REV-00
BPH/14/20

2017/12

B. SC PHYSICS
SEMESTER-1ST
MECHANICS
BPH- 102

Duration: 3 Hrs. **Marks: 70**

PART : A (OBJECTIVE) = 20
PART : B (DESCRIPTIVE) = 50

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins. **Marks: 50**

[Answer question no. One (1) & any four (4) from the rest]

1. (a) A thin uniform spherical shell has a radius of R and mass M. Calculate its moment of inertia about its diameter. **5+ 5=10**

(b) A uniform solid sphere has a radius R and mass M. Calculate its moment of inertia about any axis through its centre.

2. Solve the numerical problems given below. **3 + 4 +3=10**

(a) Show that the given force is conservative: $\vec{F} = (y^2 - x^2)\hat{\imath} + 2xy\,j$.

(b) A frame S' is moving with velocity $5\hat{\imath} + 7\hat{\jmath}$ m/s relative to an inertial frame S. A particle is moving with velocity $(t + 5)\hat{\imath} + 9\hat{\jmath}$ m/s with respect to S. Find the acceleration of the particle in the frame S'.

(c) Two bodies of masses 6 gm and 30 gm have position vectors $(3\hat{\imath} + 2\hat{\jmath} - \hat{k})$ and $\hat{\imath} - \hat{\jmath} + 3\hat{k}$ respectively. Find the position vectors and the distance of centre of mass from the origin.

3. What is a Cantilever? Obtain an equation of displacement of cantilever loaded at the free end with reference to the following: **2 + 4 + 4=10**

(i) weight of the beam is ineffective

(ii) weight of the beam is effective.

4. What are inertial and non-inertial frames of reference? Discuss about Coriolis force and obtain an expression for Coriolis acceleration and Coriolis force. **2+ 8=10**

5. Write short note on the following. **2.5 X 4 =10**
   (a) Gravitational mass
   (b) Radius of gyration
   (c) Reduced mass
   (d) Universal law of gravitation

6. What is the principle of conservation of angular momentum? Find the equation of motion for a body rolling down an inclined plane. **2 + 8=10**

7. Obtain the expression for Gravitational Potential and Gravitational Field Intensity due to a point inside and outside a Solid sphere. 10

8. Obtain the expression for Gravitational Potential and Gravitational Potential energy due to a point inside a Solid Sphere. 10

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[PART-A : Objective]

Choose the correct answer from the following : **1X20=20**

1. The range of a projectile is
   a. $x = \frac{u^2 Sin\ 2\alpha}{g}$
   b. $x = \frac{u^2 Sin^2 \alpha}{g}$
   c. $x = \frac{u^2 Sin\ \alpha}{g}$
   d. $x = \frac{u^2 Sin\ 2\alpha}{2g}$

2. The law of conservation of energy is
   a. independent of the Galilean transformation equation.
   b. not invariant to the Galilean transformation equation.
   c. invariant to the Galilean transformation equation.
   d. all of the above

3. Change in momentum is defined as
   a. angular momentum
   b. Force
   c. linear momentum
   d. impulse

4. The motion of a parabola is called
   a. translatory motion
   b. trajectory motion
   c. oscillatory motion
   d. rotational motion

5. A non-conservative force is the one in which work done in
   a. an open curve is non-zero.
   b. curved path is non-zero.
   c. an open path is non-zero.
   d. round trip is non-zero.

6. Choose the **incorrect** option(s) from the following
   a. $U = -\int \vec{F} . \overrightarrow{dr}$
   b. $V = \int \vec{E} . \overrightarrow{dr}$
   c. $V = -\int \vec{E} . \overrightarrow{dr}$
   d. $W = \int \vec{F} . \overrightarrow{dr}$

7. On being slightly disturbed from its equilibrium position, if a body tends to acquire the original configuration then the body is said to be in
   a. Neutral equilibrium
   b. Unstable equilibrium
   c. Stable equilibrium
   d. All of the above

8. In case of a conservative force, the work done around a closed path is
   a. zero
   b. infinity
   c. undefined
   d. none of the above

9. The SI unit of mechanical energy is
   a. Electron Volt
   b. Watts
   c. Joule per Second
   d. Joule

10. Which among the following is a conservative force
    a. Viscous
    b. Frictional force
    c. Tension
    d. None of the above

11. The rate of change of energy is equal to
    a. Activity of force
    b. Work
    c. Power
    d. all of the above

12. Mass is taken to be the measure of inertia of
    a. Linear motion
    b. Rotational motion
    c. Translational motion
    d. all of the above

13. Moment of inertia of a uniform rod about an axis through its centre and perpendicular to its length is
    a. $\frac{Ml^2}{3}$
    b. $\frac{Ml^2}{12}$
    c. $\frac{Ml^2}{2}$
    d. $\frac{Ml^2}{4}$

14. Moment of inertia of a solid sphere about a diameter is
    a. $\frac{7MR^2}{5}$
    b. $\frac{2MR^2}{3}$
    c. $\frac{2MR^2}{5}$
    d. $\frac{3MR^2}{5}$

15. The rotational analogue of Newton's second law of motion is given by
    a. $\vec{J}_p = \vec{r} \times \vec{p}$
    b. $\tau = I\alpha$
    c. $v = r\omega$
    d. none of the above

16. The external bending moment required to produce a curvature of unit radius in the beam is called
    a. modulus of rigidity
    b. modulus of elasticity
    c. tensile elasticity
    d. flexural rigidity

17. The area around a body within which its force of gravitational attraction is perceptible is called
    a. gravitational field
    b. gravitational potential
    c. gravitational potential energy
    d. none of the above

18. The intensity of the gravitational field at a point inside a solid sphere is directly proportional to the distance of the point from the
    a. surface of the sphere
    b. centre of the sphere
    c. A point outside the sphere
    d. none of the above

19. What do taking off in a jet airplane, riding a merry-go-round, and the circular motion of a tropical cyclone have in common? Each exhibits
    a. Centrifugal force
    b. Coriolis force
    c. Real force
    d. None of the above

20. The shear modulus is called Modulus of rigidity; Bulk modulus describes the Volumetric elasticity. Which among the following best describes Young's modulus
    a. tensile elasticity
    b. elastic modulus
    c. ratio of tensile stress to tensile strain
    d. All of the above

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UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA

[PART (A) : OBJECTIVE]

Duration : 20 Minutes

Serial no. of the main Answer sheet

Course : .....

Semester : ..... Roll No : .....

Enrollment No : ..... Course code : .....

Course Title : .....

Session : 2017-18 Date : .....

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Instructions / Guidelines

- The paper contains twenty (20) / ten (10) questions.
- Students shall tick (✓) the correct answer.
- No marks shall be given for overwrite / erasing.
- Students have to submit the Objective Part (Part-A) to the invigilator just after completion of the allotted time from the starting of examination.

Full Marks	Marks Obtained
20	

Scrutinizer's Signature *Examiner's Signature* *Invigilator's Signature*