(Pages : 3) **D – 5034**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme Under CBCSS
Physics
Core Course – I
PY 1141 : BASIC MECHANICS AND PROPERTIES OF MATTER
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. What do you mean by centre of mass of a system ?
2. Give the expression for the rotational work done by a torque.
3. Define radius of gyration.
4. What do you mean by conservative force ? Give one example.
5. Define work energy theorem.
6. Two spheres are identical in mass and volume, but one is hollow and the other is solid. How will you identify them experimentally ?
7. What is resonance in forced oscillations ?
8. Show that the oscillations of a loaded spring are simple harmonic.
9. Define flexural rigidity.
10. Define surface energy. What is its unit ?

(10×1=10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions, **not** exceeding a paragraph. **Each** question carries **two** marks. 7

11. State and explain parallel axes theorem with an example.
12. Derive the expression for total energy of a rotating body.
13. Distinguish between elastic and inelastic collisions.
14. A light body and heavy body have equal kinetic energy. Which will have greater momentum ?
15. "Centre of suspension and centre of oscillations are interchangeable". Justify.
16. What are beats ? Mention two important application of beats.
17. Explain the Poiseoulle's formula for determining the viscosity of a liquid.
18. What is an I-section girder ? Write its two advantages.
19. Explain Doppler effect.
20. Discuss the factors affecting acoustics of building.
21. What is Reynold's number ? What is its importance ?
22. Explain the principle and working of Venturimeter. **(8×2=16 Marks**

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. Four spheres of a diameter of a 2a and mass M are placed with their centres on the four corners of a square of side b, calculate the moment of inertia of the system about the side of the square ?
24. Determine the earth's angular momentum magnitude, due to its daily rotation. Mass of the earth is 6×10^{24} kg and its radius of 6.4×10^{6} m.
25. Two bodies A and B of masses 100 g and 400 g respectively are moving towards each other with speeds 1 m/s and 0.1 m/s respectively. They stick together after a head on collision. Find :
    a) The velocity of the bodies after the collision and
    b) Loss in kinetic energy during the collision.
26. A metallic disc of radius R with its plane vertical is made to oscillate about a horizontal axis passing through any one of a number of holes drilled along a diameter. Show that the minimum period of oscillation is given by $T = 2\pi\sqrt{\frac{1,414R}{g}}$.

27. An air bubble of radius 5×10^{-3} m rises steadily through a liquid of relative density 0.83 at the rate of 22.6 m/s. Calculate the viscosity of the liquid. Neglect the density of air.

28. Calculate the mass of water flowing in 10 minutes through a tube of 0.1 cm diameter, 40 cm long, if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.0089 CGS units.

29. An ideal fluid is flowing through a tube of cylindrical cross section with smoothly varying radius. The velocity of fluid particles at the point where tube's cross sectional area is 1×10^{-4} m^2 is given by 0.01 m/s. Find the velocity at a point where the cross sectional area is 2×10^{-4} m^2.

30. Two metal wires A and B having lengths l and 2l and radii R and 2R respectively are joined end to end along their axis. When one end of the system is fixed and the other end is pulled with constant force F, the elongation in both the wires is equal. Find the ratio of their young's moduli.

31. An air bubble of diameter 1 cm is situated just below the surface of water. What is the pressure inside the bubble if the atmospheric pressure on the surface is 10^5 N/m^2 and the surface tension is 72×10^{-2} N/m ? **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks.

32. Define moment of inertia of a body and discuss its physical significance. Derive expression for MI of a straight rod about :
    a) An axis passing through the centre and perpendicular to its plane and
    b) About an axis passing through one end perpendicular to its length.

33. Distinguish between a transverse and a longitudinal wave and obtain an expression for a plane progressive wave. Also derive the general differential equation of one dimensional.

34. Derive the expression for potential and kinetic energy of in a simple harmonic motion. Show that the total energy of a simple harmonic oscillator is a constant.

