Rayat Shikshan Sanstha's

Rajarshi Chhatarapati Shahu College, Kolhapur

Department of Physics

Question Bank

Paper **I**- DSC-A-2 **Mechanics-II**

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Unit-III Chapter-I Gravitation

- **Multiple Choice Questions (Correct answer is shown in red color)**

1. Who did give the heliocentric theory?

A) Copernicus B) Tycho -Brahe

C) Kepler D) Galileo

2. If the particle moves in a central force field it's…… is conserved.

A) linear momentum B) angular momentum

C) velocity D) Torque

3. SI unit of gravitational constant is.....

A) Nm^2kg^2 B) Nm^2kg^{-2}

C) Nm^2s^2 D) $Nm^{-2}kg^2$

4. If the particle moves in a central force field it……. remains constant.

A) areal velocity B) linear velocity

C) angular velocity D) linear momentum

5. The gravitational force of attraction between two bodies are separated by a distance r is proportional to

A) r^2 B) $\frac{1}{r^2}$ C) r^3 D) $\frac{1}{r^3}$

6. The fundamental force which holds the planet in their orbits around the sun is…… force of attraction.

A) electromagnetic B) nuclear

C) electrostatic D) gravitation

7. The weight of an object of mass 10 kg on the earth is.....

A) 9.8N B) 9.8kg C) 98N D) 98kg

8. Law of gravitation gives the gravitational force between....

A) the Earth and a point mass only

B) the Earth and Sun only

C) any two bodies having some mass

D) two charged bodies only

9. The Kepler's law states that the line joins any planet to the sun sweeps equal areas in equal intervals of time are...

A) Law of gravitation B) Law of periods

C) Law of areas D) Law of orbits

10. The planetary orbits around the sun are.....

A) circular B) elliptic

C) parabolic D) hyperbolic

11. The atmosphere around the earth is held by....

A) Gravity B) Winds

C) Clouds D) Earth's magnetic field

12. The value of universal gravitational constant is.....

A) 6.67×10^{-23} Nm^2kg^{-2} B) 6.67×10^{23} Nm^2kg^{-2}

C) 6.6710^{-11} Nm^2kg^{-2} D) 6.67×10^{11} Nm^2kg^{-2}

13. Kepler's first law of planetary motion is referred to....

A) law of elliptical orbits B) law of equal areas

C) harmonic law D) law of equal periods

14. The force of attraction between two unit point masses separated by a unit distance is called....

A) gravitational potential B) gravitational force

C) gravitational field D) universal gravitational constant

15. The dimensions of universal gravitational constant are....

A) $[M^1L^{-3}T^2]$ B) $[M^{-1}L^3T^{-2}]$ C) $[M^{-1}L^3T^2]$ D) $[M^{-1}L^{-3}T^2]$

16. Gravitational force is always …….. in nature.

A) attractive B) repulsive

C) both D) neither (A) nor (B)

17. Two particles are placed at some distance. If the mass of each of the two particles is doubled, keeping the distance between them unchanged, the value of gravitational force between them will be....

A) 1/4 times B) 4 times C) 1/2 times D) unchanged

18. Kepler's third law of planetary motion is referred to....

A) law of elliptical orbits B) law of equal areas

C)harmonic law D) law of equal period

19. The periodic time of satellite .....as height of the projection of satellite is in....

A) increases B) decrease

C) remains constant D) either increases or decreases

20. Newton's law of gravitation applies to....

A) Small bodies only B) large bodies only

C) All bodies irrespective of their size D) For solar system

21. The period of geostationary satellite...

A) 6 hours B) 12 hours C) 24 hours D) 48 hours

22. Kepler's third law of planetary motion is is given as.....

A) $T^2 \propto r^3$ B) $T^2 \propto r^2$ C) $T^2 \propto r$ D) $T \propto r^3$

23. The period of GPS satellite.....

A) 6 hours B) 12 hours C) 24 hours D) 48 hours

24. Period of satellite does not depend on.....

A) radius of earth B) mass of earth

C) height of satellite D) mass of satellite

25. Kepler's second law of planetary motion is referred to.....

A) law of elliptical orbits B) law of equal areas

C)harmonic law D) law of equal periods

- **Short answer questions**

1. State the Newton's law of gravitation and define the universal constant of gravitation. Derive its dimensions.
2. What is mean by central force?
3. State Kepler's laws of planetary motion.
4. Give the applications of the satellites.
5. Explain geosynchronous orbits and geostationary satellite.
6. Explain why an astronaut in an orbiting satellite experiences a feeling of weightlessness.
7. Write a note on Global Positioning System.

