



12 SA – 71

First Semester B.Sc. Degree Examination, Nov./Dec. 2014
(New Scheme) (New Syllabus)
PHYSICS – I
Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) The question paper consists of **three** Sections **A, B and C**.
2) Draw **neat** and labeled diagrams **wherever** necessary.
3) Section **A** should be answered in the beginning pages **only**.
4) Symbols used have their **usual** meaning.

SECTION – A

1. Answer **any six** of the following : (2×6=12)
- a) State and explain co-efficient of rolling friction.
 - b) State Kepler's 1st and 2nd law of planetary motion.
 - c) State and explain perpendicular axes theorem.
 - d) Explain with examples the law of conservation of Angular momentum.
 - e) What is a conservative force ? Explain.
 - f) State and explain Hooke's law.
 - g) Distinguish between Cohesive and Adhesive forces with examples.
 - h) State and explain work-energy theorem.

SECTION – B

- Answer **any six** of the following : (8×6=48)

- ② Derive an expression for the instantaneous velocity of a rocket.
- 3. Obtain an expression for M-I of a solid sphere about an axis passing through its diameter and tangent.
- ④ Obtain an expression for radial and transverse components of acceleration in a plane.

- (5)^{2,6} What is a single cantilever ? Obtain an expression for the depression at the loaded end of a single cantilever.
6. Write a note on collisions. Obtain an expression for the velocities of two particles after an head on collision and discuss it for different cases.
7. Obtain an expression for acceleration of a body rolling down an inclined plane without slipping and hence write the expressions for acceleration of a circular disc and solid sphere rolling down an inclined plane.
8. Distinguish between stream line flow and turbulent flow, and hence deduce Poiseuille's formula for the coefficient of viscosity of a fluid.
- (9)⁴ What is a Geostationary satellite ? Give an example, obtain an expression for the orbital velocity and escape velocity of the satellite around the earth.

SECTION - C

Answer **any five** of the following :

(4×5=20)

10. A circular disc having moment of inertia $2.5 \times 10^{-3} \text{ Kgm}^2$ is making 60 revolutions per minute about an axis passing through its centre and perpendicular to its plane. Calculate its kinetic energy.
- (11)³ A block of mass 10 Kg is placed on a horizontal plane. The mass just begins to slide when the angle of inclination of the plane gradually increased to 25° with the horizontal. Calculate the coefficient of static friction between the block and the surface and hence the force of static friction. ($g = 9.8 \text{ ms}^{-2}$).
12. Calculate the workdone in blowing a soap bubble of radius 10 cm and surface tension $30 \times 10^{-3} \text{ N/m}$.
13. A load of 0.500 Kg is suspended to a spiral spring in performing S.H.M. with a period of 2 second. Determine the force constant.
14. Calculate the angular momentum of an electron moving in a circular orbit round a nucleus with a velocity of $4 \times 10^6 \text{ ms}^{-1}$. The radius of the orbit is 0.52 \AA and mass of the electron is $9.1 \times 10^{-31} \text{ Kg}$.
15. What force is required to stretch a steel wire 1 sq.cm in cross-sectional area to double its length. Given Young's modulus $q = 2 \times 10^{11} \text{ Nm}^{-2}$.

First Semester B.Sc. Degree Examination, May/June 2015
(New Scheme) (New Syllabus)
Paper – I : PHYSICS
Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) The question paper consists of **four** Sections **A, B, C & D**.
2) **Draw** neat and labelled diagrams **wherever** necessary.
3) Section **A** Should be answered in the beginning pages only.
4) Symbols used have their **usual** meanings.

SECTION – A

1. Answer **any ten** of the following. (2×10= 20)
- Write the expression for workdone by a gravitational force during rising and falling of an object.
 - What is meant by elastic head on and elastic oblique collision ?
 - Show that workdone by a conservative force around a closed path is zero.
 - Distinguish between inertial and noninertial frames of reference.
 - What are Galelian transformations ? Write the Galelian transformation equations.
 - What is meant by centripetal and centrifugal force ?
 - What are the conditions for a satellite to be Geostationary ?
 - Mention the methods used to reduce the friction between the various parts of a machine.
 - State and explain parallel axis theorem on moment of inertia.



