

SECTION "A" (MULTIPLE CHOICE QUESTIONS)**1. Choose the correct answer for each from the given option:**

- I.** A bus of weight 3000N is moving with uniform velocity of 14m/s. its acceleration is:
- $14ms^{-2}$
 - Zero
 - $7ms^{-2}$
 - $9.8ms^{-2}$
- II.** The angular speed of the minute hand of a clock is:
- $\frac{\pi}{30}$
 - $\frac{\pi}{60}$
 - $\frac{\pi}{1800}$
 - $\frac{\pi}{3600}$
- III.** A projectile is fired at an angle θ with the horizontal will be minimum at:
- The highest point
 - The point of projection
 - The point of landing on the ground
 - All point of its path
- IV.** Torque is maximum when force:
- Is parallel to moment arm
 - Is anti-parallel to moment arm
 - Makes an angle of 60° with moment arm
 - Is perpendicular to moment arm
- V.** Light year is the unit of:
- Time
 - Distance
 - Velocity
 - Luminous intensity
- VI.** The ocean tides are caused by:
- Earth's gravitational force only
 - Moon's gravitational force only
 - Sun's gravitational force only
 - Gravitational force of both the sun and the moon
- VII.** If a man goes above the earth's radius, the value acceleration due to gravity at that point becomes:
- $\frac{1}{3}g$
 - $\frac{1}{4}g$
 - $\frac{1}{9}g$
 - $\frac{1}{-16}g$
- VIII.** Both kilowatt hour and electron volt are unit of:
- Power
 - Energy
 - Charge
 - Angular momentum

- IX.** If the frequency of the fifth harmonic of a vibration string is 200Hz, it's fundamental frequency is:
- 5 Hz
 - 25hZ
 - 40hz
 - 100Hz
- X.** The speed of sound in vacuum is:
- Zero
 - $332ms^{-1}$
 - $33200cms^{-1}$
 - $3 \times 10^8ms^{-1}$
- XI.** The distance between two consecutive nodes of a transverse stationary wave is equal to:
- $\frac{\lambda}{4}$
 - $\frac{\lambda}{-2}$
 - λ
 - 2λ
- XII.** The number of lines per cm of a diffraction grating is 4000. It's grating element is:
- $2.5 \times 10^{-4}cm$
 - $2.5 \times 10^{-6}cm$
 - 4×10^2cm
 - 4×10^5cm
- XIII.** An astronomical telescope is focused at infinity. The focal length of its objective is 0.2m and that of the eyepiece is 5cm. the length of the telescope is:
- 2.5cm
 - 4cm
 - 5.2cm
 - 25.cm
- XIV.** The ratio of S.I unit of angular momentum to linear momentum is:
- J.s
 - $N.J^{-1}$
 - $J.N$
 - $J.N^{-1}$
- XV.** The number of significant figure in 106×10^{-19} is:
- 2
 - 3
 - 4
 - 6
- XVI.** The magnitude of product $k.(j \times i)$:
- Zero
 - 1
 - 1
 - $|k|$
- XVII.** Stoke's law is applicable to the:
- Bodies resting on the surface of liquid
 - Moving bodies through viscous medium
 - Moving bodies through non viscous medium
 - Moving bodies through vacuum

SECTION "B" (SHORT –ANSWER QUESTION)

NOTE: Answer 10 question from this section

(40)

1. What does the term radar stand for? On what principle does the RADAR work? Which one of the following has larger wavelength and larger frequency?
 - a) Sound waves
 - b) Light waves
2. If $\vec{A}=2\hat{i}-6\hat{j}-3\hat{k}$ and $\vec{B}=4\hat{i}+3\hat{j}-\hat{k}$, find a unit vector perpendicular to the plane of A and B.
3. What is meant by an isolated system? Prove that the linear momentum of two interacting bodies is conserved in an isolated system.
4. The ratio of acceleration due to gravity inside a deep mine to that on the surface earth is 0.99. Find the depth of the mine, assuming that the density of the earth is uniform. Take the radius of the earth as $6.38 \times 10^6 \text{ m}$.
5. a horse pulls a cart horizontally with a force of 60 lb at an angle of 30° above the horizontal and moves along at a speed of 8 miles per hour. How much work does the horse do in 15 minute and what is the power output of the (1hp=550 ft-lb/s), (1mile=5280ft).
6. If the radius of the 5th dark Newton's ring is 3mm when light of wavelength $5.89 \times 10^{-7} \text{ m}$ is used, what will be the radius of curvature of the lower surface of the lens used.
7. Show that the expression $f = \frac{1}{2\ell} \sqrt{\frac{f \times \ell}{m}}$ is dimensionally correct and find the dimensions of kinetic energy.
8. A boy standing 12m from a building can just barely reach the roof 10m above him when he throws a ball at the optimum angle with respect to the ground. Find the initial velocity components of the ball.
9. Name the acceleration produced due to the change in the direction of linear velocity of a body moving in a circle. Derive the relevant mathematical expression for it.
10. Two thin convex lenses of focal lengths f_1 and f_2 are placed in contact with each other. Drive an expression for the focal length of their equivalent lens.
11. A diffraction grating produce 3rd order spectrum of light of wavelength $7 \times 10^{-7} \text{ m}$ at an angle of 30° from the normal. What is its grating element? Calculate the number of lines per mm.
12. A lens 2cm focal length is to be used a magnifying glass. How far from the lens should the object be placed? What is magnifying power?
13. Prove that the motion of simple pendulum is simple harmonic when it is given small displacement.
14. Define torque of a couple and prove that $\tau = fd$.
15. A 100 cm long string vibrated in 4 loops at 50 Hz. The linear density of the string is $4 \times 10^{-4} \text{ gram/cm}$. calculate the tension in the string.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

(28)

3.

- a) Gives the construction and working of an astronomical telescope. Derive an expression for its magnifying power when it is focused for infinity.
- b) What is an inclined plane? A body mass m is sliding down and inclined plane. Drive expression for the acceleration of the body in the
 - I) Presence of friction
 - II) Absence of friction

4.

- a) What is Doppler Effect? Derive expression for the apparent frequency heard by the listener when:
 - I) The listener moves towards the stationary source.
 - II) The source move towards the stationary listener.
- b) Derive an expression for the mass of the sun. What conservation filed? Prove that gravitational field is a conservative field.

5.

- a) By rectangular components method, describe step, the addition of two vectors \vec{A}_1 and \vec{A}_2 , making angles θ_1 and θ_2 with x-axis respectively.
- b) Give the quantitative description of young's double slit experiment. Derive an expression for fringe spacing's.

