**DEPARTMENT OF PHYSICS**

CLASSICAL DYNAMICS AND RELATIVITY

Objective Questions for I M.Sc students

**Unit-1: Fundamental principles and Lagrangian formulation**

1. The degree of freedom for a free particle in space are
	1. one (b) two (c ) three (d) zero

Answer (c)

1. The number of independent variable for a free particle in space are
	1. zero (b) one (c ) two (d) three

Answer (d)

1. The degree of freedom for N particles in space are
	1. 2N (b) 3N (c ) N (d) zero

Answer (b)

1. The generalized coordinates for motion of a particle moving on the surface of a sphere of radius ‘ɑ ’ are \_\_\_\_\_\_\_\_\_

(a) ɑ and θ (b) ɑ and φ (c ) θ and φ (d) 0 and φ

Answer (c)

1. constraints are independent of time.
	1. Holonomic (b) Non-Holonomic (c) Scleronomous (d) Rheonomous

Answer (c)

1. constraints are time dependent.
	1. Holonomic (b) Non-Holonomic (c) Scleronomous (d) Rheonomous

Answer (d)

1. The Lagrangian equations of motion are order differential equations.
	1. First (b) second (c ) zero (d) forth

Answer (b)

1. The Lagrange‟s equations of motion for a system is equivalent to equations of motion.
	1. Newton’s (b) Laplace (c ) Poisson (d) Maxwell’s

Answer (a)

1. The Lagrangian function is define by
	1. L= F + V (b) L= T – V (c) L = T + V (d) L = F – V

Answer (b)

1. The Lagrangian for a charged particle in an electromagnetic field is Where T is kinetic energy and ϕ and A are magnetic scalar and vector potentials
	1. L= T+ q ϕ + q(v.A) (b) L= T – qϕ – q(v.A)

 (c) L= T – qϕ + q(v.A) (d) L= T + qϕ – q(v.A)

Answer (c)

1. The constraints on a bead on a uniformly rotating wire in a force free space is
	1. Rheonomous (b) Scleronomous (c) a and b both (d) None of these

Answer (a)

1. Generalized coordinates
	1. Depends on each other (b) Independent on each other

 (c) Necessarily spherical coordinates (d) May be Cartesian coordinate

Answer (a)

1. Which of the following can be used as set of generalized coordinates?

 (a) Cartesian coordinate system (b) Spherical coordinate system

 (c) Cylindrical coordinates system (d) All of the above

Answer (d)

1. If the Lagrangian does not depend on time explicitly

(a)The Hamiltonian is constant (b)The Hamiltonian cannot be constant

(c) The kinetic energy is constant (d) the potential energy is constant

Answer (a)

1. Three particles moving in space so that the distance between any two of them always remain fixed have degree of freedom equal to

 (a) 1 (b) 3 (c) 6 (d) 9

Answer (c)

1. A non holonomic constrain may be expressed in the form of

 (a) Equality (b) Inequality (c) Vector (d) None of these

Answer (b)

1. The conditions which restrict the motion of the system are called \_\_\_\_\_.

 (a)Constraints (b)Degree of freedom (c)Generalized coordinates (d)None

Answer (a)

1. The number of independent ways in which a mechanical system can move without

 violating any constraint is called \_\_\_\_\_.

(a)Constraint (b)Number of freedoms (c)Degrees of freedom (d)Generalized coordinates

Answer (c)

1. A thing moving in space has \_\_\_ degrees of freedom.

(a)1 (b)2 (c)3 (d)4

Answer (c)

1. Work done by external force in N-particle system is known as \_\_\_\_.

(a)Work (b)Total work (c)Virtual work (d)None of these

Answer (c)

1. Total virtual work done on N-particle system is \_\_\_\_\_.

(a)Zero (b)Maximum (c)Minimum (d)None

Answer (a)

1. Virtual work is represented as \_\_\_\_\_\_.

(a)δW = ∑Fei δri=0 (b)δW = ∑Few δri=0 (c)W = ∑FeI ri=0 (d)δW = ∑FeI δri

Answer (a)

1. D ‘Alembert’s Principle can be written as

 (a)∑Ni=0 (Fl-pi). δri=0 (b)∑Ni=1 (Fl-pi). δri=0 (c)∑Ni=1 (Fl-p). δri=0 d)∑Ni=1 (Fl-p). δr=0

Answer (a)

1. In Lagrange’s Equation if there are N number of particles and so the generalized coordinated are

(a)n=N-k (b)n=3N-k (c)n=3N (d)n=3n-k

Answer (b)

1. In Lagrange’s Equation Virtual Displacement does not involve

 (a)Space (b)Time (c)N number of particles (d)None

Answer (b)

1. Lagrangian function equation is known as

(a) 𝑑 /[ 𝜕𝐿 / 𝜕𝑞𝑗]− 𝜕𝐿 / 𝜕𝑞𝑗 =0 ,𝑗 =1,2,3…. (b) 𝑑/[𝜕𝐿/𝜕𝑞𝑗]−𝜕𝐿/𝜕𝑞𝑗 ,𝑗 = 1,2,3….

(c) 𝑑/𝑑𝑡 [𝜕𝐿/𝜕𝑞𝑗]= 0 ,𝑗 =1,2,3…. (d) 𝑑/[𝜕𝐿/𝜕𝑞𝑗]−𝜕𝐿/𝜕𝑞𝑗 =0 ,

Answer (a)

1. The generalized momentum PI need not always\_\_\_\_\_\_ of linear momentum.

(a)Speed (b)Velocity (c)Dimension (d)None

Answer (c)

1. The simple mechanical system involving constraint is the atwoods machine pully is assumed.

(a)Friction less (b) mass less (c)both a and b (d) all of above

Answer (c)

1. To determine the value of lagrangian L we assume

(a)Kinetic energy (b) potential energy (c)Both a and b (d) all of above

Answer (c)

1. Langrage’s equation of motion for a simple pendulum is \_\_\_\_.

(a) -(l)sin0=1 (b) –(L/I)sin 0=0 (c) 0-(L/I)sin0 =0 (d) (L/I)sin =0

Answer (c)

1. The K.E of (simple pendulum).

(a) T= ½ ml^20 (b) T= ½ ml^2 0^2 (c) T= ½ ml^2 (d) all of above

Answer (b)

1. In simple pendulum we take a horizontal plane passing through the

(a)Lowest point of mass (b) Highest point of mass (c) both a and b (d)All of above

Answer (a)

1. V=\_\_\_\_\_\_\_\_

(a)mg r cos θ (b)-mg cos θ (c)-mg r cos θ (d)–mr cos θ

Answer (c)

1. Newton’s laws of motion are valid in the two systems moving with a \_\_\_\_\_\_\_ relative velocity

(a) accelerated (b) double (c) non uniform (d) uniform

Answer (d)

1. The statement ‘For a conservative holonomic system, the line integral of Lagrangian function from initial time to final time has an extreme value” describes?

(a) D’ Alembert principal (b) Hamilton’s principal

(c) Poisson’s theorem (d) Modified

Answer (b)

1. The equation *d/dt(∂ L/∂ q´j)−(∂ L/∂ q j)=0* is Lagrange’s equation for?

(a) Conservative non-holonomic system (b) non-conservative system

(c) conservative holonomic system (d) All of these

Answer (c)

1. The conditions which restrict the motion of the system are called \_\_\_\_\_.

(a)Resistances (b) Exceptions (c) Restricts (d) Constraints

Answer (d)

1. Which of the following can be derived from each other?

(a) Lagrangian and Hamiltonian mechanics (b) Lagrangian and relativistic mechanics

(c) Hamiltonian and relativistic mechanics (d) All of these

Answer (a)

1. The number of constraints involve in simple pendulum are

(a) 1 (b) 2 (c) 3 (d) 4

Answer (b)

1. The statement ‘For a conservative holonomic system, the line integral of Lagrangian function

from initial time to final time has an extreme value” describes?