- **Long answer questions**

1. Show that for a motion of particle in central force field, angular momentum is conserved and areal velocity remains constant.
2. Obtain an expression for period of satellite in a circular orbit round the earth.
3. Show that the square of the period of revolution of a satellite is directly proportional to the cube of the orbital radius.

Unit-III Chapter-I Gravitation

- **Multiple Choice Questions (Correct answer is shown in red color)**

1. If a watch with a wound spring is taken on to the moon then it…

A) runs faster

B) shows no change

C) runs slower

D) does not work at all

2. The oscillatory motion of a body about its mean position only under the action of restoring force developed is called…… oscillatory motion.

A) damped

B) free

C) over damped

D) force

3. Damped oscillatory motion occurs when the restoring force is.....

A) greater than damping force

B) less than damping force

C) equal to damping force

D) equal to external periodic force

4. A particle in SHM while passing through mean position will have....

A) Maximum Kinetic energy and maximum potential energy

B) Maximum Kinetic energy and minimum potential energy

C) Minimum Kinetic energy and maximum potential energy

D) Minimum Kinetic energy and minimum potential energy

5. The vibratory motion of a body is heavily damaged if the damping force…. restoring force.

A) much greater than

B) much less than

C) equal to

D) less than

6. The total energy of a body performing SHM is E.. then average kinetic energy of the body over a period is....

A) E

B)E/4

C) E/2

D) 2E

7. The periodic time of a body moving in SHM is.....

A) Directly proportional to its angular velocity

B) Directly proportional to the weight of the body

C) Directly proportional to the momentum of swinging body

D) Inversely proportional to its angular velocity

8. For a body moving with SHM, the number of cycles per second is known as....

A) Oscillation

B) Amplitude

C) Periodic Time

D) Frequency

9. The natural frequency of Guitar is changed by changing its....

A) area

B) diameter

C) length D) stiffness

10. If an object moves back and forth repeatedly around a mean position is called....

A) oscillating B) revolving

C) rotating D) circulating

11. Masses m_1 and m_2 are suspended together by a massless spring of constant (k). When system is in equilibrium, m_1 is removed without disturbing the system. Now angular frequency of Oscillation is....

A) $\sqrt{\frac{k}{m_1}}$ B) $\sqrt{\frac{k}{m_2}}$

C) $\sqrt{\frac{k}{m_1+m_2}}$ D) $\sqrt{\frac{k}{m_1 m_2}}$

12. The displacement of a particle executing SHM is, $y = a\sin(\omega t)$. The acceleration after time, $t = \frac{T}{4}$ (where T is period) is.....

A) $a\omega$ B) $a\omega^2$

C) $-a\omega$ D) $-a\omega^2$

13. A particle of mass 10gm is executing SHM with amplitude of 0.5m and time period of $\left(\pi/5\right)$s. The maximum value of force acting is.....

A) 25 N B) 2.5 N C) 5 N D) 0.5 N

14. A weightless spring with force constant (k), oscillates with a frequency (ν) when suspended by a mass (m). If the spring is cut into two equal parts and mass (2m) is suspended from one of the part, then the frequency of oscillation becomes.....

A) ν B) ν/2 C) 2ν D) $\sqrt{2}\nu$

15. If natural frequency of vibration of a body is ν and is subjected to periodic force of frequency ν", then the body vibrates with a frequency....

