CET 2022
Definitions

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Physics (Concept Batch)

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Chapter 1

Rotational Dynamics

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1. Circular Motion:
   The motion of the particle along a complete circle or part of it is called as circular motion.
2. Angular Displacement:
   The change in angular position of the particle performing circular motion with respect to a reference line in the plane of motion of the particle and passing through centre of circle is called as angular displacement.
3. Angular Velocity:
   The time rate of angular displacement of a particle performing circular motion is called as angular velocity.
4. **Uniform Circular Motion:**
   A particle is said to perform uniform circular motion if it moves in a circle or a circular arc at constant linear speed or constant angular velocity.
5. Non Uniform Circular Motion:
   A particle is said to perform non-uniform circular motion if it moves in a circle or a circular arc at non uniform linear speed or non uniform angular velocity.
6. Period of revolution:
   The time taken by a particle performing UCM to complete one revolution is called as period of revolution or the period of UCM.

$$T = \frac{2\pi r}{v} = \frac{2\pi}{\omega}$$

   Where v = linear speed, ω = angular velocity
7. Frequency of Revolution:
   The number of revolutions per unit time made by a particle in UCM is called the frequency of revolution.

   Frequency $f = \frac{1}{T} = \frac{v}{2\pi r} = \frac{\omega}{2\pi}$

   SI Unit : Hertz (Hz)
8. Angular Acceleration:
   The rate of change of angular velocity with respect to time is called as angular acceleration.

$$\alpha = \frac{d\omega}{dt}$$

   SI Unit: rad/s^2
9. Tangential Acceleration:
   For the particle performing circular motion, the linear velocity is tangential to the path. The rate of change of linear velocity is tangential acceleration.
10. Centripetal Force:
    The force which directed radially inwards and produces radial acceleration is called as centripetal force.
11. Centrifugal Force:
    Centrifugal force is defined as an imaginary force which is directed outwards and whose magnitude is equal to mass times the centripetal acceleration.
12. Banking of a road :
    To avoid the risk of skidding as well as to reduce the wear and tear of the car tyres, the road surfaces at the bend is tilted inwards i.e. outer side of the road is raised above the inner side. This is called as banking of the road.

13. Conical Pendulum:
A conical pendulum is a simple pendulum whose bob revolves in a horizontal circle with constant speed such that the string describes the surface of an imaginary right circular cone.

14. Moment of Inertia:
The moment of inertia of a body about the given axis of rotation is defined as sum of the products of masses of particles of the body and the squares of their respective distances from the axis of rotation.
$I = \sum_{i=1}^{N} m_i r_i^2$
SI Unit : $kg.m^2$

15. Radius of Gyration:
The radius of gyration of a body rotating about an axis is defined as the distance between axis of rotation and the point at which the entire mass of the body can be supposed to be concentrated so as to give the same moment of inertia as that of a body about the given axis of rotation.

16. Theorem of Parallel Axis:
The moment of inertia of a body about an axis is equal to sum of its (i) its moment of inertia about parallel axis through its centre of mass and (ii) the product of mass of a body and square of the distance between the two axes.

17. Theorem of Perpendicular Axis:
The moment of inertia of a plane lamina about an axis perpendicular to its plane is equal to the sum of its moments of inertia about two mutually perpendicular axes in its plane and through the point of intersection of perpendicular axes and the lamina.

18. Angular Momentum:
The angular momentum of a particle is defined as the moment of the linear momentum of the particle.

19. Principle of Conservation of Angular Momentum:
The angular momentum of the body is conserved if the resultant external torque on a body is zero.

Chapter 2

Mechanical Properties of Fluid

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1. Fluid:
A fluid is a substance that can flow. The shear modulus of fluids is **zero.** Example : all gases, lava, honey etc.

2. Ideal Fluid:
An ideal fluid has following properties:
   a. It is incompressible i.e. its density is constant throughout the fluid.
   b. Its flow is irrotational i.e. the flow is steady and laminar.
   c. Its flow is non-viscous.
   d. Its velocity is constant.

3. Incompressible Fluid :
An incompressible fluid is a fluid which does not undergo change in volume for a large range of pressures. Thus, its density has constant value throughout the fluid.

4. Surface Tension:
Surface tension is unique property of liquids that arises because the net intermolecular force of attraction on the liquid molecules at or near a liquid surface. The force on the molecules at top is different than that of on molecule deep inside the liquid. This results in tendency of free surface of the liquid to minimize its surface area and behave like a stretched membrane.