* 1. D’ Alembert principal (b) Hamilton’s principal

(c) Poisson’s theorem (d) Modified

Answer (b)

1. Mark the correct number of degrees of freedom for a simple pendulum.
	1. 1 (b)2 (c)3 (d)0

Answer (a)

1. A system with N particles and m holonomic equations of constraints needs at least \_\_\_\_\_\_generalized coordinates.

(a)3N – m (b)3N + m (c)N – m (d)3N m

Answer (a)

1. Identify an appropriate generalized coordinate to define a simple pendulum efficiently.

(a)Angle of string θ (b)Arc length s (c)Length of string ℓ (d)Any of a and b

Answer (d)

1. Identify the holonomic equation of constraint for a dumbbell of length 𝑙 in 3D space.

(a)𝑥𝑖2+𝑦𝑖2+𝑧𝑖2= 𝑙2 (b)(𝒙𝟐−𝒙𝟏)𝟐+(𝒚𝟐−𝒚𝟏)𝟐+(𝒛𝟐−𝒛𝟏)𝟐=𝒍𝟐

(c)𝑥𝑖2+𝑦𝑖2= 𝑧𝑖2−𝑙2 (d)(𝑥2+𝑥1)2+(𝑦2+𝑦1)2+(𝑧2+𝑧1)2= 𝑙2

Answer (b)

1. How did the D ’Alembert rewrite Newton’s 2nd law?

(a) (b) (c) (d)Both a and b

Answer (a)

1. For a particle in 3D; the generalized force is given by

 (a) (b)

 (c) (d)None of these

Answer (a)

1. Application of D ‘Alembert’s Principle to a particle in 3D yields \_\_\_\_\_\_\_.

(a)Lagrange equations of motion (b)Hamilton’s equations of motion

(c)Newton’s equations of motion (d)None of these

Answer (a)

1. D ‘Alembert assumes everybody in his reference frame to be \_\_\_\_\_.

(a)Static (b)Dynamic (c)In equilibrium (d)Not in equilibrium

Answer (c)

1. The generalized coordinates are \_\_\_\_\_\_ each other.

(a)independent to (b)dependent to (c)analogous to (d)functions of

Answer (a)

1. If 𝐹𝑎= applied force and 𝑓𝑖=force of constraints, then the force𝐹𝑖acting on the body is 𝐹𝑖= \_\_.

(a) (b) (b) (d)None of these

Answer (a)

1. The law of all virtual work is also termed as \_\_\_\_\_.

(a)D ‘Alembert’s Principle (b)Hamilton’s Principle

(c)Bernoulli’s Principle (d)None of these

Answer (a)

1. The D ‘Alembert’s principle says that

(a) (b) (c) (d)None of these

Answer (a)

1. The number of generalized coordinates should be \_\_\_\_ than the number of natural coordinates.

(a)Fewer (b)Greater (c)equal to (d)None of these

Answer (a)

1. Which of the following gives the acceleration of Atwoods Machine when both masses are hanging with the string.

(a) a=(m1​+m2​/m1​-m2​)g (b)a=(m1​-m2​/m1+m2​)g

(c) a=(2m1​​/m1+m2​)g (d) a=(m1​/m1+m2​)g

Answer (b)

1. For a particle moving under the action of conservative force, the Lagrangian of the system is

(a) Independent of position (b) Increases in the direction of conservative force
(c) decreases in the direction of conservative force (d) More information is needed.

Answer (b)

1. The D Alembert Principle and Principle of virtual work
	1. both are same (b) one exists and other one never

(c) one is for motion and other is for rest (d) has no meaning without each other

Answer (c)

1. Generalized force
	1. always has the dimensions of force (b) always has the dimensions of work

(c) May never have the dimensions of force or work (d) None of the above is true.

Answer (d)

1. Two particles are moving in space without any connection between them, How many Lagrangian equations can be written for the system
	1. 1 (b) 2 (c) 3 (d) 6

Answer (d)

1. According to principle of virtual work the system will be equilibrium if for small virtual displacement

(a) Work done by force of constraints is zero (b) Work done by external force is zero
(c) Both A and B (d) None of the above

Answer (c)

1. Cylinder constrained to move on a plane such that its axis of symmetery is always parallel to the plane then degree of freedom are

(a)2 (b) 4 (c) 5 (d) 6

Answer (b)

**UNIT:II RIGID BODIES**

1. In a rotational motion centripetal acceleration directed to \_\_\_\_\_\_\_\_\_ of the circle

(a) upwards (b) outwards ( c ) inwards (d) centre

Answer: d

1. In a cyclone the wind whirls in the \_\_\_\_\_\_\_\_\_ sense in the northern hemisphere

(a) upwards (b) downwards ( c ) clockwise (d) anticlockwise

Answer: d

1. What does Newton’s second law states?
a) The rate of change of momentum is equal to the force applied
b) For every reaction, there is an opposite reaction
c) The body is tend to be rotated if the force is applied tangentially
d) The body is rest until a force is applied

Answer: a

1. In the rotation of a rigid body the directions of the angular velocity and the angular momentum are \_\_\_\_\_\_\_\_\_

(a) same (b) different ( c ) perpendicular (d) parallel

Answer: b

1. The moment of inertia is a tensor of rank \_\_\_\_\_\_\_\_\_

(a) one (b) two ( c )three (d) zero

Answer: b

1. A rigid body have \_\_\_\_\_\_\_\_\_ degree of freedom

(a) one (b) two ( c )three (d) six

Answer: b

1. If I1=I2=I3, then the body is called \_\_\_\_\_\_\_\_\_

(a) spherical top (b) symmetrical top ( c )asymmetrical top (d) rotator

Answer: a

1. If I1 = I2 ≠I3\_ , then the body is called \_\_\_\_\_\_\_\_\_

(a) spherical top (b) symmetrical top ( c )asymmetrical top (d) rotator

Answer: c

1. If I1= I2 and I3 = 0 , then the body is called \_\_\_\_\_\_\_\_\_

(a) spherical top (b) symmetrical top ( c )asymmetrical top (d) rotator

Answer: a

1. In a torque free motion of a rigid body, the \_\_\_\_\_\_\_\_\_ of the body is a constant vector

(a) angular velocity (b) linear velocity ( c )angular momentum (d) angular acceleration

Answer: c

1. \_\_\_\_\_\_\_\_\_ must be applied to maintain the rotation of the system about given axis

(a) force (b) momentum ( c )velocity (d) torque

Answer: d

1. Which of the following functions represents a simple harmonic oscillation?
a) sinωt-cosωt b) sinωt+sin2ωt c) sinωt-sin2ωt d) sin2 ωt

Answer: a

1. A lightly damped oscillator with a frequency v is set in motion by a harmonic driving force of frequency v’. When v’ is lesser than v, then the response of the oscillator is controlled by \_\_\_\_\_\_\_\_\_\_\_
a) Spring constant b) Inertia of the mass c) Oscillator frequency d) Damping coefficient

Answer: a

1. The phase velocity refers to a group of waves and the group velocity refers to a single wave. State true/false.
a) True b)False
 Answer: b
2. The phase and group velocities does not depend on which of the following?
a) Frequency b) Wavelength c) Phase constant d) Attenuation constant
Answer: d
3. In a waveguide, which of the following condition is true always?
a) phase velocity = c b) group velocity = c c) phase velocity > cd) phase velocity < c

Answer: c

1. A particle is executing simple harmonic motion at midpoint of mean position and extremely. What is the potential energy in terms of total energy (E)?
a) E/4 b) E/16 c) E/2 d) E/8
Answer: a.
2. A mass m is suspended from a spring. Its frequency of oscillation is f. The spring is cut into two halves and the same mass is suspended from one of the two pieces of the spring. The frequency of oscillation of mass will be \_\_\_\_\_\_\_\_\_\_\_
a) √2 f b) f/2 c) f d) 2f
Answer: a
3. The time period of mass suspended from a spring is T. If the spring is cut into four equal parts and the same mass is suspended from one of the parts, then the new time period will be \_\_\_\_\_\_\_\_\_\_\_
a) T/4 b) T c) T/2 d) 2T

Answer: c.