PHYSICS

2016

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

- I) The dimensions of G are:
 - a) $M^{-1}L^3T^{-2}$
 - b) $M^2L^2T^{-2}$
 - c) $M^{-1}L^2T^{-2}$
 - d) MLT^{-2}
- II) Of velocity of a body is decreasing, the direction of acceleration is:
 - a) Opposite to the direction of velocity
 - b) In the direction of velocity
 - c) 60° to the direction of velocity
 - d) Perpendicular to the direction of velocity
- III) The rate of change of angular momentum is also known as:
 - a) Linear momentum

- b) Torque
 - c) Force
 - d) Energy
- IV) At a distance equal to twice radius of the earth, above the surface of the earth, the value of gravitational acceleration will be:
- a) One half
 - b) One fourth
 - c) Four times
 - d) One ninth
- V) The range of audible sound is:
- a) 1hz- 10jz
 - b) 20hz-20000hz
 - c) 21000hz-24000hz
 - d) 25000hz-50000hz
- VI) The condition of interference in thin film are reserved due to :
- a) Diffraction
 - b) Phase reversal
 - c) Refraction
 - d) Phase coherence
- VII) The magnifying power of a lens of focal length 1/2cm is:
- a) 1 dioptre
 - b) 2 dioptre
 - c) 50 dioptre
 - d) 100 dioptre
- VIII) This equation represents bragg's law:
- a) $M\lambda = 2d \sin \theta$
 - b) $M\lambda = d \sin \theta$
 - c) $2M\lambda = d \sin \theta$
 - d) $2M\lambda = 3d \sin \theta$
- IX) This equation between the principal focus and the optical centre is called:
- a) Aperture
 - b) Focal length
 - c) Principal axis
 - d) Radius of curvature
- X) If \hat{i}, \hat{j} and \hat{k} are unit vectors then $\hat{k} \cdot (\hat{i} \times \hat{j})$ is equal to:
- a) Zero
 - b) One
 - c) \hat{j}
 - d) \hat{k}
- XI) The angle between centripetal acceleration and tangential acceleration in circular motion is:
- a) 180°
 - b) 0°
 - c) 90°
 - d) 45°
- XII) Kitabul manazir was written by:
- a) Ibn-al haitham

- b) Al razi
 c) Abu-rehan al beruni
 d) Jabir bn hayyan
- XIII)** One radian is equal to:
 a) 1°
 b) 75.3°
 c) 57.3°
 d) 0.017°
- XIV)** One kilo watt hour is equal to:
 a) $3.6 \times 10^6 j$
 b) $3.3 \times 10^9 j$
 c) $3.9 \times 10^6 j$
 d) $3.6 \times 10^9 j$
- XV)** Two vibrating bodies, having slightly different frequencies, produce:
 a) Echo
 b) Beats
 c) Resonance
 d) Polarization
- XVI)** If $\vec{A} \cdot \vec{B} = 0$, $\vec{A} \times \vec{B} = 0$, and $\vec{A} \neq \vec{0}$, then vector \vec{B} is:
 a) Equal to \vec{A}
 b) Parallel to \vec{A}
 c) Perpendicular to \vec{A}
 d) Zero
- XVII)** Kinetic friction is always:
 a) Greater than static friction
 b) Equal to static friction
 c) Less than static friction
 d) Zero

PHYSICS

2016

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

**NOTE: Answer 10 question from this section
 (40)**

1. Deduce the expression for the variation of acceleration due to gravity 'g' with altitude.
2. Show that the following formulae are dimensionally correct:
 - a) $v = f\lambda$
 - b) $T = 2\pi \sqrt{\frac{m}{k}}$
3. Tarzan swings on a vine, of length 5m, in a vertical circle, under the influence of gravity, when the vine makes an angle of 30° with the vertical, Tarzan has a speed of 4 m/s. find
 - a) Centripetal acceleration at this instant

- b) His tangential acceleration
4. A uniform ladder, of length 'L' and weight 50 N, rests against a smooth vertical wall. If the coefficient of friction between angle θ such that the ladder may not slip.
 5. The radius of the moon is 27% of the earth radius and its mass is 1.2% of the earth mass. Find the acceleration due to gravity on the surface of the moon. How much will a 424 N body weigh there?
 6. A water pump is needed to lift water through a height of 2.2 m at the rate of 500 gm/minute. What will be the minimum horsepower of the pump?
 7. A moving car has a siren sounding a 2 kHz tone. What frequency will be detected by a stationary observer as the car approaches him at 80 km/h? (Speed of sound = 1200 km/h).
 8. It is observed that all bodies, sliding down a frictionless inclined plane, have same acceleration. How does it happen? Explain.
 9. Prove that the gravitational is a conservative field.
 10. A converging lens of 4 dioptres is placed in contact with a diverging lens of -2 dioptres. Find the power and the focal length of combination.
 11. Determine the unit vector perpendicular to the plane of $A=3i+4j-k$ and $B=4i+3j-2k$ vector.
 12. A car starts from rest and moves with a constant acceleration. During the 5th second of its motion, it covers a distance of 36m. calculate:
 - a) Acceleration of the car
 - b) Distance covered by the car during this time
 13. A string 2 m long, of mass 0.004 kg, is stretched horizontally by passing one end over a frictionless pulley and a mass of 1 kg is suspended, find the speed of transverse waves on the string.
 14. Derive an expression for the centripetal acceleration produced by the body of mass 'S' moving along circular path of radius 'r'.
 15. In a double slit experiment, the separation of the slit is 1.9 mm and the fringe spacing is 0.31mm, at a distance of 1 m from the slits. Find the wavelength of light.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

- (28)
3.
 - a) Defines scalar and vector product. Show that:
 - $A \cdot B = B \cdot A$
 - $B \cdot (A+C) = B \cdot A + B \cdot C$
 - b) What are Newton's rings? Derive the expression for the radius of nth bright ring.
 4.
 - a) Define elastic and inelastic collision, two non-rotating spheres of masses m_1 and m_2 , initially moving with the velocities u_1 and u_2 respectively in one dimension, collide elastically. Derive the expression for their final velocities v_1 and v_2 .
 - b) Describe the construction and working of compound microscope. Derive the formula for its magnification
 5.
 - a) a particle is in a state of uniform circular motion. Show that its projection along one of its diameters executes simple harmonic motion.
 - b) Define projectile motion, a projectile is thrown in the air at an angle ' θ ' with the horizontal with the velocity v_0 derive the equation for the time of flight and the range of projectile.