4. Cohesive Force:
   The intermolecular force of attraction between two molecules of the same material is called as cohesive force.

5. Adhesive Force:
   The intermolecular force of attraction between molecules of two different material is called as Adhesive force.

6. Range of molecular attraction or Molecular Range:
   Range of molecular attraction or molecular range is defined as the maximum distance between two molecules up to which the intermolecular force of attraction can be experienced.

7. Sphere of Influence:
   The sphere of influence of molecule is defined as an imaginary sphere with the molecule as centre and radius equal to the range of molecular range.

8. Surface Film:
   The layer of liquid surface of thickness equal to the range of molecular attraction is called as surface film.

9. Free Surface of Liquid:
   The surface of liquid open to the atmosphere is called as free surface of liquid.

10. **Surface Tension**:
    The surface tension of the liquid is defined as the tangential force per unit length, acting at right angles on either side of imaginary line on the free surface of liquid.

11. Surface Energy: The surface energy is defined as the extra potential energy possessed by the molecule in a liquid surface with an isothermal increase in the surface of the liquid.

12. Angle of contact:
    The angle of contact for liquid-solid pair is defined as the angle between the surface of the solid and the tangent drawn to the free surface of the liquid at the extreme edge of the liquid, as measured through the liquid.

13. Capillary:
    A tube of narrow bore is called as capillary tube.

14. Capillarity:
    The rise of the wetting liquid and fall of the wetting liquid in a capillary tube is called as capillarity.

15. Hydrodynamics:
    Hydrodynamics is the branch of the physics which deals with the study of fluid in motion.

16. Steady Flow:
    When a liquid flows slowly over a surface or through a pipe such that its velocity or pressure at any point within the fluid is constant, is said to be in steady flow.

17. Streamline Flow:
    When a liquid flows slowly over a surface or through a pipe with velocity less than a certain critical velocity, the motion of its particles is orderly. All particles passing through a given point with same velocity. Such type of flow is called as streamline flow.

18. Flow tube:
    A bundle of adjacent streamlines form a tube of flow or flow tube through which the fluid is flowing.

19. Turbulent Flow: Turbulent flow is non-steady fluid flow in which streamlines andflowtubes change continuously.

20. Viscosity:
    The resistance to relative motion between the adjacent layers of the fluid is known as viscosity.

21. Viscous drag:
    When a solid moves through a fluid, there is friction between the solid and liquid which opposes the motion of the solid. This force of fluid friction is called as viscous drag.

22. Velocity Gradient:
    In steady flow of the fluid past a solid surface, the rate at which the velocity changes with the distance within the limiting distances from the surface of liquid is called as velocity gradient.

23. Coefficient of Viscosity:
    The coefficient of viscosity of a fluid is defined as the viscous drag per unit area acting on a fluid layer per unit velocity gradient established in a steady flow.

Chapter 3

Kinetic Theory of Gases and Radiation

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1. Ideal or perfect gas:
   An ideal or perfect gas is a gas which obeys the gas laws (Boyle's Law, Charles' Law and Gay-Lussac's Law) at all pressures and temperature.

2. Modes of heat transfer:
   a. Conduction:
      Conduction is the mode of heat transfer within the body or between the two bodies in contact, from a region of high temperature to a region of low temperature without migration of particles of medium.
   b. Convection:
      Convection is the mode of heat transfer from one part of the fluid to another by the migration of the particles of the fluid.
   c. Radiation:
      Radiation is mode of heat transfer by electromagnetic waves.

3. Coefficient of Absorption or Absorptive Power or Absorptivity:
   It is the ratio of quantity of radiant heat absorbed by the body to the quantity of radiant heat incident on the body in the same time.

4. Coefficient of Reflection or Reflectance or Reflective Power:
   It is the ratio of quantity of radiant energy reflected by the surface to the quantity of radiant energy incident on the surface in the same time.

5. Coefficient of transmission or Transmittance or Transmissive Power:
   It is the ratio of quantity of radiant heat transmitted by the body to the total heat incident on the body in the same time.

6. Athermanous Substance:
   A substance which is largely opaque to thermal radiations i.e. a substance which can not transmit heat radiations incident on it, is known as athermanous substance. eg,. Wood, iron, copper etc.

7. Diathermanous Substance:
   A substance through which heat radiations can pass is known as diathermanous substance. Examples: Quartz, Sodium Chloride, Oxygen, dry air etc.