35. What is a torsional pendulum ? Obtain an equation for couple per unit twist when a cylindrical rod fixed at one end is given a twist at the other end and hence obtain the expression for rigidity modulus. **(2×15=30 Marks)**

(Pages : 3)

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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, December 2014
(First Degree Programme Under CBCSS)
PHYSICS
Core Course : PY 1141 : Basic Mechanics and Properties of Matter
(For 2014 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. What is work energy theorem ?
2. What is radius of gyration ?
3. How will you connect acceleration and displacement of a particle under SHM ?
4. State theorem of parallel axis.
5. How will you explain the shape of a drop ?
6. State Sabines reverberation formula.
7. What is critical velocity ?
8. What is cohesive force ?
9. Define angular momentum of a body.
10. State and explain Stoke's formula.

(10×1=10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions not exceeding a paragraph. **Each** question carries **two** marks.

11. State and explain surface tension on molecular basis.
12. Obtain the relation between rotational kinetic energy and angular momentum about the same axis.
13. Define Poisson's ratio. Obtain its limiting values.
14. Obtain the relation connecting the three elastic modulii.
15. Distinguish between streamline and turbulent flow.
16. Obtain the expression for moment of inertia of a ring about a diameter.
17. What are the factors affecting acoustics of buildings ?
18. State and explain perpendicular axis theorem.
19. How will you distinguish conservative and non conservative forces with examples ?
20. What are the limitations of Poiseuille's formula ?
21. Obtain the conditions for maximum and minimum time periods for a compound pendulum.
22. Differentiate between angle of twist and angle of shear. **(8×2=16 Marks**

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. Calculate the frequency of oscillation of a system of two masses of 30 gm and 70 gm connected by a spring of length 15 cm and force constant 700 n/m.
24. A cantilever of length 50 cm is depressed by 15 mm at the loaded end. Calculate the depression at distance 30 cm, from the fixed end.
25. A grind stone has a moment of inertia of 50 SI units. A constant couple is applied an the grind stone is found to have speed of 150 revolutions per minute after starting from rest. Find the couple.
26. A copper wire 3 metres long for which Young's modulus is 12.5×10^7 Nm^{-2} has a diameter of 1 mm. If a mass of 10 Kg is attached to one end, what extension is produced ? If Poisson's ratio is 0.26, what lateral strain is produced ?

27. If the excess pressure inside a spherical bubble is balanced by that due to a column of oil (sp. gravity 0.8), 2 mm high, when radius of the bubble = 1.0 cm, find the surface tension of the soap bubble.

28. Calculate the mass of water flowing in 10 minutes through a tube 0.1 cm in diameter, 0.4 m long, if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.89×10^{-3} NSm^{-2}.

29. What is the wavelength of longitudinal waves of frequency 400 in an alloy whose density is 5500 Kg/m^3 and Young's modulus 8.8×10^{10} N/m^2 ?

30. A solid sphere of mass 0.1 Kg and radius 0.025 m rolls without sliding with a uniform velocity of 0.1 m/sec along a straight line on a smooth horizontal table. Calculate its total energy.

31. A solid sphere of mass 4 Kg and radius 0.05 m is suspended from a wire. Find the period of oscillation, if the torque required to twist the wire is 4×10^{-2} N-m/radian. **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks.

32. Describe plane progressive harmonic wave. Obtain the expression for energy density of a plane progressive wave.

33. With necessary theory, briefly explain the determination of moment of inertia of a flywheel.

34. Obtain the expression for torsional couple. What is the work done in twisting a wire ?

35. State and explain Bernoulli's theorem. How will you measure the amount of flow of a liquid in a pipe using a venturimeter. **(2×15=30 Marks)**

(Pages : 3) **D – 5034**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme Under CBCSS
Physics
Core Course – I
PY 1141 : BASIC MECHANICS AND PROPERTIES OF MATTER
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. What do you mean by centre of mass of a system ?
2. Give the expression for the rotational work done by a torque.
3. Define radius of gyration.
4. What do you mean by conservative force ? Give one example.
5. Define work energy theorem.
6. Two spheres are identical in mass and volume, but one is hollow and the other is solid. How will you identify them experimentally ?
7. What is resonance in forced oscillations ?
8. Show that the oscillations of a loaded spring are simple harmonic.
9. Define flexural rigidity.
10. Define surface energy. What is its unit ?