PHYSICS

2015

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

I. Electron volt is the unit of:

- a) Power
- b) Voltage
- c) Energy
- d) Charge

II. Intravenous injection by means of silver syringe was initially used by:

- a) Ibn-e-sina
- b) Omer Khayyam
- c) Al-beruni
- d) Jabir bin hayan

III. The y-components of vector $|A|=15$ units when it forms an angle of 50° with positive x-axis is:

- a) 9.6 units
- b) -9.6 units
- c) 11.5 units
- d) -11.5 units

IV. The rate of change of linear momentum is:

- a) Acceleration
- b) Torque
- c) Force
- d) Velocity

V. If 'F' be the limiting friction and 'R' the normal reaction. Then co-efficient of static ' μ ' is:

- a) $\mu = \frac{f}{r}$
- b) $\mu = \frac{r}{f}$
- c) $\mu = FR$

d) $\mu = \frac{1}{FR}$

VI. When a torque acting on a system is zero, this will be constant

- a) force
- b) angular momentum
- c) linear momentum
- d) velocity

VII. The unit of angular velocity is:

- a) Radian/cm
- b) Metre/sec
- c) Radian.sec
- d) Radian/ sec^2

VIII. The value of gravitational constant 'G' was determined experimentally by:

- a) Cavendish
- b) Newton
- c) Joules
- d) Huygen

IX. Newton's rings illustrate the phenomenon of:

- a) Polarization
- b) Diffraction
- c) Interference
- d) Dispersion

X. The final image formed by a compound microscope is :

- a) Virtual and diminished
- b) Real and diminished
- c) Real and magnified
- d) Virtual and magnified

XI. The dimension of 'G' are:

- a) $ML^{-1}T$
- b) $ML^{-2}T^{-3}$
- c) $M^{-1}L^3T^{-2}$
- d) ML^2T^{-2}

XII. In thin interference, the position of constructive and destructive interference are interchanged due to:

- a) Phase coherence
- b) Phase reversal
- c) Diffraction
- d) Interference

XIII. The angle between centripetal and tangential acceleration in circular motion is:

- a) 108°
- b) Zero
- c) 90°
- d) 45°

XIV. The velocity of a wave of wavelength ' λ ' and frequency ' ν ' is given by:

- a) $\frac{\nu}{\lambda}$
- b) $\frac{\lambda}{\nu}$
- c) $\nu\lambda$
- d) $\frac{1}{\nu\lambda}$

XV. Polarization of light due to tourmaline crystals takes place because of:

- a) Reflection
- b) Absorption

c) Refraction

d) Collision

XVI. Two convex lenses of same focal length ; f are lensi is:

a) $2f$

b) $f/2$

c) $2+f$

d) $2-f$

XVII. This one of the following is not the unit power:

a) Horse power

b) Joule/sec

c) Kilowatt hour

d) Foot-pound/sec

PHYSICS

2015

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

NOTE: Answer 10 question from this section (40)

- i. Derive an expression for acceleration of a body moving downward on an inclined plane making angle ' θ ' with the horizontal when friction is present.
- ii. At what distance from centre of earth does the gravitational acceleration have one third of the value that it has on the earth's surface?
- iii. A 80 kg man runs up a hill through a height of $3n$ in 2 sec. what is his average power output?
- iv. A car emitted a note of frequency 490 Hz, if the car approaching towards a stationary listener at speed of 55 km/h, what frequency will be detected by the listener. Take speed of sound as 334 m/s.
- v. An object moves along a straight line in a force field from (3, 2, -6) to (14, 13, 9) when a uniform force $f=4i+j+3k$ acts on it. Find the work done.
- vi. If the tension in a string is increased four times, what will be the effect on the speed of standing waves in the string?
- vii. A boy whose mass is 100 kg when resting on the ground at the equator if the radius of earth ' R ' is 6.4×10^6 m calculate the centripetal acceleration & centripetal force
- viii. Why and how artificial gravity is created in a space craft. Derive a formula for spinning frequency of the space craft to provide artificial gravity.
- ix. What is the necessary condition to observe the interference of light? Differential between interference and diffraction.
- x. Prove that $v=r\omega$ or $a=ra$.
- xi. Derive the work-energy equation.
- xii. Two sides of a triangle are formed by vector $A=3i+6j-2k$ and $B=4i-j+3k$, determine the area of the triangle.
- xiii. A 100 g bullet is fired from a 10 kg gun with a speed of 1000m/s. what is speed of recoil of the gun?
- xiv. A body hanging from a spring is set into motion and the period of oscillation is found to be 0.5 sec. after the body has come to rest, it is removed. How much shorter will the spring be when it comes to rest.

- xv. A parallel beam of x-rays is diffracted by rock salt crystal. The 1st order maximum being obtained when the glancing angle of incidence is 6 degree and 5 minute, the distance between the planes of crystal is 2.81×10^{-10} . Calculate the wavelength of radiation.

SECTION "C" (DETAILED –ANSWER QUESTION)

**NOTE: attempt 2 questions from this section. Draw diagram where necessary
(28)**

- 3.
- Two vectors P and Q are acting on a point making angles θ_1 and θ_2 with positive x-axis respectively. Find the expression for the magnitude of the resultant vector and its direction.
 - What is a simple pendulum? Prove that the motion of a simple pendulum is simple harmonic. Derive the expression for its time period.
- 4.
- Defines longitudinal waves & transverse waves. Derive the expression for the frequency of a stretched string vibrating in;
 - One loops
 - Two loops
 - Three loops
 - An object is thrown upward with initial velocity v_0 at the angle ' θ ' with horizontal. Derive the expression for;
 - Time required to reach maximum height
 - Horizontal range
- 5.
- Explains the young's double slits experiment and derive formula for fringe spacing.
 - Two bodies of unequal masses are attached to the ends of a string which passes over a frictionless pulley. If one body moves vertically downward and the second body moves horizontally on a smooth horizontal surface. Derive the expression for tension in the string and acceleration of the bodies.

OR define visual angle and least distance of distinct vision with the help of a diagram derive the expression for magnifying power of magnifying glass.

PHYSICS

2014

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

- I. If a person ascends from the surface of the earth to the distance equal to the radius of the earth, the value of g will be:
- $\frac{1}{2}g$
 - $\frac{1}{4}g$
 - $2g$
 - $4g$
- II. Kilowatt hour is unit of:

- a) Energy
- b) Power
- c) Time
- d) Force

III. The earth quake waves are the example of :

- a) Audible waves
- b) Infrasonic waves
- c) Shock waves
- d) Ultrasonic waves

IV. The unit of luminous intensity is:

- a) Decibel
- b) Candela
- c) Dioptre
- d) $\frac{W}{m^2}$

V. The distance between two consecutive nodes of a converging wave will be:

- a) λ
- b) $\frac{\lambda}{2}$
- c) $\frac{\lambda}{4}$
- d) $\frac{\lambda}{6}$