8. Perfect Blackbody:
   A perfect blackbody is a body which absorbs all the incident radiations.

10. Emissive Power or Radiant Power of a body: The emissive power or radiant power of a body at a given temperature is defined as the quantity of radiant energy emitted by the body per unit time per unit surface area of the body at that temperature.

$$R=\frac{Q}{At}$$

11. Coefficient of Emission(Emissivity): The coefficient of emission or emissivity of the body is defined as the ratio of emissive power of the body to the emissive power of the black body.

$$e=\frac{R}{Rb}$$

12. Wien's Displacement Law: For a blackbody at an absolute temperature T, the product of T and wavelength λ_m corresponding to the maximum radiation of energy is constant. T. λ_m**=b**

13. Stefan-Boltzmann Law: The rate of emission of radiant energy per unit area i.e. the power emitted per unit area of perfect blackbody, is directly proportional to the forth power of its absolute temperature.

Chapter 4

Thermodynamics

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1. Thermodynamics:
   Thermodynamics is the branch of physics which deals with:
   a. The conversion of energy from one form to another
   b. The direction of energy transfer between a system and its surrounding.
2. Thermal Equilibrium:
   A system is said to be in thermal equilibrium if there is no transfer of heat between the various parts of the system or between system and surrounding.
3. Zeroth Law of Thermodynamics:
   If two systems are each in thermal equilibrium with the third system, they are also in thermal equilibrium with each other.
4. Internal Energy: Internal energy of the system is defined as the energy associated with the random, disordered motion of the molecules of the system.
5. Thermodynamic system :
   A thermodynamics system is a collection of the objects under study as a unit which may be able to exchange energy with its surrounding. Everything outside system is called as surrounding or environment.
6. Classification of Thermodynamic Systems:
   a. Open System:
      A system that can freely exchange matter and energy with its surrounding is called as open system.
   b. Closed System:
      A system that can freely exchange energy but not the matter with its environment is called as closed system.
   c. Isolated System:
      A system that can not exchange energy as well as matter with its surrounding is called as isolated system.
7. Thermodynamic Process:
   A process in which the thermodynamic state of the system is changed is called as thermodynamic process.
8. First Law of Thermodynamics: The change in the internal energy of the system (ΔU) is the difference between the amount of heat supplied to the system (Q) and the work done by the system on its surrounding (W). Mathematically, $\Delta U = Q - W$

9. System Variable (or property of the system):
   The system variable or property of the system is any measurable or observable characteristic or property of the system when the system remains in equilibrium.

10. Intensive Variable:
    A variable which does not depend on the size of the system is called as intensive variable.

11. Extensive Variable:
    A variable that depend on the size of the system is called as extensive variable.

12. Mechanical Equilibrium:
    A system is said to be in mechanical equilibrium when there are no unbalanced forces within the system and between system and surrounding.

13. Chemical Equilibrium:
    A system is said to be in chemical equilibrium when there are no chemical reactions going on within the system.

14. Thermal Equilibrium:
    A system is said to be in thermal equilibrium when its temperature is uniform throughout the system and it does not change with time.

15. Quasistatic Process:
    A quasistatic process is an idealised process which occurs infinitely slowly such that at all the times the system is close to a state of thermodynamic equilibrium.

16. Reversible Process:
    A reversible process is process whose direction can be reversed, i.e. path of the process can be followed backwards, so that both the system and its surrounding restore their original state without producing any change in the rest of the universe.

17. Irreversible Process:
    The process in which the system and its surrounding can be restored to their original state without affecting the rest of the universe.

18. Isothermal Process:
    A system in which the temperature remains constant and only pressure and volume undergoes change.

19. Isobaric Process:
    A system in which the pressure remains constant and only temperature and volume undergoes change.

20. Isochoric Process :
    A system in which the volume remains constant and only pressure and pressure undergoes change.

21. Adiabatic Process:
    A process during which there is no transfer of heat from system to the surrounding or from the surrounding to the system is called as adiabatic process.

22. Cyclic Process: A thermodynamic process in which the system returns to its original state is called as cyclic process. The forward and backwards paths are different.

Chapter 5

Oscillations

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1. Periodic Motion:
   A motion that repeats itself at definite intervals of time is said to be a periodic motion. Example: The motion of hands of clock, Motion of earth around sun.
2. Oscillatory Motion:
   A periodic motion in which a body moves back and forth over the same path, straight or curved, between the alternate extremes is said to be an oscillatory motion. Example: Oscillations of simple pendulum.
3. Linear Simple Harmonic Motion (Linear SHM):
   Linear SHM is defined as linear periodic motion of a body, in which the force (or acceleration) is always directed towards the mean position and its magnitude is proportional to the displacement from the mean position.