1. In case of a forced vibration, the resonance peak becomes very sharp when the \_\_\_\_\_\_\_\_\_\_\_
a) Damping force is small b) Restoring force is small c) Applied periodic force is small
d) Quality factor is small

Answer: a

1. The circular motion of a particle whose speed is constant is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
a) Periodic but not simple harmonic b) Simple harmonic but not periodic
c) Periodic and simple harmonic d) Neither periodic not simple harmonic
Answer: a
2. Which of the following is a simple harmonic motion?
a) Particle moving in a circle with uniform speed
b) Wave moving through a string fixed at both ends
c) Earth spinning about its axis d) Ball bouncing between two vertical walls
Answer: b.
3. A particle executes simple harmonic motion along the x-axis. The force acting on it is given by?
a) A cos(kx) b) A e(-kx) c) A kx d) –A kx
Answer: d
4. Which one of the following represents simple harmonic motion?
a) Acceleration = kx b) Acceleration = k0 x+k1 x2

c) Acceleration = -k(x+a) d) Acceleration = k(x+a)
Answer: c

1. A particle executing simple harmonic motion of amplitude 5cm has a maximum speed of 31.4 cm/s. The frequency of its oscillation is?
a) 4Hz b) 3Hz c) 2Hz d) 1Hz
Answer: d
2. A particle executes simple harmonic oscillation. Its amplitude is a. The period of oscillation is T. The minimum time taken by the particle to travel half of the amplitude from the equilibrium position is\_\_\_\_\_\_\_\_\_\_\_
a) T/8 b) T/12 c) T/2 d) T/4
Answer: b
3. Harmonic oscillator has an amplitude A and time period T. The time require by it to travel from x = A to x = A/2 is \_\_\_\_\_\_\_\_\_\_\_
a) T/6 b) T/4 c) T/3 d) T/2
Answer: a.
4. If a simple harmonic oscillator has got a displacement of 0.02m and acceleration equal to 2m/s2 at any time, the angular frequency of the oscillator is equal to \_\_\_\_\_\_\_\_\_\_\_
a) 10 rad/s b) 0.1 rad/s c) 100 rad/s d) 1 rad/s
Answer: a
5. The phase difference between the acceleration of a particle executing simple harmonic motion and the instantaneous velocity is?
a) π b) 0.707π c) Zero d) 0.5π
Answer: c
6. Which one of the following statements is true for the speed v and the acceleration of a particle executing simple harmonic motion?
a) When c is maximum, a is maximum
b) Value of a is zero, whatever may be the value of v c) When v is zero, a is zero
d) When v is maximum, a is zero Answer: d
7. A body of mass 5kg hangs from a spring and oscillates with a time period of 2π seconds. If the body is removed, the length of the spring will decrease by?
a) g/k meters b) k/g meters c) 2π meters d) g meters

Answer: d.

1. The ratio of the acceleration for a solid sphere (mass m and radius R) rolling down an incline of angle θ without slipping and slipping down the incline without rolling is,

  (a) 5:7 (b)2:3 (c) 2:5 (d) 7:5

Answer: a

1. Time period of a simple pendulum is 2sec. If its length is increased by 4 times, then its period becomes \_\_\_\_\_\_\_\_\_\_\_
a) 8 sec b) 12 sec c) 16 sec d) 4 sec

Answer: d.

1. If the length of a simple pendulum is increased by 2%, then the time period \_\_\_\_\_\_\_\_\_\_\_
a) Increases by 1% b) Decreases by 1% c) Increases by 2% d) Decreases by 2%
Answer: a
2. A second’s pendulum is mounted in a rocket. Its period of oscillation will decrease when rocket is \_\_\_\_\_\_\_\_\_\_\_
a) Moving down with uniform acceleration b) Moving around the earth in geostationary orbit
c) Moving up with uniform velocity d) Moving up with uniform acceleration
 Answer: a
3. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration a, then the time period is given by T=2π√(l/g), where g is equal to \_\_\_\_\_\_\_\_\_\_\_
a) g b) g-a c) g+a d) √(g2+a2 )

Answer: d.

1. In case of a forced vibration, the resonance peak becomes very sharp when the \_\_\_\_\_\_\_\_\_\_\_
a) Damping force is small b) Restoring force is small
c) Applied periodic force is small d) Quality factor is small
 Answer: a.
2. A particle with restoring force proportional to displacement and resisting force proportional to velocity is subjected to a force Fsinωt. If the amplitude of the particle is maximum for ω=ω1 and the energy of the particle maximum for ω=ω2, then?
a) ω1≠ω0 and ω2=ω0 b) ω1=ω0 and ω2=ω0 c) ω1≠ω0 and ω2≠ω0 d) ω1≠ω0 and ω2≠ω0

Answer: a.

1. Two simple pendulums of lengths 5m and 20m respectively are given small linear displacement in one direction at the same time. They will again be in the phase when the pendulum of shorter length has completed.
a) 2 oscillations b) 1 oscillation c) 5 oscillations d) 3 oscillations

Answer: b

1. The composition of two simple harmonic motions of equal periods at the right angle to each other and with a phase difference of π results in the displacement of the particle along?
a) Circle b) Figure of eight c) Straight line d) Ellipse
Answer: c
2. By what percentage does the kinetic energy increase, if the linear momentum is increased by 50%

(a) 25% (b) 50% (c) 100% (d) 125%

Answer: (d)

1. What is the angular momentum vector in an orbital motion?

(a) The vector is perpendicular to the orbital plane (b) The vector is along the radius vector

(c) The vector is parallel to the linear momentum (d) The vector is in the orbital plane

Answer:(a)

1. What is the acceleration of the rolling sphere at the centre of the plane with inclination, Ө to the horizontal?

(a) Zero (b) Less than g sin Ө (c) Greater than g sin Ө (d) g sin Ө

Answer**:**(b)

1. On which of the following factor does the moment of inertia of an object not depend upon

(a) Axis of rotation (b) Angular velocity (c) Distribution of mass (d) Mass of an object

Answer**:**(b

1. What is the frictional force of a round object with mass M and radius R which rolls down the inclined plane without slipping along the way

(a) There is a decrease in the rotational motion

(b) There is a decrease in the rotational and translational motion

(c) There is a conversion of translational motion into rotational motion

(d) Kinetic energy is converted into heat

Answer**:**(c)

1. When the torque acting on the system is zero, which of the following is constant?

(a) Linear impulse (b) Linear momentum (c) Force (d) Angular momentum

Answer**:**(d)

1. The angular momentum of a rigid body is L and its kinetic energy is halved. What happens to its angular momentum?

(a) L (b) 2L (c) L2L2 (d) L4L4

Answer**:**(c) L4L4

1. Consider two objects a disk and a sphere that has the same radius but different masses which roll down the two inclined planes with the same altitude and length. Out of the two objects, which one gets to the bottom of the plane first?