VI. If an object is placed at principal focus 'F' of a converging lens, the image will be formed:

- a) At F
- b) At 2F
- c) At infinity
- d) Between focus & optical centre

VII. If $A=5i+j$ and $B=2k$ then $A-B$ is equal to:

- a) $5i+j+2k$
- b) $5i-j+2k$
- c) $5i+j-2k$
- d) $-5i-j+2k$

VIII. Diffraction of light is a special types of:

- a) Reflection
- b) Refraction
- c) Interference
- d) Polarization

IX. An angle subtended at its centre by an arc whose length is double to that of its radius is:

- a) 84.3°
- b) 57.3°
- c) 114.6°
- d) 168.6°

X. The length of a Galilean telescope when focused for infinity is:

- a) $\frac{F_0}{F_e}$
- b) $\frac{F_e}{F_0}$
- c) F_0+F_e
- d) F_0-F_e

XI. Artificial gravity can be created in the spaceship by producing:

- a) Translatory motion
- b) Vibratory motion

- c) Spin motion
d) Orbital motion
- XII.** If mass and speed both are double, the kinetic energy will be
a) Double
b) Four times
c) Six times
d) Eight times
- XIII.** The noble price in physics was rewarded to this Pakistani scientist:
a) Dr.abdul qadeer khan
b) Dr.saleem uz zaman siddiqui
c) Dr.abdus salam
d) Dr. samar muburak mand
- XIV.** In young double slit experiment, the fringe spacing is:
a) $\frac{d\lambda}{L}$
b) $\frac{L\lambda}{d}$
c) $\frac{ld}{\lambda}$
d) $L\lambda d$
- XV.** If the mass of the bob of the simple pendulum is doubled, its time period will be:
a) Be doubled
b) Become doubled
c) Remain the same
d) Havled
- XVI.** If $A \cdot B = 0$, $A \times B =$ and $A \neq 0$ vector B is equal to:
a) Zero
b) Perpendicular
c) Anti parallel to
d) Equal to A
- XVII.** The dimension of torque is:
a) ML^2T
b) ML^2T^{-2}
c) ML^2t^2
d) MLT^{-2}

PHYSICS

2014

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

**NOTE: Answer 10 question from this section
(40)**

- i. A particle of mass 500 gm rotates in a circular orbit of radius 25 cm at a constant rate 105 revolution per second. Find the angular momentum with respect with to centre of the orbit.
- ii. How is the magnifying power of the
 - a) Astronomical telescope and
 - b) Compound microscope affected by increasing the focal length of their objectives?

- iii. Drive an expression for the variation of 'g' with altitude.
- iv. A car starts from rest and moves with a constant acceleration during the 4th second of its motion, it covers a distance of 24 metres. Calculate the acceleration and the total distance covered by the car during the time.
- v. If the tension in a string is increased four times, what will be the effect on the speed of standing waves in the string?
- vi. What is the difference between static and dynamic equilibrium? State the condition of equilibrium. **OR** a string 2m long and mass 0.004kg is stretched horizontally by passing one end over a frictional pulley and attaching a 1kg mass vertically to it. Find the speed of the second and fourth harmonics to which the string will resonate.
- vii. State and prove the law of conservation of linear momentum.
- viii. Green light wavelength 5400 Å is diffracted by grating having 2000 lines/cm. compute the angular deviation of the third order image.
- ix. A mortar shell is fired at a ground level target of 400m distance with an initial velocity 85cm/sec. calculate the maximum time to hit the target.
- x. Determine the unit vector perpendicular to the plane containing A and B, if $A=2i-3j-k$, $B=i+4j-2k$. **OR** prove that $|A \times B|^2 + (A \cdot B)^2 = A^2 B^2$
- xi. Prove that the gravitational field is a conservative field.
- xii. Calculate the centripetal acceleration force on a man whose mass is 80 kg when resting on the ground at the equator if the radius of earth is 6.4×10^6 metres.
- xiii. The radius of moon is 27% of the earth radius and its mass is 1.2% of the earth mass. Find the acceleration due to gravity on the surface of the moon.
- xiv. A pump of how much minimum horse power is needed to lift water through a height of 2.5cm at the rate of 50g/min?
- xv. A watch maker uses a magnifying glass of focal length 5cm to see the damaged spring of a watch. If he holds the glass close to the eye what is the best position of the object? What is the linear magnification?
OR differentiate between Fresnel & Fraunhofer diffraction.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

(28)

3.

- a) Defines elastic of masses and inelastic collisions. Two non-rotating spheres of masses m_1 & m_2 , initially moving with the velocities u_1 and u_2 respectively in one dimension, collide elastically. derive the expression for their final velocities v_1 and v_2 .
- b) What are the Newton's rings? Derive the expression for the radius of the nth bright ring.

OR define centripetal acceleration and centripetal force. Derive an expression for centripetal acceleration.

4.

- a) Defines scalar and vector products and shows that:
 - i) $A \times B \neq B \times A$
 - ii) $A \cdot (B + C) = A \cdot B + A \cdot C$
- b) With the help of a ray diagram, describe the construction & working of an astronomical telescope & derive the formula for its magnification when it is focused for infinity.

5.

- a) Defines simple harmonic motion. A particle in its state of uniform circular motion. Prove that its projection along one of its diameters executes an unequal simple harmonic motion.

- b) Two bodies of unequal masses m_2 ($m_1 > m_2$) are attached to the ends of a string which passes over a frictionless pulley. If they are moving vertically, derive the expression for the tension string and the acceleration of the bodies.

PHYSICS

2013

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

I) Power law determines:

- a) Intensity
- b) Work
- c) Power
- d) Loudness of sound

II) If the average and instantaneous velocities of a body are the same, the body will move with:

- a) Variable velocity
- b) Uniform velocity
- c) Uniform acceleration
- d) Variable acceleration

III) The maximum number of beats per second which can be detected by the human ear is :

- a) 2
- b) 3
- c) 5
- d) 7

IV) In the terrestrial telescope, the central lens is used to:

- a) Erect the image
- b) Increase magnifying power
- c) Both of these
- d) None of these

V) Two forces act together on an object, the magnitude of their resultant is minimum when the angle between them is:

- a) 0°
- b) 45°
- c) 90°
- d) 180°

VI) A body falls freely. The distance covered by it in 2 sec is:

- a) 9.8m
- b) 19.6m
- c) 39.2m
- d) 100m

VII) The centre of mass of a body:

- a) Always coincide with the centre of gravity
- b) Never coincides with the centre of gravity