   F = -kx, where k = force constant, x= displacement from the mean position.
4. Period or Periodic time of SHM:
   The time taken by the particle performing SHM to complete one oscillation is called as period or periodic time of SHM.
5. Frequency of SHM:
   The number of oscillations performed per unit time by a particle performing SHM is called as frequency of SHM.
6. Amplitude of SHM:
   The magnitude of the maximum displacement of particle performing SHM from its mean position is called as amplitude of SHM.
7. Path length of SHM:
   The length of the path over which a particle performs SHM is twice the amplitude of the motion and is called path length or range of the SHM.
8. Phase:
   Phase of SHM represents the state of oscillation of the particle performing SHM, i.e., it gives the displacement of the particle, its direction of motion from equilibrium position and the number of oscillations completed.
   The displacement of the particle is given by $x = A\sin(\omega t + \alpha)$. The angle $(\omega t + \alpha)$ is called as phase angle or simply the phase of SHM. The SI unit of phase angle is **radian.**
9. Epoch:
   Epoch of SHM represent the initial phase of particle performing SHM, i.e., it gives the displacement of the particle and its direction of the motion when t=0.
10. Ideal Simple Pendulum:
    An ideal simple pendulum is defined as a heavy point mass suspended from a rigid support by a weightless, inextensible and twistless string, and set into oscillation under gravity through a small angle in a vertical plane.
11. Seconds Pendulum:
    A simple pendulum of the period two seconds is called as seconds pendulum.
12. Angular SHM: Angular SHM is defined as the oscillatory motion of a body in which the restoring torque responsible for angular acceleration is directly proportional to angular displacement and its direction is opposite to that of angular displacement.

$$\tau = -c\theta$$

13. Free Vibrations:
A body capable of vibrations is said to perform free vibrations when it is disturbed from equilibrium position and left to itself.
In absence of opposing forces such as friction due to surrounding air and internal forces, the total energy and thus amplitude of vibrations remains constant. The frequencies of free vibrations of body are called as natural frequencies.
In absence of maintaining force, in practice, the total energy and hence the amplitude decreases due to opposing forces and the vibration is said to be damped. The frequency of damped vibrations is less than natural frequency.

14. Forced Vibrations: The vibrations of a body in response to an external periodic force are called as forced vibrations.
The external force provides energy necessary for overcoming the opposing force. The frequency of forced vibrations is equal to the frequency of external periodic force.
The amplitude of forced vibrations depend on the mass of vibrating body, the amplitude of external periodic force, the difference between the natural frequency and the frequency of periodic force, and the extend of damping.

Chapter 6

Superposition of Waves

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1. Progressive Wave (or travelling wave):
A wave, in which the disturbance produced in the medium travels in a given direction continuously, without any damping and obstruction, from one particle to another particle, is progressive wave.

2. Transverse Wave:
In transverse wave, the vibrations of the particles of the medium vibrate perpendicular to the direction of propagation of wave and produce crest and troughs in their medium of travel.
Example: ripple of water

3. Longitudinal Wave:
In longitudinal wave, the particles of medium vibrate parallel to the direction of propagation of wave and produce compression and rarefaction in the medium. Example: Sound waves

4. Mechanical Wave:
A mechanical wave is a wave motion in a material medium. It needs medium for propagation. The medium should be elastic and capable of storing energy.

5. Electromagnetic Wave:
An electromagnetic wave does not need any medium for propagation.

6. Wave Speed:
The distance covered by a progressive wave per unit time is called as wave speed.

7. Frequency:
The number of waves that pass per unit time across a given point of the medium is called as frequency of the wave.

8. Wavelength:
Wavelength is a distance between consecutive particles of medium which are moving in exactly the same way at the same time and have the same displacement from their equilibrium positions.

9. Amplitude:
The magnitude of the maximum displacement of a particle of medium from its equilibrium position is called as amplitude of the wave.

10. Period:
    The time taken by a complete wave to pass a given point in a medium is called as period of wave.

11. Wave Number:
    The number of waves present per unit distance is called as wave number.

12. Principle of Superposition of Waves:
    When a two or more waves, travelling through a medium, pass through a common point, each wave produces its own displacement at that point, independent of the presence of the other wave. The resultant displacement at that point is equal to the vector sum of the displacements due to the individual wave at that point.