- j) Define strain. Mention its types.
- k) Define 'Surface tension' and 'Angle of contact'.
- l) Distinguish between streamline and turbulent motion.

SECTION - B

Answer any two of the following.

(5×2=10)

- 2. What is centre of mass? Obtain the expressions for velocity and acceleration of the center of mass.
- 3. Obtain an expression for moment of inertia of a solid sphere about its diameter.
- 4. Obtain the relation between k , η and σ where, the symbols have their usual meaning.

SECTION - C

Answer any five of the following.

(6×5= 30)

- 5. Deduce $\vec{F} = M\vec{a}$ for a system of particles.
- 6. Obtain an expression for period of oscillation for a loaded spiral spring whose mass is not negligible.
- 7. Define escape velocity and obtain its expression.
- 8. By considering the elastic head on collision of two particles of masses m_1 and m_2 derive the final velocities of the two particles.
- 9. Obtain an expression for couple per unit twist of a cylinder.
- 10. Obtain an expression for excess of pressure across a curved surface.
- 11. Derive Poiseuille's formula for the rate of flow of liquid through a capillary tube.



SECTION - D

Answer any five of the following.

(4×5= 20)

- 12. Three particles of masses 1, 2 and 3 kg are placed in a X - Y plane at positions (1, 2), (-2, 4) and (-1, 2). Find the co-ordinates of centre of mass.
- 13. A 1 kg ball falls vertically on to the floor with a speed of 25 m/s it rebound with an initial speed of 10 m/s. Find the coefficient of restitution. What impulse acts on the ball during contact? If the ball is in contact for 0.020 secs. What is the average force exerted on the floor?
- 14. A mass of 70 kg is making 8 revolutions per second round a circle of radius 14 m. Find the force towards the centre of the circle, which must be acting upon the mass.
- 15. A small artificial satellite is revolving round the earth very close to it. If the radius of the earth is 6400 km and acceleration due to gravity 9.8 m/s^2 . Find the period of revolution of the satellite.
- 16. A fly wheel of mass 50 kg and Radius of gyration 0.25 m makes 60 revolutions per minute. Calculate moment of inertia of the flywheel and the energy stored in it.
- 17. Calculate the height to which water rises in a capillary tube of radius $0.031 \times 10^{-2} \text{ m}$ when dipped into water. Surface tension of water is 0.0735 N/m , density of water = 1000 kg/m^3 and $g = 9.8 \text{ m/s}^2$. Assuming angle of contact $\theta = 0$.
- 18. A cube of Aluminium of side 10 cm is subjected to a shearing force of 100 N. The top surface of the cube is displaced 0.01 cm with respect to the bottom. Calculate the shearing stress, shearing strain and shear modulus.
- 19. Check whether the electrostatic field represented by $\vec{E} = axy^2(y\hat{i} + x\hat{j})$ is conservative or not.

First Semester B.Sc. Degree Examination, May/June 2014
(New Scheme) (New Syllabus)

Paper – I : PHYSICS
Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) The question paper consists of **four** Sections **A, B, C and D**.
2) Draw **neat** and labeled diagrams **wherever** necessary.
3) Section **A** should be answered in the beginning pages **only**.
4) Symbols used have their **usual** meaning.

SECTION – A

1. Answer **any ten** of the following : (2×10=20)
- State and explain the law of conservation of linear momentum of system of particles.
 - State and explain work – energy theorem.
 - Define orbital velocity and escape velocity of a satellite.
 - What is a non-inertial frame of reference ? Give an example.
 - State and explain the co-efficient of static friction.
 - Write the essential conditions for an artificial satellite to be a Geo-stationary satellite.
 - What is moment of inertia ? What are the factors on which it depends ?
 - Obtain an expression for Kinetic energy of a rotating body.
 - Derive the relation between angular momentum and moment of inertia.
 - Define Poisson's ratio and mention its limiting values.
 - Mention the factors affecting the surface tension.
 - State and explain Stoke's law.