(a) It is dependent on the masses of the objects (b) Disk (c) Sphere (d) Both reach at the same time

Answer:(c)

1. The motion of planets in the solar system is an example of conservation of

(a) Energy (b) Linear momentum (c) Angular momentum (d) Mass

Answer: (c)

1. When does the moment of inertia of a body come into the picture?

(a) When the motion is rotational (b) When the motion is linear

(c) When the motion is along a curved path (d) None of the above

Answer**:**(a)

1. The center of mass of a system of particles does not depend upon,

  (a) position of particles (b) relative distance between particles

 (c) masses of particles (d) force acting on particle

  Answer: d

1. A couple produces,

(a) pure rotation(b) pure translation (c) rotation and translation (d) no motion

  Answer: a

1. A particle is moving with a constant velocity along a line parallel to positive X-axis. The magnitude of its angular momentum with respect to the origin is,

(a) zero (b) increasing with x (c) decreasing with x (d) remaining constant

 Answer: d

1. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force 30 N?

(a) 0.25 rad s–2 (b) 25 rad s–2(c) 5 m s–2 (d) 25 m s–2.

 Answer: b

1. A closed cylindrical container is partially fi lled with water. As the container rotates in a horizontal plane about a perpendicular bisector, its moment of inertia,

  (a) increases(b) decreases (c) remains constant (d) depends on direction of rotation.

  Answer: a

1. A rigid body rotates with an angular momentum L. If its kinetic energy is halved, the angular momentum becomes,

  (a) L (b) L/2 (c) 2L **(d)** L/ 2

 Answer: d

1. A particle undergoes uniform circular motion. The angular momentum of the particle remain conserved about,

 (a) the center point of the circle**.** (b) the point on the circumference of the circle.

 (c) any point inside the circle. (d) any point outside the circle.

 Answer: a

1. When a mass is rotating in a plane about a fi xed point, its angular momentum is directed along,

(a) a line perpendicular to the plane of rotation

(b) the line making an angle of 45° to the plane of rotation

(c) the radius (d) tangent to the path

 Answer: a

1. Two discs of same moment of inertia rotating about their regular axis passing through center and perpendicular to the plane of disc with angular velocities ω1 and ω2. They are brought in to contact face to face coinciding the axis of rotation. The expression for loss of energy during this process is,

  (a) 1/4 I (ω1- ω2)2(b) I (ω1- ω2)2 (c) 1/8 I (ω1- ω2)2 (d) 1/2 I (ω1- ω2)2

 Answer: a

1. A disc of moment of inertia Ia is rotating in a horizontal plane about its symmetry axis with a constant angular speed ω. Another discinitially at rest of moment of inertia Ib is dropped coaxially on to the rotating disc. Then, both the discs rotate with same constant angular speed. The loss of kinetic energy due to friction in this process is,



Answer: d

 **Unit-III:**

1.  is called \_\_\_\_\_.

(a)Hamilton’s Principle (b)Lagrangian Principle (c)Minimal Integral (d)Both a and c

Answer (a)

1. Hamilton’s principle is also called \_\_\_\_\_\_.

(a)Principle of least action (b)Generalized Principle (c)Both a and b (d)None of these

Answer (a

3. Hamilton’s constant H = T+V tells us about the \_\_\_\_\_\_ of the system.

(a)Energy (b)Motion (c)Velocity (d)None of these

Answer (a)

4. The space containing generalized coordinates is called \_\_\_\_\_\_\_.

(a)Generalized space (b)Configuration space (c)Euclidean space (d)None of these

Answer (b)

5. Hamilton’s equations of motion can be derived from \_\_\_\_\_\_.

(a)Lagrange’s equations (b)Variational Principle (c)Both a and b (d)None of these

Answer (c)

6. (Hamiltonian) is always \_\_\_\_\_\_.

(a)Variable (b)Constant (c)Zero (d)None of these

Answer (b)

8. Hamilton’s equations contain \_\_\_\_\_ time derivatives.

(a)1storder (b)2nd order (c)Not any (d)Both a and b

Answer (a)

9. Hamiltonian H = is also called \_\_\_\_\_\_\_.

(a)Legendre’s transform (b)Linear transform (c)Canonical transform (d)Both a and b

Answer (a)

10. The Hamilton’s method is connected with \_\_\_\_\_.

(a)Symmetry (b)Conservation (c)Both a and b (d)None of these

Answer (c)

11. The space involved in Hamilton’s system is called \_\_\_\_\_\_.

(a)Configuration space (b)Phase space (c)Both a and b (d)None of these

Answer (b)

12. The equations are called \_\_\_\_\_\_\_ of motion.

(a)Hamilton’s equations (b)Lagrange’s equations (c)Time-drift equations (d)None of these

Answer (a)

13. Hamilton’s equations are also called \_\_\_\_\_.

(a)Canonical equations (b)Legendre’s equations (c)Linear equations (d)None of these

Answer (a)

14. Hamilton’s principle is applicable to \_\_\_\_\_\_\_.

(a)Holonomic system (b)Non-holonomic system (c)Conservative system (d)Both a and c

Answer (d)

15. Hamiltonian H is defined as

(a)The total energy of the system (b) the difference in energy of the system

(c)The product of energy of the system (d) All of these

Answer (a)

16. H is expressed as a function of \_\_\_\_\_\_\_.

(a)Open coordinates (b)System coordinates (c)Generalized coordinates (d)None of these

Answer (c)

17. How many ways can the Hamilton’s equation are derived?

(a)3 (b)4 (c)2 (d)None of these

Answer (c)

18. Hamilton’s variational principle is given by \_\_\_\_\_.

 (d) None of these

Answer (a)

19. Modified Hamilton’s principal in phase space is \_\_\_\_\_\_.

(a)Independent (b)Variational (c)Non-variational (d)None of these

Answer (b)

20. The co-efficient of 𝑑𝑞𝑖 and 𝑑𝑝𝑖 in modified Hamilton’s Principal must \_\_\_\_\_\_.

(a)Vanish collectively (b)Appear collectively (c)Vanish separately (d)Appear separately

Answer (c)

21. Hamilton’s principle gives an independent method for obtaining Hamilton’s equations without prior\_\_\_\_\_.

(a) Lagrangian formalism (b) Jacobi’s integral of motion

(c)Generalized momenta (d)None of these

Answer (a)

22. The function of generalized coordinates 𝑞𝑖, generalized momenta 𝑝𝑖 and time t is \_\_\_\_\_\_\_.

(a)Lagrangian (b)Hamiltonian (c)Jacobian (d)None of these

Answer (b)

23. h in Hamilton’s equation is called \_\_\_\_\_\_\_.

(a) Lagrangian formalism (b) Jacobi’s integral of motion

(c)Generalized momenta (d)None of these

Answer (b)

24. In mathematics the Jacobic identity is a property of------------- describe how the order of evaluation effect the result of operation

a) Unary operation b) Arithmatic operation c) Binary operation d) Dicimal operation

Answer (c)

25. The transformation of one set of coordinates to another set of coordinates by transformation equations is called \_\_\_\_\_\_\_.