13. Stationary Wave:
    When two **identical waves** travelling in along the same path in opposite directions interfere with each other, the resultant wave is called as stationary wave.

    a. Nodes:
       The points at which the particles of the medium are always at rest are called as nodes.

    b. Anti-Nodes:
       The points at which particles of the medium vibrate with the maximum amplitude are called as anti-nodes.

14. Harmonics:
    The lowest allowed frequency of vibration(fundamental) of bounded medium and all its integral multiples are called as harmonics.
    The lowest allowed frequency(fundamental), n, is called as first harmonic. The second harmonic is 2n, third harmonic is 3n…..... and so on.

15. Overtones:
    The higher allowed frequencies of vibration above the fundamental are called as overtones. Above the fundamental, the first allowed frequency is called as first overtone which may be either second or third harmonic. Depending on the system, the p^{th} overtone corresponds to $(p+1)^{th}$ or $(sp+1)^{th}$ harmonic.

16. Beats:
    When there is superposition o0f two sound waves, having same amplitude but slightly different frequencies, travelling in the same direction, the intensity of sound varies periodically with time. This phenomenon is known as formation of beats.
    The occurrences of maximum intensity are called as waxing and those of minimum intensity are called wanning. One waxing and successive wanning together constitute one beat. The number of beats heard per second is called as beat frequency.

Chapter 7

Wave Optics

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1. Ray of Light :
   The path along which light energy is transmitted from one point to another point in an optical system.

2. Ray Optics:
   The study of optical phenomena under the assumption that light travels in straight line as a ray is called as ray optics or geometrical optics.

3. Absolute Refractive Index:
   The absolute refractive index of light is called as the ratio of speed of light in vacuum to the speed of light in the medium.

   $$Absolute\ Refractive\ Index\ of\ medium(n) = \frac{Speed\ of\ Light\ in\ Vacuum\ (c)}{Speed\ of\ the\ light\ in\ the\ medium\ (v)}$$

4. Primary Source of Light:
   The source that emit light on its own is called as primary source of light. This emission of light is may be due to:
   a. The high temperature of the source, e.g., the sun, the stars, objects heated to high temperature, a flame etc.
   b. The effect of current being passed through the source. E.g., tube light, TV etc.
   c. Chemical or nuclear reactions taking place in the source. E.g., firecrackers, nuclear energy.

5. Secondary Source of Light:
   Secondary sources of light are those sources which do not produce light of their own but receive light from some other source and reflect or scatter it around. E.g., the moon, the planets, objects such as humans, animals, plants etc.

6. Wavefront or Wave Surface:
   The locus of all points where waves starting simultaneously from a source reach at the same instant of time and hence particles at the oscillates in same phase, is called as wavefront or wave surface.

7. Wave-normal:
   Wave-normal at a point on a wavefront is defined as line drawn perpendicular to the wavefront in the direction of propagation of wavefront.

8. **Huygens' Principle:**
   Each point on a wavefront acts as a secondary source of light emitting secondary light waves called as wavelets in all directions which travels with the speed of light in the medium. The new wavefront can be obtained by taking envelop of these secondary wavelets travelling in forward direction and is thus, the envelop of secondary wavelets in forward direction. The wavelets travelling in the backward direction are ineffective.

9. Principle of Superposition of waves:
   The displacement at a point due to combined effect of number of waves arriving simultaneously at a point is vector sum of displacements due to individual waves arriving at that point.

10. Interference of Light:
    The phenomenon in which superposition of two or more light waves produces a resultant displacement of redistributed light intensity or energy is called as interference of light.

11. Constructive Interference: Light waves are transverse in nature. If two monochromatic waves of light of same frequency arrive in phase at a point, the crest of one wave coincide with crest of other wave and the trough of one wave coincide with trough of other wave. Therefore, the resultant amplitude and hence the intensity if the light at that point is maximum and the point is bright. This phenomena is called as constructive interference.

For Constructive interference :

1. **Path Difference : $n\lambda$**
2. **Phase Difference : $2\pi n$**

12. Destructive Interference:

If two light waves having the same amplitude are in opposite phase, the crest of one wave coincides with trough of other wave and vice-versa. Therefore, the resultant amplitude, and hence the intensity, at that point is minimum and the point is dark. The phenomena is called as destructive interference.

For Destructive Interference:

1. **Path Difference : $(2n-1)\frac{\lambda}{2}$**
2. **Phase Difference : $(2n-1)\pi$**

13. Coherent Source of light:

Two sources of light are said to be coherent source of light if phase difference between emitted waves remains constant.