(10×1=10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions, **not** exceeding a paragraph. **Each** question carries **two** marks.

11. State and explain parallel axes theorem with an example.
12. Derive the expression for total energy of a rotating body.
13. Distinguish between elastic and inelastic collisions.
14. A light body and heavy body have equal kinetic energy. Which will have greater momentum ?
15. "Centre of suspension and centre of oscillations are interchangeable". Justify.
16. What are beats ? Mention two important application of beats.
17. Explain the Poiseoulle's formula for determining the viscosity of a liquid.
18. What is an I-section girder ? Write its two advantages.
19. Explain Doppler effect.
20. Discuss the factors affecting acoustics of building.
21. What is Reynold's number ? What is its importance ?
22. Explain the principle and working of Venturimeter. **(8×2=16 Marks**

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. Four spheres of a diameter of a 2a and mass M are placed with their centres on the four corners of a square of side b, calculate the moment of inertia of the system about the side of the square ?
24. Determine the earth's angular momentum magnitude, due to its daily rotation. Mass of the earth is 6×10^{24} kg and its radius of 6.4×10^{6} m.
25. Two bodies A and B of masses 100 g and 400 g respectively are moving towards each other with speeds 1 m/s and 0.1 m/s respectively. They stick together after a head on collision. Find :
    a) The velocity of the bodies after the collision and
    b) Loss in kinetic energy during the collision.
26. A metallic disc of radius R with its plane vertical is made to oscillate about a horizontal axis passing through any one of a number of holes drilled along a diameter. Show that the minimum period of oscillation is given by $T = 2\pi\sqrt{\frac{1,414R}{g}}$.

27. An air bubble of radius 5×10^{-3} m rises steadily through a liquid of relative density 0.83 at the rate of 22.6 m/s. Calculate the viscosity of the liquid. Neglect the density of air.

28. Calculate the mass of water flowing in 10 minutes through a tube of 0.1 cm diameter, 40 cm long, if there is a constant pressure head of 20 cm of water. The coefficient of viscosity of water is 0.0089 CGS units.

29. An ideal fluid is flowing through a tube of cylindrical cross section with smoothly varying radius. The velocity of fluid particles at the point where tube's cross sectional area is 1×10^{-4} m^2 is given by 0.01 m/s. Find the velocity at a point where the cross sectional area is 2×10^{-4} m^2.

30. Two metal wires A and B having lengths l and 2l and radii R and 2R respectively are joined end to end along their axis. When one end of the system is fixed and the other end is pulled with constant force F, the elongation in both the wires is equal. Find the ratio of their young's moduli.

31. An air bubble of diameter 1 cm is situated just below the surface of water. What is the pressure inside the bubble if the atmospheric pressure on the surface is 10^5 N/m^2 and the surface tension is 72×10^{-2} N/m ? **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks.

32. Define moment of inertia of a body and discuss its physical significance. Derive expression for MI of a straight rod about :
    a) An axis passing through the centre and perpendicular to its plane and
    b) About an axis passing through one end perpendicular to its length.

33. Distinguish between a transverse and a longitudinal wave and obtain an expression for a plane progressive wave. Also derive the general differential equation of one dimensional.

34. Derive the expression for potential and kinetic energy of in a simple harmonic motion. Show that the total energy of a simple harmonic oscillator is a constant.