(a)Point transformation (b)Functional transformation

(c)Canonical transformation (d)None of these

Answer (a)

26. Identify the Hamilton’s canonical equations

Answer (a)

27. Point transformation in which the variables obey the Hamilton’s equation is called \_\_\_\_\_\_.

(a)Canonical transformation (b)Equation transformation (c)Function transformation (d)None of these

Answer (a)

28. In canonical transformation, the set of variables obeys the \_\_\_\_\_\_\_\_.

(a)Hamilton’s equations (b)Newton’s laws (c)Pythagorean theorem (d)Both a and c

Answer (a)

29. The function F can be written in \_\_\_\_\_ forms in canonical transformation.

 (a)3 (b)2 (c)1 (d)4

Answer (d)

30. The point transformation is also known as \_\_\_\_\_\_\_\_.

(a)Contact transformation (b)Functional transformation (c)Both a and b (d)None of these

Answer (a)

31. The poission brackets between 𝜽 and 𝜽 is

a){𝜃,𝜃} = 1/m b) {𝜃,𝜃} = 1 c) {𝜃,𝜃} = 1/𝑚𝑙2 d) {𝜃,𝜃} = 𝑔/𝑙

Answer (c)

32. What is the Jacobic identity are

a) [f, {g, h}}+[g,{h,f}]+[h{f,g}]=0 b) [f, {g, h}}+[g,{h,f}]-[h{f,g}]=0

c) [f, {g, h}}+[g,{h,f}]+[h{f,g}]=1 d) [f, {g, h}}-[g,{h,f}]-[h{f,g}]=0

Answer (a)

33. Which is the property of Poisson brackets?

a) [F,G]= - [G,F] b) [F,F] = 0 c) both a &b d) none

Answer (c)

34. Equation of motion in Poisson Bracket for a function F

a) [F, H]+∂F/∂t b) [H ,F] = 0 c) [F, H]+dt=0 d) [F,H]=0

Answer (a)

35. Following is not a Poisson brackets.

a) [qj,pk] q,p=0 b) [pj,pk] q,p=0 c) [qj,qk] q,p=0 d) [qj,pk] q,p= ∇j⋅k

Answer (a)

36. Poisson brackets are similar to the ……………. In quantum mechanics .

a) commutator brackets b)square brackets c) none d) phase brackets

Answer (a)

37. Most important property of passion brackets is

a) Invariant under canonical transformation b) [F,G] q,p=[F,G]Q⋅P c) both a & b d) none of these

Answer (c)

38. The bridge between Classical Mechanics is privided by:

a)Lagrange brackets b) Poisson brackets c) Jacobi's Identity d) none of these

Answer (b)

39. Hamiltonian Equations of motion give:

a)time evolution b) momenta of a system c) properties of a matter d) both a and b

Answer (d)

40. Let F,G and H be functions of canonical variables (q,p) and time then:

a)[F,F]=π b) [F,F]=0 c) [F,F]=1 d) none of these

Answer (b)
41. From the given transformation q = √2𝑃 sin𝜃 and P = √2𝑃 cos𝜃, we have

a) tan𝜃 = 𝑞/𝑃 b) cot𝜃 = 𝑝/𝑞 c) sec𝜃 = 𝑞/𝑃 d) both (a) and(b)

Answer (d)

42. From the given transformation q = √2𝑃 sin𝜃 and P = √2𝑃 cos𝜃, the value of P is:

a) P = 𝑞2 + 𝑃2 b) P = (𝑞2 + 𝑃2)/2 c) P = 𝑞2−𝑃2  d) P = 𝑞2 + 𝑃2

Answer (b)

43. By the definition of Poisson bracket in the transformation q = √2𝑃 sin𝜃 and P = √2𝑃 cos𝜃, it is obvious that:

a) [P, P] = 0 b) [Q, P] = 0 c) [Q, P] = 0 d) Both (a) and (c)

Answer (d)

44. The equation 𝑐𝑜𝑠2(1 + 𝑡𝑎𝑛2𝜃) is equal to:

a) 0 b) 𝑠𝑒𝑐2𝜃 c) 1 d) cos 𝜃

Answer (c)

45. The partial derivative of equation 2P = q2 + p2 with respect to p and q respectively is:

a) 𝜕𝑃/𝜕𝑃 = P, 𝜕𝑃/𝜕𝑞 = q b) 𝜕𝑃/𝜕𝑞 = P, 𝜕𝑃/𝜕𝑃 = P

c) 𝜕𝑃/𝜕𝑃 = q, 𝜕𝑃/𝜕𝑞 = P d) none of these

Answer (a)

46. By the given Poisson bracket the given transformation q = √2𝑃 sin𝜃 and P = √2𝑃 cos𝜃 is:

a) Elliptical b) Parabolic c) Conical d) Circular

Answer (c)

47. [F, G] = 0 are said to \_\_\_\_\_\_\_ with each other.

a) Associative b) Distributive c) Subtract d) Commute

Answer (d)

48. Under canonical transformations Lagrange brackets are \_\_\_\_\_\_\_\_.

a) Variant b) Invariant c) Angular d) None of these

Answer (b)

49. Lagrange brackets are invariant under conical transformation such as:

a) [𝐹,𝐺]𝑞,𝑃 = [𝐹,𝐺]𝑄,𝑃 b) [𝐹,𝐺]𝑞,𝑃 = [𝐹,𝐺]𝑄,𝑃 c) [𝐹,𝐺]𝑞,𝑃 −[𝐹,𝐺]𝑄,𝑃 = 0 d) both (a) and (c)

Answer (d)

50. Lagrange brackets \_\_\_\_\_\_\_ Jacobi’s identity.

a) Violate b) Obey c) Commute d) None of these

Answer (a)

51. The properties of commutators are \_\_\_\_\_\_\_\_ to those of Poisson brackets.

a) Dissimilar b) Similar c) Equivalent d) None of these

Answer (b)

52. In quantum mechanics, commutators replace \_\_\_\_\_\_\_\_\_\_.

a) Lagrange bracket b) Poisson bracket c) Jacobi’s identity d) None of these

Answer (b)

53. There is inverse relation between Poisson brackets and \_\_\_\_\_\_\_.

a) Lagrange brackets b) Jacobi’s identity c) Commutators d) Operators

Answer (a)

54. The dynamical variables occurring in these equations is:

a) Position coordinates r b) Linear momentum P

c) Angular momentum L d) All of these

Answer (d)

55. The equation ∑𝑔.𝑚𝑞 is equal to \_\_\_\_\_\_.

(a)T (b)2T (c)T2 (d)3T2

Answer (b)

56. The total energy H is equal to \_\_\_\_.

(a)2T (b)T2 (c)T+2V (d)T+V

Answer (d)

57. The generalized force at equilibrium will be \_\_\_\_\_\_.

(a)Maximum (b)Minimum (c)0 d)None of these

Answer (c)

58. Generalized coordinates

 (a) Depends on each other (b) Independent on each other

(c ) necessarily spherical coordinates (d) May be Cartesian coordinate

Answer (a)

59.If the lagrangian does not depend on time explicitly

(a) The Hamiltonian is constant (b) The Hamiltonian cannot be constant

(c ) The kinetic energy is constant (d) the potential energy is constant

Answer (a)

60. As there are three generalized coordinates, then Hamilton’s canonical equations will be … in number

(a) Three (b) Four (c) Five (d) Six

Answer (d)

**UNIT – IV**

**Q1. A linear time invariant system is stable if :**

1. System in excited by the bounded input, the output is also bounded
2. In the absence of input output tends zero
3. Both a and b
4. None of the mentioned

**Ans: (c)**

**Q2. Linear mathematical model applies to :**

1. Linear systems
2. Stable systems
3. Unstable systems
4. All of the mentioned

**Ans: (b)**

**Q3. The type of dominant force associated with simple pendulum is**

1. Restoring force
2. Gravitational force
3. Electromagnatic force
4. Nuclear force

**Ans: (a)**

**Q4. For non-linear systems stability cannot be determined due to:**

1. Possible existence of multiple equilibrium states
2. No correspondence between bounded input and bounded output stability and asymptotic stability
3. Output may be bounded for the particular bounded input but may not be bounded for the bounded inputs
4. All of the mentioned