A) ν B) ν"

C) greater than ν D) less than ν

16. Due to damping frequency of oscillations.....

A) increases B) decreases

C) remains constant D) becomes zero

17. In SHM acceleration is directly proportional to...

A) displacement B) time

C) velocity D) frequency

18. The total energy of a particle executing SHM is proportional to

A) square of amplitude of motion

B) velocity in equilibrium position

C) frequency of oscillation

D) displacement from equilibrium position

19. The acceleration of particle executing SHM when it is at mean position is....

A) infinite B) varies C) maximum D) zero

20. Due to damping time period of oscillations.....

A) increases B) decreases

C) remains constant D) becomes zero

- **Short answer questions**

1. Write note on damped oscillations.
2. Write note on forced oscillations.
3. Discuss amplitude and epoch of wave.

- **Long answer questions**

1. Set up differential equation for SHM and hence obtain expression for displacement (x), velocity (v) and acceleration of the particle executing SHM. 3. Derive expressions for P.E. (U), K.E. (K) and total energy (E) of a particle performing SHM.
2. Set up differential equation for SHM and then obtain solution for the same and explain the physical significance of angular frequency (0), amplitude (a) and initial phase (a).
3. Write down differential equation for SHM and hence obtainexpressions for (x), (v) and acceleration and represent them graphically. 6. Obtain expressions for average P.E. (U) and average K.E. (R) of aparticle executing SHM. 7. Obtain expression for P.E. (U) and average P.E. (U) of a particle executing SHM.
4. What are damped oscillations? Set up differential equation for a damped oscillator and obtain the solution for the same. Explain, how the amplitude and frequency of oscillator are affected.
5. What do you mean by damped oscillations? Set up differential equation for a damped oscillator and obtain its solution. Discuss various cases depending upon relative values of restoring force and damping force.
6. What are forced oscillations? Set up differential equation for a forced oscillator in presence of damping and obtain its solution. Discuss how the amplitude and frequency of oscillator are affected by the applied periodic force.
7. What are forced oscillations? Set up differential equation for the same and obtain its solution.

Unit-IV Chapter-I Elasticity

- **Multiple Choice Questions (Correct answer is shown in red color)**

1.When a beam is fixed at one end and loaded at the other, the mid filament which is neither elongated nor compressed is called.....

A) plane of bending B) neutral axis

C) neutral surface D) neutral filament

2. A plane perpendicular to neutral surface is called.....

A) plane of bending B) axis of bending

C) neutral bending D) neutral axis

3. The section of the neutral surface by the plane of bending is called the.....

A) bending axis B) neutral axis

C) plane of axis D) free axis

4. The quantity Yak^2 is called.....

A) geometrical moment of inertia B) flexural rigidity

C) bending moment D) depression in bending

5. The quantity ak^2 is called.....

A) geometrical moment of inertia B) flexural rigidity

C) bending moment D) radius of gyration

6. A beam fixed horizontally at one end and located at the other is called a.....

A) bent beam B) loaded beam

C) cantilever D) unloaded beam

7. A beam supported at both the ends and loaded at the centre is equivalent to....

A) a cantilever B) two cantilevers

C) three cantilevers D) four cantilevers

8. A stretched wire is said to be under torsion, if it is.....

A) heavily loaded B) twisted

C) bent into an arc of a circle D) shotened

9. Torsional oscillations of a wire are due to its .....

A) modulus of rigidity B) Young's modulus

C) bulk modulus of elasticity D) high density

10. The motion of a torsional pendulum is.....

A) uniform linear motion

B) accelerated linear motion

C) angular S.H.M.

D) linear S.H.M.

11. In equilibrium position of bending of beam.....

A) bending couple > restoring couple

B) bending couple < restoring couple

C) bending couple = restoring couple

D) bending couple = 0

12. Geometrical moment of Inertia of beam of circular cross-section of radius r is.....

A) πr^4 B) $\frac{\pi r^2}{4}$ C) $\frac{\pi r^4}{4}$ D) πr^2

13. If C is tortional couple, then work done in twisting the wire is.....

A) $\frac{1}{2}C\theta$ B) $\frac{1}{2}C\theta^2$ C$C\theta^2$ D) $C\theta$

14. The modulus of rigidity of material of wire of radius a is proportional to.....

A) a^2 B) a^4 C) $\frac{1}{a^2}$ D) $\frac{1}{a^4}$

15. Young's modulus Y, modulus of rigidity η and Poisson's ratio σ of wire are related by the equation.....

A) $\sigma = \frac{Y}{2\eta}$ B) $\sigma = \frac{Y}{2\eta} - 1$ C) $Y = \frac{\eta}{2\sigma} - 1$ D) $Y = \frac{\sigma}{2\eta} - 1$

- **Short answer questions**

1. Obtain an expression for work done in twisting a wire.
2. Write note on Torsional Oscillations.
3. Write note on cantilever.
4. Write note on Bending Moment.

