

SUBJECT CODE :15PH/MC/ME34  
B.Sc. DEGREE EXAMINATION NOVEMBER 2018  
BRANCH III - PHYSICS  
THIRD SEMESTER

COURSE : MAJOR – CORE  
PAPER : MECHANICS  
TIME : 3HOURS

MAX. MARKS :100

SECTION – A

ANSWER ALL QUESTIONS:

(30 x 1 = 30)

I. CHOOSE THE CORRECT ANSWER:

- The formula of impulse is \_\_\_\_\_.  
a) Time/Force                      b) Force x distance      c) Force/Time                      d) Force x Time
- Conservation of linear momentum is equivalent to  
a) Newton's 2<sup>nd</sup> law of motion                      b) Newton's 1<sup>st</sup> law of motion  
c) Newton's 3<sup>rd</sup> law of motion                      d) conservation of angular momentum
- The principle of conservation of linear momentum can be strictly applied during a collision between two particles provided the time of impact is \_\_\_\_\_.  
a) extremely large                      b) extremely small      c) moderately small      d) none
- The differential equation representing the free vibration of a body is  $\frac{d^2y}{dt^2} + \omega^2y = 0$   
The natural frequency of the body is \_\_\_\_\_.  
a)  $2\pi/\omega$                       b)  $\omega/2\pi$                       c)  $\omega$                       d)  $\omega^2$
- Which one of the following is S.H.M.?  
a) Motion of the earth round the sun  
b) A stone moving in a circular path  
c) Motion of an electron around the nucleus  
d) A glass ball rolling freely in a shallow spherical shell
- The girl is swinging on a swing in the sitting position. How will the period of swing be affected if she stands up?  
a) The period will now be shorter                      b) The period will now be larger  
c) The period will remain unchanged                      d) None of the above is correct
- The unit of M.I is \_\_\_\_\_.  
a) Kgm                      b)  $\text{Kg/m}^2$                       c)  $\text{Kg m}^2$                       d) gmcm
- The M.I of the solid sphere about the tangent T is \_\_\_\_\_.  
a)  $2/5 MR^2$                       b)  $5/7 MR^2$                       c)  $1/2 MR^2$                       d)  $7/5 MR^2$
- The value of 'g' is \_\_\_\_\_.  
a) 9.80665 ms                      b) 9.80665 m/s                      c) 9.80665  $\text{ms}^2$                       d) 9.80665  $\text{m/s}^2$

10. The C.G of the solid hemi-sphere is on its axis at a distance \_\_\_\_\_ from the centre.  
 a)  $\frac{8}{3} r$       b)  $\frac{3}{4} h$       c)  $\frac{3}{8} r$       d)  $r/2$
11. The Mass of a particle at the centre of the earth is \_\_\_\_\_.  
 a) Zero      b) Same as at other places      c) Infinite      d)  $>$  the original mass
12. The moment of inertia of a circular disc \_\_\_\_\_.  
 a)  $MR^2$       b)  $MR^2/2$       c)  $MR^4/2$       d)  $2MR$
13. For a particle constrained to move on a plane, only two variables  $x, y$  or  $r, \theta$  are sufficient to describe its motion and the particle is said to have \_\_\_\_\_ degrees of freedom.  
 a) 3      b) 2      c) 1      d) 4
14. In Atwood's machine, there is \_\_\_\_\_ coordinates.  
 a) Only one dependent      b) Cartesian  
 c) Only one independent      d) generalised
15. The walls of the gas vessel constitute a \_\_\_\_\_ constraints.  
 a) Scleronomic      b) Holonomic      c) Rheonomic      d) Non-holonomic

## II. FILL IN THE BLANKS:

16. The impulse of a force is \_\_\_\_\_ to the change in momentum produced.
17. When the amplitude of a particle executing S.H.M increases, its time period \_\_\_\_\_.
18. In a compound pendulum, the time period will be minimum when points of suspension and oscillation are equidistant from the \_\_\_\_\_.
19. The C.G of a hollow hemisphere is on its axis at a distance \_\_\_\_\_ from the centre.
20. \_\_\_\_\_ equation is termed as principle of virtual work.

## III. STATE WHETHER TRUE OR FALSE:

21. The ratio, with a negative sign, of the relative velocity of two bodies after impact to their relative velocity before impact is called the coefficient of restitution.
22. The necessary and sufficient condition for S.H.M is inversely proportional to restoring force and displacement from equilibrium position.
23. In a compound pendulum the centre of suspension and the centre of oscillation are interchangeable.
24. The C.G of the cone is along its axis at a distance of  $\frac{3}{8} h$  from the vertex.
25. The number of mutually independent variables required to define the state or position of a system is the number of degrees of freedom.

## IV. ANSWER BRIEFLY:

26. Give any two examples of impulsive force.
27. Give an example of forced vibrations.
28. What is bifilar suspension?
29. Define centre of gravity.
30. What are constraints?

**SECTION – B****ANSWER ANY FIVE QUESTIONS:****( 5 x 5 = 25 )**

31. A smooth sphere of mass 4kg moving with a velocity of  $8 \text{ ms}^{-1}$  impinges directly on a smooth sphere of mass 5kg moving in the same direction with a velocity of  $4 \text{ ms}^{-1}$ . Find the velocities of the spheres after impact. Calculate also the loss of KE due to the impact and the impulse of the blow on the sphere of smaller mass. ( $e = 5$ )
32. The acceleration  $x$  (in cm) of an oscillating particle varies with time  $t$  (in seconds) according to the equation  $x = 2 \cos (0.5\pi t + (\pi/3))$ . Find the time period of oscillation?
33. A circular disc of mass 100 grams and radius 10cm is making 120rpm about an axis passing through its centre and perpendicular to its plane. Calculate its kinetic energy.
34. Find the vertical angle of a right circular solid cone if the CG, of its surface including the plane base may coincide with the C.G. of its volume.
35. State and explain D'Alembert principle.
36. Apply Lagrange's equation to solve the problem of Atwood's machine.
37. A steel ball is let fall through a height of 0.64m on a plate of steel. The height through which it rebounds is 0.36m. Calculate the coefficient of restitution.

**SECTION – C****ANSWER ANY THREE QUESTIONS:****( 3 x 15 = 45 )**

38. Explain the following  
 a) direct impact of two smooth spheres      b) oblique impact of two smooth spheres
39. Write a short note on the following  
 a) free      b) damped      c) forced vibrations
40. How will you determine the acceleration due to gravity 'g' using bifilar pendulum.
41. Find the position of C.G in the following cases  
 a) Compound body      b) Remainder      c) Solid tetrahedron
42. Derive the Lagrange's equation of motion.

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