**Ans: (d)**

**Q5. The description of evolution of physical systems is given by**

1. Newton’s law
2. Gauss law
3. Coulomb’s law
4. Hooke’s law

**Ans: (a)**

**Q6. The flow of energy is unidirectional in which oscillators?**

1. Harmonic oscillators
2. Relaxation oscillators
3. Both a and b
4. None of the above

**Ans: (a)**

**Q7. For a linear harmonic oscillator F = -Kx. The corresponding potential V(x) is............**

1. kx2

Ans: **(a)**

**Q8. System non-linearities are taken account by:**

(a) Analytical

(b) Graphical and numerical techniques

(c) Both a and b

(d) None of the mentioned

**Ans: (c)**

**Q9. In the Kepler problem potential is proportional to**

1. r
2. r2

**Ans: (a)**

**Q10. Harmonic oscillators generate \_\_\_\_\_\_\_ waveforms as output.**

1. Saw tooth
2. Square
3. Triangular
4. Sinusoidal

**Ans: (d)**

**Q11. The potential of a cubic anhormonic oscillator with a force F = kx - x3 is**

1. 2kx + 4x3
2. 2k2x + 4x2

**Ans: (a)**

**Q12. Harmonic oscillators are \_\_\_\_\_\_\_\_.**

1. Sinusoidal oscillators
2. Non-Sinusoidal oscillators
3. Both a and b
4. Relaxation oscillators

**Ans: (a)**

**Q13. Linear superposition principle is obeyed by**

1. Linear dynamical systems
2. Nonlinear dynamical systems
3. Static physical systems
4. None of the above

**Ans: (a)**

**Q14.** Duffing's equation **is the second-order \_\_\_\_\_\_\_\_.**

1. Linear equation
2. Nonlinear equation
3. Unstable equation
4. All of the mentioned

**Ans: (b)**

**Q15. For a linear differential equation, after rationalization, its total degree in the dependent**

 **variables and their derivatives is**

1. either 1 or 0
2. Either 2 or 3
3. Either ½ or 3/2
4. Either 5/2 or 7/2

**Ans: (a)**

**Q16. Basically, solitons are pulses which propagates through the fiber without showing any variation in \_\_\_\_\_\_**

1. Amplitude
2. Velocity
3. Shape
4. All of the above

**Ans: (d)**

**Q17. For nonlinear systems \_\_\_\_\_\_\_\_ is not valid**

1. Linear superposition principle
2. Correspondence principle
3. Uncertainity principle
4. Hamilton’s Principle

**Ans: (a)**

**Q18. The equation is ∂tu+∂x3u+6u∂xu=0**

1. Kdv equation
2. Nonlinear equation
3. Duffing equation
4. All of the mentioned

**Ans: (a)**

**Q19.The phase –portrait of free harmonic oscillator is**

1. Circle
2. Spiral
3. Parabola
4. Hyperbola

**Ans: (a)**

**Q20. Important feature that unlike the case of linear oscillator the ------------- is dependent on the amplitude.**

1. Amplitude
2. Velocity
3. Shape
4. Angular frequency

**Ans: (d)**

**Q21. In general in nonlinear oscillators the frequency of oscillation depends on**

1. Amplitude
2. Velocity
3. Momentum
4. Acceleration

**Ans: (a)**

**Q22. Nonlinear system depends heavily on the ---------------while it is not so for linear systems.**

1. Unstable systems
2. Stable conditions
3. Linear systems
4. Initial conditions

**Ans: (d)**

**Q23. For the undamped unforced duffing oscillator the phase-trajectories are**

1. Concentric circles
2. Circle
3. Spiral
4. parabola

**Ans: (a)**

**Q24. Stable equilibrium point has real parts of both the eigen values are -------------**

1. Negative
2. Positive
3. Both Negative and Positive
4. None of the above

**Ans: (a)**

**Q25. Jump phenomenon is exhibited by which of the following nonlinear system**

1. Duffing oscillator
2. logistic map
3. Henon-Heiles system
4. linear harmonic oscillator

**Ans: (a)**

**Q26. The stability is exchanged at a critical value when the control parameter is varied. This**

 **bifurcation is called as -------------- b**ifurcation.

1. Critical
2. Supercritical
3. *Transcritical*
4. None of the above

**Ans: (a)**

**Q27. A pendulum has \_\_\_\_\_ distinct vertical equilibrium states.**

1. Two
2. One
3. Three
4. Four

**Ans: (a)**

**Q28. Fractals were discovered by---------------**

1. Einstein
2. Benoît Mandelbrot
3. SN. Bose
4. None of the above

**Ans: (b)**

**Q29. Dynamical systems whose equations of motion have no explicit dependence on time are called as**

1. Autonomous System
2. Non-autonomous system
3. Isolated System
4. Combined systems

**Ans: (a)**

**Q30. An autonomous nonlinear electronic circuit requires minimum -------------- energy storage elements to generate chaos.**

1. One
2. Two
3. Three
4. Five

**Ans: (a)**

**Q31. For stable node / star the nature of eigen values is**

1. 1 and 2 are complex conjugates
2. 1 and 2are complex number

Ans: **(a)**

**Q32. Fractals exhibit similar patterns at increasingly small scales called---------------**

1. Invarience
2. *Self similarity*
3. Affinity
4. None of the above

**Ans: (b)**

**Q33.For stable / unstable focus the nature of eigen values is**

1. *1 and 2 are complex conjugates*
2. 1 = 2  =

**Ans: (a)**

**Q34. The soliton phenomenon was first described by--------------**

1. Einstein
2. Benoît Mandelbrot
3. SN. Bose
4. John Scott Russell

**Ans: (d)**

**Q35. For a centre equilibrium point**

1. *The eigen values are purley imaginary and complex conjugates*
2. The eigen values are real
3. the eigen values are imaginary

**Ans: (a)**

**Q36. ------------ waves are approximate solutions to the Boussinesq equations.**

1. Saw tooth wave
2. *Square wave*
3. *Nonlinear wave*
4. ***Cnoidal waves***

**Ans: (d)**

**Q37. For a saddle equilibrium point**

1. 1 and 2 are imaginary

Ans: **(a)**

**Q38. The equation ∂tu+∂x3u+6u∂xu=0 is------------**

1. Linear equation
2. Nonlinear equation
3. Duffing equation
4. All of the mentioned

**Ans: (b)**

**Q39. In discrete dynamical systems**

1. Time variable is discrete
2. Space variable is discrete
3. Time variable is continuous
4. Timeand space variable are continuous