- **Long answer questions**

1. Derive an expression for bending moment of a horizontal beam fixed at one end and loaded at the other.
2. Assuming the general expression for bending moment of a horizontal beam fixed at one end and loaded at the other, derive expressions for the same when the cross-section of the beam is (i) rectangular and (ii) circular.
3. What is a cantilever? Derive an expression for the depression of the free end of a cantilever due to a load.
4. Describe the method to determine Young's modulus of material of a bar by bending of the bar.
5. Derive the expressions for the depressions of the centrally loaded beams supported at both the ends.
6. What is meant by (i) torsion, (ii) torsional oscillations? Derive an expression for the torsional couple per unit angular twist in case of a wire.

7. Show that torsional oscillations are angular simple harmonic. Hence, obtain an expression for the time period of oscillation and explain how the modulus of rigidity of the material of a wire can be determined by torsional oscillation method.
8. Obtain an expressions for Y, η and σ for material of a wire using Searle's method.

Unit-IV Chapter-II Surface Tension

- **Multiple Choice Questions (Correct answer is shown in red color)**

1. Which of the following is not the unit of surface tension?

A) dyne/cm
B) dyne/cm^2
C) erg/cm^2
D) newton/m

2. The angle of contact between glass and mercury is.....

A) a right angle
B) an acute angle
C) an obtuse angle
D) zero

3. A liquid has a solid surface if the angle of contact between them is....

A) a right angle
B) an acute angle
C) an obtuse angle
D) π^c

4. A small amount of liquid, set free in the air, takes spherical shape because of its.....

A) high density
B) elasticity
C) viscosity
D) surface tension

5. What will be the excess pressure inside a water drop of radius 1.5 cm? Surface tension of water is 72 dyne/cm.

A) 72 dyne/cm
B)36 dyne/cm
C) 24 dyne/cm.
D) 96 dyne/cm

6. Two plates of glass wetted by few drops of water between them can be separated from each other by...

A) pulling them apart normal to the surface
B) sliding them parallel to their planes
C) introducing some more water between them
D)introducing some oil between them

7.Which of the following does not happen because of the surface tension ?

A) Oil rises along the wicks in oil lamps
B) The soaking of ink by blotting paper
C) Some insects can walk along the water surface
D) While heating, convection currents are formed in water

8. If surface tension of a soap solution is 50 dyne cm then what is the excess pressure inside its

bubble of radius 2 cm ?

A) 50 dyne/cm² B) 100 dyne/cm²

C) 150 dyne/cm² D) 200 dyne/cm²

9. If T is the surface tension of a liquid then the excess pressure inside the liquid drop of radius r is.....

A) $\frac{T}{r}$ B) $\frac{2T}{r}$ C) $\frac{4T}{r}$ D) $\frac{T}{2r}$

10. If T is the surface tension of a soap solution then the excess pressure side its bubble of radius r is.....

A) $\frac{2T}{r}$ B) $\frac{4T}{r}$ C) $\frac{T}{4r}$ D) $\frac{T}{2r}$

- **Short answer questions**

1. What is mean by surface tension.
2. Discuss angle of contact.
3. Write note on wettability.
4. State and explain some applications of surface tension.

- **Long answer questions**

1. What is surface tension? Explain it on the basis of molecular forces 3. What do you understand by 'angle of contact'? Derive the condition for the angle of contact to be acute or obtuse.
2. Explain wettability on the basis of angle of contact and also on the basis of cohesive and adhesive forces.
3. Show that the excess pressure on the concave side of a curvilinear surface of a liquid is 27 where and 2 are the radii ofcurvature and T is the surface tension of the liquid.
4. Derive the relation between surface tension, pressure and curvature. Hence, show that the excess pressure inside a soap bubble of radius r is 4T r
5. Describe the Jaeger's method to determine surface tension of a liquid.