14. A satellite is orbiting very close to a planet of density $8 \times 10^3 \text{ kg m}^{-3}$, if $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$, find the time period of the satellite.
 15. Calculate the excess pressure inside a soap bubble of radius $3 \times 10^{-3} \text{ m}$. Surface tension of soap solution is $20 \times 10^{-3} \text{ N/m}$. Calculate also the surface energy of the soap bubble.
 16. A body of mass 2 kg collides elastically with another body at rest and then continues to move in the original direction with one-fourth of its original speed. What is the mass of the struck body ?
 17. A thin metal ring of radius 0.5 m and mass 0.5 kg starts from rest and rolls down an inclined plane. Its linear velocity on reaching the foot of the plane is 5 ms^{-1} , calculate the moment of inertia of the ring and kinetic energy of rotation.
 18. A circular disc of mass 100 grams and radius 10 cm is making 120 rpm about an axis passing through its centre and perpendicular to its plane. Calculate its kinetic energy.
 19. Calculate the work done in twisting a steel wire of radius 10^{-3} m and length 0.25 m through an angle of 45° . Given $\eta = 8 \times 10^{10} \text{ N/m}^2$.
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12SA – 71

First Semester B.Sc. Degree Examination, Nov./Dec. 2013
(New Syllabus) (Semester Scheme)

PHYSICS

Paper – I : Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- 1) The question paper consists of **four** Sections **A, B, C and D**.
 - 2) Answer **ten** questions in Section **A**, **two** questions from Section **B**, **five** questions from Section **C** and **four** questions from Section **D**.
 - 3) Draw **neat and labelled** diagrams **wherever** necessary.
 - 4) Take **necessary** data from the tables.
 - 5) Symbols used have their **usual** meanings.

SECTION – A

Answer any ten of the following :

(2×10=20)

1. a) Prove the law of conservation of linear momentum for a system of particles.
b) What are conservative and non-conservative forces ? Give example for each.
c) Distinguish between inertial and non-inertial frames of references.
d) State Newton's law of gravitation and express it in vector form.
e) State and explain Parallel axes theorem.
f) Obtain an expression for Kinetic energy of rotation.
g) Define Poisson's ratio and write its limiting value.
h) Deduce an expression for elastic potential energy.
i) Show that the surface energy /unit area of a surface is numerically equal to the surface tension.
j) Distinguish between turbulent motion and stream line flow.
k) State and explain Galilean principle of relativity.
l) Mention the factors affecting the surface tension.

SECTION - B

Answer any two of the following :

(5×2=10)

2. State and prove Work-Energy theorem.
3. Deduce the expression for total energy of a particle executing SHM.
4. Give the theory of single cantilever.

SECTION - C

Answer any five of the following :

(6×5=30)

5. Derive the expressions for velocity, acceleration and total energy of a body rolling down along an inclined plane.
6. Derive Kepler's First law of planetary motion.
7. Define Pseudo force. Determine the total force and fictitious force acting on a body in a non-inertial frame.
8. Explain the theory of Fly-wheel.
9. Deduce the expression for excess of pressure across a curved liquid surface.
10. What is terminal velocity ? Obtain the relation for Poiseuille's formula for coefficient of viscosity of a liquid.
11. Obtain an expression for Couple/unit twist of a cylinder.

SECTION - D

Answer any five of the following :

(4×5=20)

12. A rocket of mass 20 kg has 180 kg of fuel. The exhaust velocity of fuel is 1.6 km/s. Calculate the maximum velocity gained by the rocket. Assume initial velocity of rocket is zero.
13. Calculate the fictitious force and total force acting on a mass of 3 kg in a frame of reference moving vertically upwards with an acceleration of 4 m/s^2 . Assume $g = 9.8 \text{ m/s}^2$.