- c) Coincide with centre of gravity only in uniform field
d) Is lower than the centre of gravity
- VIII)** The weight of a man is 600N at the earth , his weight on the moon, where $g_m = \frac{g}{6}$, will be:
a) 3600N
b) 600N
c) 300N
d) 100N
- IX)** The angular momentum of a particle changes from 0 to 720 J.S in 4sec.; the magnitude of torque acting will be:
a) 1440j
b) 360 j
c) 180 j
d) 4.5 j
- X)** A wave enters from one medium to another medium, no change is occurs in its:
a) Frequency
b) Wavelength
c) Amplitude
d) Speed
- XI)** Monochromatic yellow light is unable to show:
a) Reflection
b) Refraction
c) Dispersion
d) Interference
- XII)** Power of a magnifying glass having focal length 5 cm is:
a) 5 diopter
b) 10 diopter
c) 20 diopter
d) 50 diopter
- XIII)** The dimension of force is:
a) MLT
b) MLT^{-1}
c) MLT^2
d) MLT^{-2}
- XIV)** Light year is the unit of:
a) Time
b) Distance
c) Velocity
d) Intensity
- XV)** The time period of simple pendulum depends upon:
a) Mass
b) Length
c) Acceleration due to gravity
d) Both length and acceleration due to gravity
- XVI)** If the sum of torque acting on a body is zero, then this will be constant:
a) Force
b) Linear momentum
c) Pressure
d) Angular momentum
- XVII)** A weight lifter consumes 500j of energy to lift a load in 2 second, the power used by him is:
a) 125 watt

- b) 250 watt
- c) 500 watt
- d) 1000 watt

PHYSICS

2013

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

NOTE: Answer 10 question from this section

(40)

- i) $A=3i+j-2k$ and $B=-i+3j+4k$. find the projection of A and B
- ii) The mass of moon is approximately one eightieth ($1/80$) of the mass of earth and its radius is approximately one fourth ($1/4$) that of earth. Determine the acceleration due to gravity at the surface of the moon.
- iii) A sound wave of frequency 500 Hz in air enters from a region of temperature 25°C to a region of temperature 5°C . Calculate the percent fractional change in wavelength.
- iv) Prove that $|A \times B|^2 + (A \cdot B)^2 = A^2 B^2$
- v) A horse pulls a cart horizontally with a force of 40N at an angle of 25° above the horizontal & moves along at a speed of 15 m/s. how much work will the horse do in minute? What is the power output of the horse? Give your answer in horse power.
- vi) A stone is dropped from the peak of a hill. It covers a distance of 30 metres in the last second of its motion; find the height of the peak.
- vii) A magnifying glass of focal length 6 cm is used to see a small specimen. The least distance of distinct vision of the observer is 25cm. what is the magnifying power of the lens?
- viii) Tarzan swings on a vine of length 5m in a vertical circle under the influence of gravity. When the vine makes an angle of 30° with the vertical, tarzan has a speed of 4m/s. find (a) centripetal acceleration at this instant (b) his tangential acceleration.
- ix) A car is waiting at a traffic signal. As turns green, the car starts ahead with a constant acceleration of 3m/s. at the same time, a bus traveling with a constant speed of 20 m/s overtakes and passes the car? (a) How far beyond its starting point will the car overtake the bus? (b) What will be the velocity of the car at that time?
- x) A body hanging from a spring is set into motion. The period of oscillation is found to be 0.4s. After the body comes to rest, it is removed. How much shorter will the spring be when it is separated from the body?
- xi) Why does a diver pull his hands and legs close to his body when jumping from a diving board in the swimming pool to get more summersaults?
- xii) Define tension in a string. Derive the expression for the acceleration of two vertically connected bodies to the ends of a string which passes over a frictionless pulley, when $M > m$
- xiii) Differentiate between Fresnel and Fraunhofer diffraction.
- xiv) Discuss the motion of a body moving in an inclined plane, derive the expression for its acceleration in the inclined of frictional force.
- xv) Show that the following formulae are dimensionally correct
 - a) $V=f\lambda$
 - b) $T=2\pi\sqrt{\frac{m}{k}}$

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

(28)

- 3.
- Describes the addition of two vectors by rectangular components method.
 - With the help of ray diagram of a compound microscope, describe its working and derive the relevant formula for its magnification.
- 4.
- Defines projectile motion. Derive the expression for the range and maximum height.
 - What is Doppler's effect? Derive the expression for the frequency detected by a stationary listener.
 - When the source moves towards the listener.
 - When the source moves away from the listener.
- 5.
- What is the basic condition for interference of light? How did Thomas young experimentally confirm the wave nature of light? Derive the expression for the fringe spacing.
 - What are stationary waves? Discuss the vibration in a stretched string when it vibrates in
 - Three loops.
 - Two loops
 - Three loops. Also derive the formula for the frequency of loops.

PHYSICS

2012

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

I) The length of gailean telescope is equal to:

- $\frac{f_0}{f_e}$
- $f_0 - f_e$
- $f_e - f_0$
- $f_0 + f_e$

II) The S.I unit of intensity level of sound is:

- Watt

- b. Diopter
- c. Sone
- d. Decibel

III) If the axis of rotation of a rotation body passes through the body itself, then its motion is called:

- a. Linear motion
- b. Spin motion
- c. Orbital motion
- d. S.H motion

IV) If magnifying power of simple microscope is 6, the focal length of the lens used is:

- a. 6 cm
- b. 5 cm
- c. 25 cm
- d. -5 cm

V) The property of fluids due to which they resist their flow is called:

- a. Static friction
- b. Viscosity
- c. Terminal velocity
- d. Coefficient of friction

VI) The frequency of wave produced in a stretched string depends upon:

- a. Length
- b. Tension
- c. Linear density
- d. All of these

VII) According to Maxwell theory, light travels in the form of:

- a. Transverse wave
- b. Longitudinal wave
- c. Mechanical wave
- d. Electromagnetic wave

VIII) At a distance equal to the radius of the earth above the surface of earth, the value of gravitational acceleration becomes:

- a. Half
- b. One fourth
- c. double
- d. four times

IX) The products of two numbers 5.642 and 4.71 in the prospective significant number is:

- a. 26.57382
- b. 26.574
- c. 26.6
- d. 26.5738

X) Huygen's principle is used to:

- a. Determined the speed of light
- b. Locate the wave front
- c. Expressed polarization
- d. Find the refractive front

XI) A bucket of mass 10 kg is moved downwards in the gravitational field through a distance of 1 m. the work done in this case is equal to:

- a. 10 joule
- b. 98 joule
- c. -98 joule
- d. 0.1 joule

- XII)** The magnitude of torque of the couple depends on:
- The distance of (F) from origin
 - The distance (-F) from origin
 - The distance between (F) and (-F)
 - None of these
- XIII)** $\sin\theta = \theta$ if θ is specifically less than:
- 15°
 - 10°
 - 5°
 - 1 radian
- XIV)** The rate of doing work is zero when the angle between force and velocity is:
- 0°
 - 45°
 - 180°
 - 90°
- XV)** If $A = a_i$ and $B = b_j$, then $A \times B$ is equal to:
- $\vec{0}$
 - Ab_k
 - $-ab_k$
 - None of these
- XVI)** If the velocity of a body is doubled and mass is reduced to one fourth of its initial value, the K.E is:
- Doubled
 - Four-fold
 - Same
 - Halved
- XVII)** A helicopter weighing 3920 is moving up with a constant speed of 4m/sec. the force on the helicopter is
- 4720n
 - 3920N
 - 3924N
 - 3916N

PHYSICS

2012

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

**NOTE: Answer 10 question from this section
(40)**

- Define angular velocity. Give its units. Establish the relation $v = \omega r$
- Give the dimension of the following quantities: (a) Torque (b) Angular momentum (c) Pressure (d) K.E
- Two vector A and B are such that $|A|=4$, $|B|=6$ and $|A-B|=5$. Find the $|A+B|$
- An object weighing 98N is dropped from a height of 10m. it is found to be moving with a velocity 12m/sec just before it hits the ground. How large was the frictional force acting upon it?
- In a double slit experiment, eight fringes occupy 2.62mm on a screen 145 mm away from the slits. The wave length of light is 545mm. find the slit separation.