35. What is a torsional pendulum ? Obtain an equation for couple per unit twist when a cylindrical rod fixed at one end is given a twist at the other end and hence obtain the expression for rigidity modulus. **(2×15=30 Marks)**

(Pages : 3) **D – 4998**

Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme Under CBCSS
Complementary Course I for Mathematics
PY 1131.1 : MECHANICS AND PROPERTIES OF MATTER
(2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. How does viscosity varies with temperature ?
2. Define Young's modulus.
3. What is spring constant ?
4. Define surface tension.
5. Write down the equation for a plane progressive wave.
6. Define energy density of wave.
7. Write down the differential equation of forced harmonic oscillator.
8. What is Newton's law of VISCOUS flow ?
9. What do you mean by shearing stress ?
10. What is the moment of inertia of a circular disc about an axis passing through the centre and perpendicular to its plane ? **(10×1=10 Marks)**

SECTION – B

Answer **any eight** questions, **not** exceeding a paragraph. **Each** question carries **two** marks.

11. Define moment of inertia. What is its significance ?
12. Distinguish between steady flow and turbulent flow of liquid.

P.T.O.

13. Water spreads on a glass plate but collects into drops on a greased glass plate. Why ?

14. Derive an expression for the torsional potential energy.

15. What is sharpness of resonance ?

16. Distinguish between transverse wave and longitudinal wave.

17. Explain variation of surface tension with temperature.

18. State the laws of vibrating string.

19. Write down the three dimensional wave equation and explain the symbols.

20. Explain simple harmonic motion of a particle.

21. The mass of a fly wheel is concentrated at its rim. Why ?

22. Define bulk modulus and rigidity modulus. **(2×8=16 Mark**

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. Calculate the M.I. of a ring of mass 200 gm and radius 20 cm about i) an axis passing through its centre and perpendicular to its plane ii) about its diameter.

24. A liquid flows through two capillary tubes under the same pressure head. The lengths of the tubes are in the ratio 2 : 1 and the ratio of their diameters is 2 : 3. Compare the rates of flow of liquid through the tubes.

25. Calculate the pressure inside air bubble of diameter 0.2 mm situated just below the surface of water. Surface tension of water is 7.2×10^{-2} N/m.

26. A wire of length 15 m and diameter 4 mm elongates 0.3 mm when stretched by a weight of 2.2 kg. Calculate the Young's modulus of the material of wire.

27. A wire of 0.5 m length vibrates 100 times a second. If the length of the wire is shortened to 0.4 m and the stretching force is increased to 4 times its original value, what will be the new frequency ?

28. A metal disc of radius one metre with its plane vertical can be made to swing about a horizontal axis passing through any one of the holes bored along its diameter. Calculate the minimum period.

29. Two spheres, each of 100 gm mass and 5 cm diameter are joined by a weightless rod so that their centres are 10 cm apart. Calculate the moment of inertia of the system about

    i) the line PQ joining their centres and

    ii) a line which bisects PQ and is perpendicular to it.

    Locate also the position of centre of mass.

30. Calculate the frequency of oscillation of hydrogen molecule if its force constant is 4.8×10^2 N/m and mass of hydrogen atom is 1.67×10^{-27} kg.

31. A solid sphere of mass 100 gm and radius 2.5 cm rolls without sliding with a uniform velocity of 10 cm per second along a straight line on a smooth horizontal table. Calculate its total energy. **(6×4=24 Marks)**

SECTION – D

nswer **any two** questions. **Each** question carries **fifteen** marks.

2. Derive an expression for bending moment. Describe in detail an experiment to determine Young's modulus of the material of the rod using cantilever.

3. Derive the expression for velocity of longitudinal waves in rods.

4. Derive an expression for the M.I. of a sphere about i) its diameter and ii) its tangent.

5. Describe Jaeger's experiment to determine the surface tension of a liquid. **(2×15=30 Marks)**

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Reg. No. : .....

Name : .....