14. Find the mass of the sun assuming the orbit of the earth round the sun to be a circle. The distance of the earth and sun is $1.5 \times 10^8 \text{ km}$, $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$ and $T = 365 \text{ days}$.
15. A thin uniform circular disc of mass 2 kg and radius 0.1 m rotates about an axis passing through its centre and perpendicular to its plane. Calculate its moment of inertia.
16. What force is required to stretch a steel wire 1 sqcm in cross-section to double its length ? $q = 2 \times 10^{11} \text{ N/m}^2$?
17. Calculate the excess pressure inside a soap bubble of radius $3 \times 10^{-3} \text{ m}$. Surface tension of soap solution is $20 \times 10^{-3} \text{ N/m}$.
18. What couple must be applied to a wire one meter long, 1 mm in diameter in order to twist one end of it, through 90° , the other end remaining fixed. Rigidity modulus of material of the wire is $2.8 \times 10^{10} \text{ N/m}^2$.
19. Calculate the velocity with which a satellite has to be launched from the surface of the earth so that it escape from the gravitational influence of the earth. Radius of the earth is 6400 km.

First Semester B.Sc. Degree Examination, April/May 2013
(New Scheme) (New Syllabus)

Paper - I : PHYSICS
Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions : 1) The question paper consists of four Sections A, B, C and D.
2) Draw neat and labelled diagrams wherever necessary.
3) Section A should be answered in the beginning pages only.
4) Symbols used have their usual meanings.

SECTION - A

1. Answer any ten of the following.

(2x10=20)

- State and explain Newton's third law of motion.
- Define torque. Mention its S.I. Unit.
- What are conservative and non conservative forces ?
- Is a laboratory at rest on the earth's surface really an inertial frame reference ? Explain.
- What are static and dynamic frictions ?
- Write Newton's law of gravitation in vector form.
- Mention the factors on which the moment of inertia of a body depends.
- Obtain an expression for Kinetic energy of a rotating body.
- State the law of conservation of angular momentum. Give one illustration of this law.
- Define modulus of elasticity. Mention its types.
- Define the term angle of contact. On what factors does it depend ?
- Why does an object entering the earth's atmosphere at high velocity catch fire ?

SECTION - B

Answer any two of the following.

(5×2=10)

2. Show that in the absence of any external force, the velocity of centre of mass remains constant.
3. Distinguish between orbital and escape velocity. Obtain an expression for the orbital velocity of revolution of the satellite around the earth.
4. Derive an expression for the moment of inertia of a solid sphere about its diameter.

SECTION - C

Answer any five of the following.

(6×5=30)

5. What is a cantilever? Obtain an expression for the depression at the free end of a thin light beam clamped horizontally at one end and loaded at the other end.
6. State Kepler's laws of planetary motion. Derive Kepler's III Law.
7. Discuss the theory of fly wheel to determine its moment of inertia.
8. What is the terminal velocity? Deduce Stoke's law on the basis of dimensional considerations.
9. By considering the elastic head on collision of two particles of masses m_1 and m_2 , derive the final velocities of the particles. Discuss briefly what is the status of two particles when $m_1 = m_2$.
10. Derive expressions for radial and transverse components of velocity.
11. State parallel and perpendicular axis theorems. And prove parallel axis theorem.

SECTION - D

Answer any five of the following.

(4×5=20)

12. A rain drop of radius 2 mm falls from a height of 250 m above the ground. Calculate the work done by the gravitational force on the drop.
13. Calculate the time period of artificial satellite revolving at an height of 200 km from the surface of the earth. Given radius of earth is 6.36×10^6 m.

14. A circular disk of mass 1 kg and radius 0.25m. Calculate the moment of inertia
 - i) about its diameter and
 - ii) about an axis passing through the centre and perpendicular to its plane.
15. The excess of pressure inside a soap bubble of radius 1 cm is 1.5 mm of oil of density 800 kg/m^3 . Calculate the surface tension of soap solution.
16. A mass 0.05 kg executes SHM. The force acting on it when the displacement is 0.1 m is 0.5 N. Find the period. If the maximum velocity is 5ms^{-1} , calculate the amplitude and maximum acceleration. What will be its K.E. and P.E. when the displacement is 0.1 m?
17. A metal block of mass 50 g placed over an inclined plane at an angle of 15° slides down without acceleration. If the inclination is increased by 15° , what would be the acceleration of the block?
18. The angular momentum of a body is 31.4 JS and its rate of revolution is 10 cycles per second. Calculate the moment of inertia of the body about the axis of rotation.
19. Calculate the increase in energy of a brass bar of length 0.2 m and cross sectional area 1 cm^2 when compressed with a load of 5 kgwt along its length. Young's modulus of brass $= 1.0 \times 10^{11} \text{ Nm}^{-2}$ and $g = 9.8 \text{ m/s}^2$.