- vi. A diver leaps from a lower with an initial horizontal velocity components of 7m/sec and upward velocity components of 5m/sec. find the components of his velocity along x and y after 1.5 sec
- vii. Find the velocity of sound in a gas when two waves, of wavelength 0.8m and 0.81, respectively, produce 4 beats per seconds.
- viii. At what suitable angle is the maximum height of the projectile 1/3 of its range?
- ix. In a translator motion, it is not necessary for a body to move in a straight line. Discuss the statement.
- x. How many times in a second a spaceship of diameter 30 m needs rotated in order to create the similar gravity as experienced on earth.
- xi. A particle of mass 0.5 kg moves along xy-plane, at that instant, the coordinates are (3,4)m and its velocity is $(4\mathbf{j}+5\mathbf{j})$ m/sec determine the angular momentum relative to origin at that time.
- xii. An astronomical telescope has a length of 105 cm, and its magnification is 6. Determine the power of objectives and eye piece.
- xiii. A string, 1m long and of mass 0.0004 kg, is stretched with a force. Calculate the force if the speed of the wave in the string is 140m/sec.
- xiv. In what way was Newton able to conclude that the force responsible to rotate the moon around the earth is same as the force which causes an apple to fall on the surface of earth?
- xv. With the help of diagram, show the force acting on simple pendulum. Hence derive the expression for its time period.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

(28)

3.

- a) Defines elastic collision. Two non-rotating spheres of masses m_1 & m_2 , initially moving with the velocities u_1 and u_2 respectively in one dimension, collide elastically. Drive the expression for their final velocities v_1 and v_2 .
- b) How can you magnifying glass be used as a simple microscope. Derive the expression for its magnifying power. Write two differences between astronomical telescope and Galilean telescope.

4.

- a) Defines scalar and vector products, give one example of each.

Show that (1) $A \times B \neq B \times A$ (2) $A \cdot (B+C) = A \cdot B + A \cdot C$

- b) Discuss the Newton formula for the speed of sound and the flaw in it. In what way did Laplace correct the formula?

5.

- a) What are Newton's rings? Derive the expression for the radius of nth bright ring.
- b) Derive the expression for absolute gravitational potential energy.

OR derive expression for the variation of acceleration due to gravity with altitude or depth.

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

I. Earthquake waves are the example of:

- a. Audio waves
- b. Infrasonic waves
- c. Ultrasonic waves
- d. Shock waves

II. The waves theory of light cannot explain:

- a. Polarization
- b. Photoelectric effect
- c. Interference
- d. Diffraction

III. The magnifying power of a lens of focal length 25 cm is:

- a. $\frac{1}{2}$
- b. 1
- c. Zero
- d. 2

IV. Light year is the unit of:

- a. time
- b. energy
- c. distance
- d. intensity

V. A one kilogram stone, falling freely from a height of 10 metre, strikes the ground with a velocity of:

- a. 14 m/s
- b. 10 m/s
- c. 98 m/s
- d. 19.6 m/s

VI. When the angular velocity of a disk increases, angular acceleration α and angular velocity

- a. Parallel
- b. Non parallel
- c. Perpendicular
- d. None of these

VII. If the speed of moving body is halved, its kinetic energy becomes:

- a. One fourth
- b. Half
- c. Three times
- d. Four times

VIII. Electromagnetic waves consist of oscillating electric and magnetic fields, both are:

- a. Parallel to each other
- b. Perpendicular to each other
- c. Non parallel to each other
- d. none of these

IX. This is compressional wave:

- a. Light wave
 - b. X-rays
 - c. Sound wave
 - d. Radio wave
- X.** It two tuning forks of frequencies 256 Hz and 260 Hz are sounded together. The number of beats per second will be:
- a. 3
 - b. 5
 - c. 5
 - d. 6
- XI.** Is $A \cdot B = 0, A \times B = 0$ and $A \neq 0$, vector B is:
- a. Equal to A
 - b. Perpendicular to A
 - c. Parallel to A
 - d. Zero
- XII.** The rate of change of angular momentum with respect to time is:
- a. Angular acceleration
 - b. Force
 - c. Angular velocity
 - d. Torque
- XIII.** Two forces equal in magnitude but opposite in direction and not acting on the same line constitute:
- a. A couple
 - b. Power
 - c. A circle
 - d. A force
- XIV.** The acceleration of a body moving down a frictionless plane inclined at 30° will be:
- a. 4.9 m/s^2
 - b. 9.8 m/s^2
 - c. 98 m/s^2
 - d. 10 m/s^2
- XV.** The work done by a conservative force along a closed path is:
- a. Positive
 - b. Negative
 - c. Zero
 - d. None of them
- XVI.** The dimension of g is:
- a. $ML^{-2}T^3$
 - b. $M^{-1}L^3T^3$
 - c. $M^{-1}L^3T^{-2}$
 - d. $M^{-1}L^2T^2$
- XVII.** If one moves up from the surface of the earth to a distance equal to the radius of the earth value of acceleration due to gravity will be:
- a. $1/2g$
 - b. $1/4g$
 - c. $2g$
 - d. $4g$

SECTION "B" (SHORT –ANSWER QUESTION)