**Ans: (a)**

**Q40. The equation y=mx+c is------------**

1. Linear equation
2. Nonlinear equation
3. Duffing equation
4. All of the mentioned

**Ans: (a)**

**Q41. The logistic map has a \_\_\_\_\_\_ nonlinearity**

1. Quadratic
2. Cubic
3. Quintic
4. complex

**Ans: (a)**

**Q42. KdV equation is------------.**

1. Second order ODE
2. First order ODE
3. Second order PDE
4. None of the above

**Ans: (a)**

**Q43. For dispersive waves phase velocity depends on**

1. *Wave number*
2. Amplitude
3. Central position
4. Frequency

**Ans: (a)**

**Q44. Kepler problem coverned by -------------**

1. Linear ODE
2. *Linear PDE*
3. Nonliner PDE
4. None of the above

**Ans: (a)**

**Q45. First experimental observation of soliton was made by**

1. John Scott Russel
2. Zabusky
3. Kruskal
4. Fermi

**Ans: (a)**

**Q46. Difference between the harmonic oscilltorand Anharmonicoscilltor is**

1. Quintic
2. Cubic
3. Complex
4. None of the above

**Ans: (b)**

**Q47. The nonlinear equation governing Scott Russelphonemenon is**

1. KortewegdeVries equation
2. Sine – Gordon equation
3. Nonlinear Schrödinger equation
4. Gross Pitaevskii Equation

**Ans: (a)**

**Q48. Damped harmonic oscillator is -----------------------.**

1. Linear ODE
2. Nonliner PDE
3. *Linear PDE*
4. None of the above

**Ans: (a)**

**Q49. The name soliton was coined by**

1. Zabusky and Kruskal
2. Fermi and Pasta
3. Fermi and Ulam
4. Dirac

**Ans: (a)**

**Q50. Linear superposition principle valied for---------------**

1. Linear ODE
2. Nonliner PDE
3. *Linear PDE*
4. *Both a & b*

**Ans: (a)**

**Q51. Which of the following nonlinearity was not considered by Fermi – Pasta and Ulam in their numerical experiment.**

1. Quintic nonlinearity
2. Quadratic nonlinearity
3. Cubic nonlinearity
4. Cubic – Quintic nonlinearity

**Ans: (a)**

**Q52. Phase space is the graph between ---------------**

1. Possition& velocity
2. *Possition& momentum*
3. Velocity & time
4. None of the above

**Ans: (b)**

**Q53. For linear normal modes there will be**

1. No energy sharing
2. Complete energy sharing
3. Partial energy sharing
4. None of the above

**Ans: (a)**

**Q54. Lorenz equation is--------------**

1. Autonomous equation
2. Nonautonomous equation
3. Autonomous equation & Nonautonomous equation
4. None of the above

**Ans: (a)**

**Q55. The KdVequation is**

1. ut – buux + uxxx = 0
2. ut – bux2+ uxxx = 0
3. ut – buux + uxx = 0
4. utt – buuxx + uxxx = 0

**Ans: (a)**

**Q56. ------------ waves are approximate solutions to the Boussinesq equations.**

1. Saw tooth wave
2. *Square wave*
3. *Nonlinear wave*
4. *Cnoidal waves*

**Ans: (d)**

**Q57. The equation ∂tu+∂x3u+6u∂xu=0 is------------**

1. Linear equation
2. Nonlinear equation
3. Duffing equation
4. All of the mentioned

**Ans: (b)**

**Q58.The equation y=mx+c is------------**

1. Linear equation
2. Nonlinear equation
3. Duffing equation
4. All of the mentioned

**Ans: (a)**

**Q59. The initial condition taken by Zabusky and Kruskal in this numerical experiment is**

 **u (x, 0) =**

1. *cosx*
2. sin x
3. tan x
4. sechx

**Ans: (a)**

**Q60. Find the group velocity for the dispersion relation  = < k.**

* C*

B)1/C

c)2 / 2

d)c/4

**Ans: (a)**

**UNIT:V SPECIAL THEORY OF RELATVITY**

1. As an object approaches the speed of light, it’s mass becomes \_\_\_\_\_\_\_\_\_\_\_\_\_
a) Zero b) Double c) Remains Same d) Infinite

Answer: d

2. If the sun radiates energy at the rate of 4 x 1026 Js-1, what is the rate at which its mass is decreasing?
a) 5.54 x 109 kgs-1 b) 4.44 x 109 kgs-1 c) 3.44 x 109 kgs-1 d) 2.44 x 109 kgs-1

Answer: b
3. The orbit of mercury is changing slightly due to the sun’s gravity.
a) True b) False

Answer: a
4. According to Einstein’s Special Theory of Relativity, laws of physics can be formulated based on \_\_\_\_\_\_\_\_\_\_\_\_
a) Inertial Frame of Reference b) Non-Inertial Frame of Reference
c) Both Inertial and Non-Inertial Frame of Reference d) Quantum State

Answer: a
5. For Einstein’s relation, E2 – p2c2 = \_\_\_\_\_\_\_\_\_\_\_\_\_
a) moc2 b) mo2c4  c) moc4 d) mo2c6

Answer: b

6. A frame of reference has four coordinates, x, y, z, and t is referred to as the\_\_\_\_\_\_\_\_\_\_\_\_\_
a) Inertial frame of reference b) Non-inertial frame of reference
c) Space-time reference d) Four-dimensional plan

Answer: c

7. As an object approaches the speed of light, it’s mass becomes \_\_\_\_\_\_\_\_\_\_\_\_\_
a) Zero b) Double c) Remains Same d) Infinite
Answer: d
8. According to the special theory of relativity, physical laws are the same in frames of reference which
a) move at uniform velocity b) accelerate c) move in circles. d) move in ellipses

Answer: a
9. If an object reaches the speed of light, it’s length changes to \_\_\_\_\_\_\_\_\_\_\_
a) Infinite b) Double of the value c) Half of the value d) Zero
Answer: a

10. The term "relativistic" refers to effects that are
a) observed when speeds are near the speed of light. b) noticed about a moving object.
c) observed when objects move backward in time. d) measured by stationary observers only..

Answer: a

11. Which of the following is Einstein’s mass energy relation? For Einstein’s relation, E2 – p2c2 = \_\_\_\_\_\_\_\_\_\_\_\_\_
a) Ek = (m – m0)c2 b) E2 – p2c2 =mo2c4 c) Ek = mv2 /c2 d) E = mc2

Answer: d

12. The purpose of the Michelson-Morley experiment was to

a) Determine the velocity of light. b) Detect possible motion of the Earth relative to the sun
c) detect possible motion of the sun relative to the ether. d) detect possible motion of the Earth relative to the ether

Answer: d

13. A man, who weighs 60 kg on earth, weighs 61 kg on a rocket, as measured by an observer on earth. What is the speed of the rocket?
a) 2.5 X 108 m/s b) 2.5 X 107 m/s c) 5.5 X 107 m/s d) 5.5 X 108 m/s
Answer: c

14. The momentum of a photon having energy 1.00 X 10-17 J is \_\_\_\_\_\_\_\_\_\_\_\_
a) 2.33 X 10-26 kg m/s b) 3.33 X 10-26 kg m/s c) 4.33 X 10-26 kg m/s d) 5.33 X 10-26 kg m/s
Answer: b

15. According to Einstein’s special theory of relativity, which of these objects should be the heaviest?

a) A b) B c) C d) D
Answer: c

16. Which effect is shown by the following figure?

a) Gravitational Redshift b) Gravitational Blueshift

c) Gravitational Lensing d) Gravitational force

Answer: c

17) Clocks in a moving reference frame, compared to identical clocks in a stationary reference frame, it appears to run
a) Slower b) Faster c) At the same rate d) Backward in time
Answer: a

18) If two identical clocks, one clock is placed on surface of the planet and other clock is placed in interstellar space, which runs faster
a) Space clock b) Planet clock

c) Both the clock runs at the same rate d) None of the above
Answer: a

19) An object moving at a relativistic speed in a stationary observer appears to
a) have length expanded and have a faster clock.
b) have length expanded and have a slower clock.
c) have length contracted and have a faster clock.

d) have length contracted and have a slower clock.
Answer: d

20) When does length contraction affect an object
a) Only when it is moving at speed nearer to the speed of light.
b) Only at slow speeds.
c) All times when it is moving. d) When it is not moving.
Answer: a