First Semester B.Sc. Degree Examination, November/December 2012
(New Scheme) (New Syllabus)

Paper – I : PHYSICS
Mechanics and Properties of Matter

Time : 3 Hours

Max. Marks : 80

- Instructions:** 1) The question paper consists of **four** Sections **A, B, C and D.**
2) Draw **neat** and labelled diagrams **wherever necessary.**
3) Section **A** should be answered in the **beginning** pages **only.**
4) Symbols used have their **usual** meanings.

SECTION – A

1. Answer any ten of the following : (2×10=20)
- State and explain Newton's first law of motion.
 - What are non-conservative forces ? Give two examples.
 - Define simple harmonic motion. Give two examples for SHM.
 - What is non-inertial frame of reference ? Explain.
 - What are centripetal and centrifugal forces ?
 - Explain the principle of launching of satellites.
 - Define angular momentum with any one illustration .
 - Obtain an expression for Kinetic energy of a rotating body.
 - Explain moment of inertia. Write the expression for it.
 - Define Poisson's ratio. Mention its limiting values.
 - Explain any two factors which affect the surface tension.
 - Distinguish between stream line and turbulent motion.

SECTION – B

Answer any two of the following :

- (5×2=10)
- Obtain the relation between three elastic constants.
 - Obtain an expression for surface tension of a liquid during capillary rise.
 - State parallel and perpendicular axes theorems. And prove perpendicular axes theorem.



SECTION - C

Answer any five of the following :

(6x5=30)

5. a) Show that the linear momentum of system of particles remains constant, when external forces acting on the particles is zero.
- b) Calculate the position vector of centre of mass of two particles of mass 4 gm and 8 gm having position vectors $2\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$ and $4\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ respectively.
6. a) What is torque ? Obtain an expression for it.
- b) Determine the angular velocity and period of oscillation of mass 0.4 kg attached to a spring of force constant 80 Nm^{-1} .
7. a) State and explain Galilean principle of relativity.
- b) Explain the static friction. Write the expression for coefficient of static friction.
8. a) State Kepler's laws of planetary motion.
- b) A satellite is orbiting very close to a planet of density $8 \times 10^3 \text{ kg m}^{-3}$. If $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$, find the time period of satellite.
9. a) Derive a relation between angular momentum and moment of inertia.
- b) A circular disc has mass 1 kg and radius 0.25 m. Calculate the moment of inertia
 - i) about an axis passing through its centre and perpendicular to its plane,
 - ii) about its diameter.
10. a) Obtain an expression for Stoke's law for highly viscous liquids by dimensional analysis.
- b) Calculate the horizontal force required to move a rectangular lamina of area 1 m^2 resting on a layer of thickness $3 \times 10^{-3} \text{ m}$ with a velocity 1.8 ms^{-1} . The coefficient of viscosity of the liquid is 1 NS m^{-2} .
11. a) Derive the relation between surface energy and surface tension.
- b) Calculate the excess pressure inside a drop of mercury of radius $2.5 \times 10^{-3} \text{ m}$ at room temperature. Given surface tension of mercury is 0.472 Nm^{-1} .



SECTION - D

Answer any two of the following :

(10x2=20)

12. a) Obtain an expression for velocities of two particles after an elastic head-on collision.
- b) Show that energy is conserved in a loaded spiral spring.
13. a) Derive expressions for radial and transverse components of velocity of a particle moving in a plane.
- b) Define escape velocity. Obtain an expression for it.
14. a) Derive an expression for moment of inertia of rectangular plate about an axis passing through CG and perpendicular to plane.
- b) Obtain an expression for moment of inertia of fly wheel.