**NOTE: Answer 10 question from this section
(40)**

- i. In the game of cricket, why is it easy to catch a ball of high trajectory?
- ii. It is observed that all bodies sliding down. How does it happen? Explain
- iii. For simple harmonic motion, will the time period change or not, by doubling the mass of the bob attached to: (a) elastic spring? (b) Inelastic string? Explain
- iv. Can the magnitude of resultant of two vector of the same magnitude be equal to the magnitude of either of the vector? Explain mathematically.
- v. Why are x rays not diffracted by diffraction grating or thin films?
- vi. Determine a unit vector perpendicular to the plane of $A=2i-6j-3k$ and $B=4i+3j-k$
- vii. A wooden block having 10 kg mass is suspended by a long cord that can swing as pendulum. A 50 gram bullet is fired which lodges itself into the block. Due to the impact, the centre of gravity of the block is raised by 10 cm. what was the initial speed of the bullet?
- viii. Prove that power is scalar product of force & velocity.
- ix. Calculate the centripetal acceleration and centripetal force on a man whose mass is 80 kg when resting on the ground at the equator. The radius of the earth is 6.4×10^6 m.
- x. A uniform ladder having length ' ℓ ' and weighing 50N rests against a smooth vertical wall. If the coefficient of friction between the ladder and the ground is 0.40, find the minimum angle Θ , such that the ladder may not slip.
- xi. How is weightlessness experienced in a satellite overcome? Explain
- xii. A water pump is needed to lift water through a height of 2.5m at a rate 500 gm/minute. Find its minimum power in horse power.
- xiii. A note of frequency of 500 Hz is being emitted by an ambulance moving towards a listener at rest. If the listener detects a frequency of 526 Hz, calculate the speed of the ambulance. (Speed of sound is 340 m/s at that moment.)
- xiv. If the diffraction grating produce first order spectrum of light of wavelength 6×10^{-7} m at an angle of 20° from the normal, calculate the number of lines per mm.
- xv. Two converging lenses in contact. What is the focal length of this combination? Calculate the power of the combination in dioptries.

SECTION "C" (DETAILED –ANSWER QUESTION)

**NOTE: attempt 2 questions from this section.
(28)**

3.

- a) What is projectile motion? A shell is fired with a velocity v_0 at an angle Θ with the horizontal to target at the ground level. Drive the expression for: (1) total time of flight (2) horizontal range

- b) A particle is in a state of uniform circular motion. Prove that its projection along one of its diameters executes simple harmonic motion.

4.

- c) Two bodies of unequal masses are attached to the ends of a string which passes over a frictionless pulley. If one body moves vertically and the second body moves horizontally surface, derive the expressions for the tension in the string and the acceleration of the bodies.
- d) Describe young's double slit experiment derive the relevant expression and the formula for fringe spacing.

5.

- a) Two forces f_1 and f_2 are acting on a point making angles θ_1 and θ_2 with positive x-axis respectively. Derive the expression for the magnitude of the resultant force and its direction with respect to the positive x-axis.
- b) With the help of a neat diagram describe of the construction and working of a compound microscope. Derive the formula for its magnification.

OR what is doppler's effect? Explain this effect analytically when the source of sound moves away from a listener at rest. Write three applications of doppler's effect.s

PHYSICS

2010

TIME: 20 MINUTES

MAX. Marks: 17

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

- i. If we go up from the surface of the earth to a distance equal to the radius of earth, the value of 'g' will become:
- a) One-fourth
 - b) One-ninth
 - c) One-eight
 - d) Double
- ii. When a body moves vertically upward, the work done will be:
- a) Positive
 - b) Negative
 - c) Zero
 - d) Maximum
- iii. By using adjustable aperture of a lens we can reduce the defect of the lens which is called:
- a) Astigmatism
 - b) Spherical aberration
 - c) Chromatic aberration
 - d) None of them
- iv. Which of the following does not exhibit simple harmonic motion:
- a) A hanging spring supporting a weight
 - b) The balance wheel of a watch
 - c) The wheel of an automobile
 - d) The string of a violin

- v. Pitch depends upon:
- Frequency
 - Loudness
 - Time period
 - Distance
- vi. The velocity of sound in space is:
- 332 m/sec
 - 344 m.sec
 - 330 m/sec
 - Zero
- vii. A cyclist around a circular racing track skids because :
- The centripetal force upon him is less than the limiting friction
 - The certripetal force upon him is greater than the limiting friction
 - The centripetal force upon him is equal to the limiting friction
 - None of them
- viii. In young's double slit experiment, the condition for the constructive interference is that path diff. must be.
- An odd multiple of the half wavelength
 - An odd multiple of the whole wavelength
 - An integral multiple of the wavelength
 - An even number of the wavelength
- ix. If the power of a converging lens is 4 dioptries, what is the focal length of the lens?
- 20cm
 - 25cm
 - 10cm
 - 50cm
- x. If $A \cdot B = 0$ and $A \times B = 0$ and $A \neq 0$, then vector B is:
- Equal to A
 - Perpendicular to A
 - Zero
 - Parallel to A
- xi. The number of significant figures of 7.050×10^{-2} is:
- 2
 - 3
 - 4
 - 6
- xii. Kitabul-manazir is written by:
- Ibne-sine
 - Ibn-ul-haitham
 - Al-razi
 - Al-beruni
- xiii. The dimension of angular momentum is :
- $l^2 M^2 t^2$
 - $l^2 M^2 t$
 - $l^2 M T$
 - $l^2 M t^{-1}$
- xiv. Torque is defined as the time rate of change of:
- Angular momentum
 - Linear momentum
 - Angular velocity
 - Angular acceleration

- xv. Stoke's law holds good for:
- The bodies of all shapes
 - Motion through non-viscous medium
 - Motion through vacuum
 - Motion through viscous medium
- xvi. How many metres will a 20 kg ball, starting from rest, fall freely in one second?
- 19.6m
 - 9.8m
 - 4.0m
 - 4.9m
- xvii. The horizontal range of a projectile depends upon:
- The angle of projection
 - The velocity of the projectile
 - 'g' at the place
 - All of them

PHYSICS

2010

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

NOTE: Answer 10 question from this section
(40)

- If the tension in a string is doubled, what will be the effect on the speed of standing waves in the string?
- It is observed that all bodies slide down a frictionless inclined plane have the same acceleration. How it happen? Explain.
- How is the magnifying power of a telescope & a microscope affected by increasing the lengths of their objective?
- What is interference of light? Give the difference of Fresnel's and Fraunhofer's fraction.
- At what points will the speed of a projectile be maximum? Calculate the range of the projectile.
- Why does a slight push on an axle wheel not cause any motion?
- Show by calculation why acceleration due to gravity at the centre of the earth is zero. Also calculate the mass of earth.
- If one of the rectangular components of force 50N is 25N; find the value of the other.
- A helicopter weight 3920N; (a) calculate the force on it if it is ascending vertically at a rate of 2 m/sec^2 .
(b) what will be the force on the helicopter if it is moving up vertically with the constant speed of 4 m/sec?
- A water pump is needed to lift water through a height of 2.5 meters at the rate of 500 gm/minute. What will be the minimum horse power of the pump?
- A string 2 metre long and mass 0.004 kg is stretched horizontally by passing one of its end over a pulley and the string is attached with one kg mass to it vertically. Find the speed of the transverse wave on the string and the frequency of the fundamental and fifth harmonic at which the string will vibrate.
- A simple pendulum completes 4 vibrations in 8 seconds on the surface of the earth. Find the time period on the surface of the moon where the acceleration due to gravity is one-sixth that of the earth.