First Semester B.Sc. Degree Examination, February 2018
First Degree Programme and CBCSS
PHYSICS
Core Course – I
PY 1141 – Basic Mechanics and Properties of Matter
(2013 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark.

1. Give any two examples for conservative force.
2. Define torque.
3. What is meant by energy function ?
4. Define a simple harmonic motion.
5. Write down the relation between velocity and the displacement of a particle executing simple harmonic motion.
6. State Hook's law of elasticity.
7. Define the term neutral surface.
8. What is surface energy of a liquid ?
9. Why kerosene oil rises up in the wick of a lantern ?
10. Write the Poiseuille's formula for the rate of flow of a liquid through a capillary tube.

(10×1=10 Marks)

P.T.O.

SECTION – B

Answer **any eight** questions, **not** exceeding a paragraph. **Each** question carries **two** marks.

11. "The laws of mechanics can be applied only to objects of large size and moving with velocities less than that of light". Discuss.
12. Define moment of inertia in terms of Torque and angular momentum.
13. Calculate the kinetic energy of a rolling body with circular symmetry.
14. Explain potential energy curve.
15. Explain work-energy theorem.
16. What are the positions at which acceleration becomes :
    i) minimum
    ii) maximum for a simple harmonic oscillator ?

    What are the minimum and maximum values ?
17. Show that the work done per unit volume is $\frac{1}{2}$ (stress × strain) in the case of linear strain.
18. Explain bending moment.
19. What is surface tension of a liquid ? What are the factors affecting the surface tension of a liquid ?
20. Discuss Bernoulli's theorem.
21. Explain the principle of venturimeter.
22. Derive the equation of continuity in hydrodynamics. **(8×2=16 Marks)**

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks.

23. A solid sphere of mass 1 kg rolls without sliding with uniform velocity of 0.1 m/s along a horizontal table. Calculate the total energy of the sphere.
24. A flywheel rotating at the rate of 150 rotations per minute can just raise a load of 50 kg through 4 meters before coming to rest. Neglecting the friction at the bearings, calculate the moment of inertia of the flywheel.

25. Show that the force given by $F = \hat{i} \sin y - \hat{j} \cos y - \hat{k} \cos z$ is conservative.

26. A particle executing SHM makes 90 oscillations per minute. At the equilibrium position, its velocity is 9 cm/s. Find :
    i) The length of the path of the particle.
    ii) Its velocity at a point midway between its equilibrium position and extreme position.

27. Prove that oscillation of two particle connected by a spring is a simple harmonic oscillation.

28. A bar of length 1.2 m, breadth 3 cm and thickness 4 mm is used as a cantilever. When a load of 0.25 kg is attached to the free end, the depression at the free end is 1 cm. Calculate the Young's modulus of the material.

29. A metallic disc of mass 1 kg and radius 12 cm is suspended in a horizontal plane by a wire attached to its center. The radius of the wire is 0.6 mm and its length is 2 m. The period of oscillation is found to be 5 s. Find the modulus of rigidity of the wire.

30. Calculate the work done against surface tension in blowing a soap bubble of radius 5×10^{-2} m, if the surface tension of soap solution is 25×10^{-3} N/m.

31. A venturimeter is connected to a main water pipe, the diameters at the constrictions and outside are 10 cm and 20 cm respectively and the levels of the water column, in the two limbs differ y 8 cm. What is the volume of water flowing through the pipe in one hour ? **(6×4=24)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks.

32. State and prove parallel and perpendicular axes theorem. Also determine the moment of inertia of a hollow cylinder about its own axis.

33. i) Derive an expression for Kinetic Energy, Potential Energy and Total Energy of a harmonic oscillator. Also discuss the variation with respect to displacement.
    ii) Derive an expression for the time period of a simple pendulum.

34. Derive the relation connecting three elastic constants.

35. i) Discuss the variation of surface tension with temperature.
    ii) Explain Jaeger's method to determine the surface tension of a liquid. **(2×15=30 Marks)**