21) Length contraction states that an object shrinks in what
direction?
a) The same as its movement. b) All directions at once.
c) The direction perpendicular to its movement. d) Towards the object's center of mas

Answer: a

22) Which of the following is a postulate of special relativity
a) The laws of physics are the same for all observers in uniformly moving frames of reference
b) The relative speed of two objects is the same for all observers
c) The wavelength of light is the same for all observers d) None of the above
Answer: a

23) Einstein's Second Postulate of Special Relativity states
that the speed of light
a) can increase if the speed of the light source increases
b) is constant regardless of the speed of the observer
c) can decrease if the speed of the observer decreases
d) it changes depending upon its light source

Answer: b

24)If v << c, Lorentz transformation is the same as
a) Einstein’s transformation b) Planck’s transformation
c) Galilean transformation d) Maxwell’s transformation

Answer: c

25) Lorentz transformation is based on the principle of
consistency of velocity of light
a) True b) False
Answer: a

26) If two are simultaneous for one observer, they will be
simultaneous for all other observers as well.
a) True b) False

Answer: a

(27) A frame of reference moving with a constant velocity relative to a fixed frame is called

\_\_\_\_\_\_\_\_\_\_\_\_ frame

(b) inertial (b) non inertial (c) real (d) imaginary

Answer: b

(28) A frame of reference is accelerated relative to a fixed frame is called \_\_\_\_\_\_\_\_\_\_\_\_ frame

(b) inertial (b) non inertial (c) real (d) imaginary

Answer: b

(29) All the frames of reference that are rotating relative to a fixed frame of reference are the\_\_\_\_\_\_\_\_\_\_\_ frame of reference

(b) inertial (b) non inertial (c) real (d) imaginary

Answer: b

(30) If the moving frame of reference is accelerated the effective force acting on the particle

is \_\_\_\_\_\_\_\_\_ than the actual force

(a) zero (b) equal (c) smaller (d) higher

Answer: c

(31) Newton’s laws of motion are valid in the two systems moving with a \_\_\_\_\_\_\_ relative

velocity

(b) accelerated (b) double ( c ) non uniform (d) uniform

Answer: d

32. A spaceship, moving away from the Earth at a speed of 0.9c, fires a light

beam backward. An observer on Earth would see the light arriving at a speed of

a) 0.1c b) more than 0.1c but less than c c) c d) more than c but less than 1.9c.

Answer: c

33. The term "relativistic" refers to effects that are

a) observed when speeds are near the speed of light. b) noticed about a moving object.

c) observed when objects move backward in time. d) measured by stationary observers only

Answer: a

34. If an object reaches the speed of light, it’s length changes to \_\_\_\_\_\_\_\_\_\_\_

a) Infinite b) Double of the value c) Half of the value d) Zero

Answer: d

35. The length of a rod seems shorter to an observer when it moves in a specific

direction. What change would he observe when the direction of rod changes by 180o?

a) The rod becomes even smaller b) The length of the rod increases

c) The length of the rod remains the same d) The rod has the length equal to its proper length

Answer: c

36. How fast does a rocket have to move relative to an observer for its length to be contracted to 95% of its original length?

a) 0.5 c b) 0.4 c c) 0.3 c d) 0.2 c

Answer: c

37. A particle with a lifetime of 2 X 10-6 s moves through the laboratory with a speed of 0.9 c. It’s lifetime, as measured by an observer in the laboratory, is \_\_\_\_\_\_\_\_\_\_\_

a) 2 X 10-6 s b) 3.2 X 10-6 s c) 4.6 X 10-6 s d) 5.4 X 10-6 s

Answer: c

38. An atom A, moving relative to the observer, with velocity 2 X 108m/s emits a particle B which moves with a velocity of 2.8 X 108m/s with respect to the atom. The velocity of the emitter particle relative to the scientist is \_\_\_\_\_\_\_\_\_\_\_\_\_

a) 0.8 X 108m/s b) 2.4 X 108m/s c) 3 x 108m/s d) 2.95 X 108m/s

Answer: d

39. In a uniform circular motion

a. Velocity and acceleration both are constant

b. Acceleration and speed are constant but velocity changes

c. Acceleration and velocity both change d. Acceleration and speed both are constant

Answer: c

40. The equation, x = a cos (ωt + f) represents

a. Acceleration due to gravity b. Uniform straight line motion

c. dc current d. Simple harmonic motion

Answer: d

41. Relative to its period on the earth, the period a pendulum on the moon is

a. Shorter b. Longer c. The same as on the earth d. Varies with time

Answer: b

42. \_\_\_\_\_\_\_\_ transformation are replaced by the Lorentz transformation which confirms the

postulate of relativity.

a) Galelian b) Maxwell c) Plancks d) Newtons

Answer: a

43. Calculate the velocity of a body if its total energy is three times its rest

a) 0.54c b) 0.76c c) 0.94c d) c

Answer: c

44.Lorentz transformation of momentum for Y component \_\_\_\_\_\_\_\_\_\_\_

a) P`y = Py b) P`y = Pz c) P`y =Ex d) P`y = Bx

Answer: c

45. The speed of light is

a) E b) m c) Q d) C Answer: d

46. The equation, x = a cos (ωt + f) represents

a) Acceleration due to gravity b) Acceleration due to gravity

c) dc current d) Simple harmonic motion

Answer: d

47. As an object approaches the speed of light, it’s mass becomes \_\_\_\_\_\_\_

a) zero b) double c) remain same d) infinite

Answer: d

48) In relativity an electric field and magnetic fields are \_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) dependent b) independent c) interdependent d) null

Answer: c

49) A charged particle in an electromagnetic field experience a force

called\_\_\_\_\_\_\_\_\_\_\_\_

a) Gravitational force b) Lorentz force c) Frictional force d) Restoring force

Answer: b

50. The electric force is represented as \_\_\_\_\_\_\_\_\_\_

a) F=qE b) F=qE+q(uxB) c) F=q(E-uB) d) F=0

Answer: a

51. The Maxwell first equation is known as \_\_\_\_\_\_\_\_\_\_\_\_law.

a) coulombs b) newtons c) gauss d) keplers

Answer: c

52) Which of the following is Einstein’s mass energy relation?

a) Ek = (m – m0)c2 b) E2 – p2c2 = m02c4 c) Ek = mv2/c2 d) E = mc2

Answer: d

53) Relative to a stationary observer, a moving object\_\_\_\_\_\_\_\_\_

a) Appears longer than normal

b) Can do any of the above. It depends on the relative velocity between the

observer and the object

c) Appears shorter than normal. d) Keeps its same length time

Answer: d

54. In the classical mechanics the kinetic expression of a particle of mass m

and\_\_\_\_\_\_\_\_

a) force b) moving with velocity u c) momentum d) acceleration

Answer: b

55. The net force between two moving charges is \_\_\_\_\_\_\_\_\_\_\_

a) Zero b) 0ne c) infinite d) C

Answer: a

56.Length contraction equation is

a) L=LO √1-V2/C2 b)L=LO √1-C2/V2 c)L=LO d) LO=L

Answer:(a)

57.legrangian is defined as

a)L=T-V b)L=V-T c)L=L(T-V) d)L=T

Answer:(a)

58.Four dimensional space-time continuum known as

a) minkowski’s space b) world space

c) minkowski’s space & world space d) all of the above

answer:(d)

59.maxwell field equations are

a) div D=þ b) div B=0 c) curl E=0 d) a&b

answer:(d)

60) If v << c, Lorentz transformation is the same as
a) Einstein’s transformation b) Planck’s transformation
c) Galilean transformation d) Maxwell’s transformation.

Answer: c