v_0^2}{\mu g}$

(c) $\frac{v_0^2}{\mu g}$

(d) $\frac{v_0^2 g}{\mu}$

***Question* 23:-** A body of mass 1 kg is acted upon by a force $\vec{F} = 2\sin 3\pi t\hat{\imath} + 3\cos 3\pi t\hat{\jmath}$ find its position at t = 1 sec if at t = 0 it is at rest at origin.

(a) $\left(\frac{3}{3\pi^2}, \frac{2}{9\pi^2}\right)$

(b) $\left(\frac{2}{3\pi^2}, \frac{2}{3\pi^2}\right)$

(c) $\left(\frac{2}{3\pi}, \frac{2}{3\pi^2}\right)$

(d) None of these

***Question* 24:-** An object is dropped from the top of a building 5 m and rebounds to a height of 3.2 m. If it is in contact with the floor for 0.036 s, what is its average acceleration during this period? $(g = 10\, m/s^2)$

(a) Force acting on the cart is 800 N

(b) Force exerted by the pulley on the cart is 700 N

(c) Force exerted by the pulley on the cart is 750 N

(d) Tension in the string is 350 N

***Question* 25:-** An elastic ball is dropped from a height h and it rebounds many times from the floor. If the coefficient of restitution is e, the time interval between the second and the third impact, is

(a) ev/g

(b) e^2v/g

(c) $e^2\sqrt{\left(\frac{8h}{g}\right)}$

(d) $e^2\sqrt{\left(\frac{h}{g}\right)}$

***Question* 26:-** An α-particle of mass m suffers one dimensional elastic collision with a nucleus of unknown mass. After the collision the α-particle is scattered directly backward losing 75% of its kinetic energy. Then the mass of the nucleus is

(a) m

(b) 2m

(c) 3m

(d) $\frac{3}{2}\ m$

***Question* 27:-** A rod *AB* of mass *M*, length *L* is lying on a horizontal frictionless surface. A particle of mass *m* travelling along the surface hits the end *A* of the rod with a velocity v_0 in a direction perpendicular to *AB*. The collision is completely elastic. After the collision, the particle comes to rest. The ratio m/M is

(a) $\frac{\omega^2 L^2}{9v_0^2}$

(b) $\frac{9v_0^2}{\omega^2 L^2}$

(c) $\frac{9v_0}{\omega L}$

(d) $\frac{\omega L}{9v_0}$

***Question* 28:-** A force $F = (2\hat{\imath} + 4\hat{\jmath})$ N displace the body by $s = (3\hat{\jmath} + 5\hat{k})$ m in 2 s. Power generated will be

(a) $t^{1/2}$

(b) t

(c) $t^{3/2}$

(d) t^2

***Question* 29:-** A body is initially at rest. It undergoes one-dimensional motion with constant acceleration. The power delivered to it time t is proportional to

(a) $\frac{1}{2} Fv^2$

(b) Fv^2

(c) $\frac{1}{2} Fv$

(d) Fv

***Question* 30:-** If F is the force required to keep a train moving at a constant speed v, the power required is

(a) $\frac{mv_1 t}{t_1}$

(b) $\frac{mv_1^2 t}{t_1^2}$

(c) $\frac{mv_1 t^2}{t_1}$

(d) $\frac{mv_1^2 t}{t_1}$

***Question* 31:-** Two planets have radii r_1 and r_2 and their densities are ρ_1 *and* ρ_2 respectively. The ratio of acceleration due to gravity on them will be..

(a) $r_1\rho_1 : r_2\rho_2$

(b) $r_1\rho_1^2 : r_2\rho_2^2$

(c) $r_1^2\ \rho_1 : r_2^2\ \rho_2$

(d) $r_1\rho_2 : r_2\rho_1$

***Question* 32:-** Three uniform spheres, each having mass *m* and radius *r* , are kept in such a way that each touches the other two. The magnitude of the gravitational force on any sphere due to the other two is

(a) $\frac{Gm^2}{r^2}$

(b) $\frac{Gm^2}{4r^2}$

(c) $\sqrt{2}\frac{Gm^2}{4r^2}$

(d) $\sqrt{3}\frac{Gm^2}{4r^2}$

***Question* 33:-** What should be the angular velocity of rotation of earth about its own axis so that the weight of a body at the equator reduces to 3/5 or its present value? (Take R as the radius of the earth)

(a) $\sqrt{\frac{g}{3R}}$

(b) $\sqrt{\frac{2g}{3R}}$

(c) $\sqrt{\frac{2g}{5R}}$

(d) $\sqrt{\frac{2g}{7R}}$

***Question* 34:-** Two rings of same radius and mass are placed such that their centres are at a common point and their planes are perpendicular to each other. The moment of inertia of the system about an axis passing through the centre and perpendicular to the plane of one of the rings is (mass of the ring = m, radius = r)

(a) $1/2\ mr^2$

(b) mr^2

(c) $3/2\ mr^2$

(d) $2\ mr^2$

***Question* 35:-** From a given sample of uniform wire, two circular loops P and Q are made, P of radius r and Q of radius nr. If the M.I. of Q about it axis is four times that of P about its axis (assuming the wire to be diameter much smaller than either radius), the value of n is

(a) $(4)^{2/3}$

(b) $(4)^{1/3}$

(c) $(4)^{1/2}$

(d) $(4)^{1/4}$

***Question* 36:-** Two circular discs A and B are of equal masses and thickness but made of metal with densities d_A and d_B ($d_A > d_B$). If their moments of inertia about an axis passing through their centres and perpendicular to circular faces are I_A and I_B, then

(a) $I_A = I_B$

(b) $I_A > I_B$

(c) $I_A < I_B$

(d) $I_A \geq I_B$