- XIII)** A magnifying glass produces an image of magnifying 6. What is the power of the lens? What is the best position of the object if a watch maker holds the same lens close to his eye to see the damaged spring of the watch?
- XIV)** If the radius of the 14th bright Newton's ring is 1 mm and the radius of curvature of the lens is 125 mm, calculate the wavelength of the light.
- XV)** A uniform ladder L and weight 50N rests against a smooth vertical wall if the coefficient of friction between the ladder and the ground is 0.40, find the minimum angle (Θ min) such that the ladder may not slip.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.
(28)

- 3.
- a) Define elastic collision. Two spherical bodies of masses m_1 & m_2 moving with the initial velocities u_1 and u_2 collide elastically in one dimension. Derive the expression for the final velocities.
 - b) What is magnifying power? Give its formula. With the help diagram of a describe the construction & working of an astronomical telescope & derive the formula for its magnifying?
- 4.
- a) What is diffraction of light and what is diffraction grating? Derive an expression for the wavelength of light by diffraction grating.
 - b) Show that the cross product of a vector is not commutative $B \times A = A \times B$ and prove that the magnitude of cross product of two vector gives the area of a parallelogram.
- 5.
- a) Define simple harmonic motion and prove that for small amplitude of vibration the motion of a simple pendulum is simple harmonic motion. Also derive the formula for its period.
 - b) Establish work-energy equation and define centripetal acceleration and derive its formula.

OR the green light of a wavelength 5400 \AA is diffracted by a grating 2000 lines/cm

Compute the angular deviation of the third order image. Is the 10th order image possible?

SECTION "A" (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given option:

D) A projectile is thrown at an angle of 30° with the horizontal having a certain initial velocity. It will have the same range if thrown with the same velocity as before at an angle of :

- a) 45°
- b) 60°
- c) 75°
- d) 15°

II) The rate of change of angular momentum is also called:

- a) Acceleration
- b) Force
- c) Torque
- d) Power

III) A man goes up to a height from earth's surface equal to the radius of the earth. His weight relative to the earth's surface would:

- a) Become half
- b) Became double
- c) Remain the same
- d) Become one-fourth

IV) If two tuning forks with frequencies 256 Hz and 262 Hz are sounded together, the beats frequency will be:

- a) 3
- b) 4
- c) 5
- d) 6

V) Two convex lenses of the same focal length 'f' are kept in contact with other. The focal length of the combined lens will be:

- a) 2f
- b) $f/2$
- c) 2If
- d) F

VI) The number of a significant figures in 2.500×10^3 is:

- a) 2
- b) 3
- c) 4
- d) 7

VII) If the tension of a stretched string is increased 4 times, the speed of the transverse wave in it will increase:

- a) 4 times
- b) 8 times
- c) 2 times
- d) 16 times

- VIII)** If i, j and k are the unit vectors along x, y and z axes respectively, then $k \times j =$
- i
 - $-i$
 - 1
 - -1
- IX)** The velocity of sound has maximum value in:
- Solids
 - Liquids
 - Gases
 - Free space
- X)** Screw and lever were invented by:
- Newton
 - Al-farabi
 - Archimedes
 - Galileo galilie
- XI)** If a vector is divided by its own magnitude, the resulting vector is called:
- Positive vector
 - Unit vector
 - Null vector
 - Free vector
- XII)** If a light object collides elastically with a massive body which is at rest, the light object will:
- Rebound with the same velocity
 - Rebound with twice the velocity
 - Be stopped
 - Cause the massive body to move
- XIII)** The angular momentum of a particle is conserved if the:
- Net torque acting on the particle is zero
 - Net acceleration of the particle is zero
 - Net displacement of the particle is zero
 - Net force acting on the particle is zero
- XIV)** A body executes simple harmonic motion if:
- $A = k \cdot x$
 - $V = -k \cdot x$
 - $A = -\sqrt{k} \cdot x$
 - $A = -k \cdot x^2$
- XV)** The dimension of the kinetic energy are:
- $\frac{1}{2} ML^2 T^{-2}$
 - $ML^2 T^{-2}$
 - $\frac{1}{2} ML^2 T^2$
 - MLT^{-1}
- XVI)** Two perpendicular vector having magnitude of 4 units & 3 units are added. The resultant has the magnitude of:
- 7 units
 - 12 units
 - 25 units
 - 5 units
- XVII)** The S.I unit if intensity of sound is:
- Watt/m²

- b) Decibel
- c) Weber
- d) Dioptre

PHYSICS

2009

TIME: 2 HOUR 40 MINUTES

MAX. Marks: 68

SECTION "B" (SHORT –ANSWER QUESTION)

NOTE: Answer 10 question from this section
(40)

- i. Can the resultant of two vectors of the same magnitude be equal to the magnitude of either of the vectors? Give mathematical reason for your answer.
- ii. It is observed that all bodies sliding down a frictionless inclined plane have the same acceleration. How does it happen? Explain.
- iii. How is artificial gravity created in an orbiting space-craft obtain relevant expression for it.
- iv. Why do thick lenses possess chromatic and spherical aberrations? Suggest for the rectification of these defects.
- v. For what value of p are the two vectors $A=i-pj+3k$ and $B=3i+3j-4k$ perpendicular to each other?
- vi. Why did Newton's formula for the speed of sound in air fail? Who corrected the formula? Describe the discrepancy and give the corrected formula.
- vii. The time period of a simple pendulum is 2 seconds on the surface of the earth. Calculate its time period on the surface of the moon where the value of the acceleration due to gravity is one-sixth that of its value on the earth's surface.
- viii. A mortar shell is fired at a target 800 m away with the velocity of 100 m/s. calculate the maximum possible value of the launch angle.
- ix. What is the magnification of an astronomical telescope focused for infinity, when the power of its objective and the eye-piece lenses are 2 dioptres respectively?
- x. A son meter wire of length 1 mm, when plucked at the centre, vibrates with a frequency of 250 Hz. Calculate the wavelength and the speed of the waves in the wire.
- xi. A convex lens of power 2 dioptres is in close combination with a concave lens of power 2 dioptres. Find the resultant power and the focal length of the combined lens system.
- xii. An appalled beam of x-ray is diffracted by a crystal. The first order maximum is obtained when the glancing angle of incidence is 6.5° . If the distance between the atomic planes of the crystal is 2.8° . Calculate the wavelength of the radiation.
- xiii. A note of frequency 500 Hz is being emitted by an ambulance moving towards a listener at rest. If the listener defects a frequency of 526 Hz, calculate the speed of the ambulance. Take the speed of sound at room temperature to be 340m/sec
- xiv. How would the weight of a body vary as it is taken from the earth to the moon? What will be the effect on its mass?
- xv. A wire hangs from a dark high tower so that upper end is not visible. How can we determine the length of the wire? **OR** what is the difference between interference and beats of sound waves? Elaborate it.

SECTION "C" (DETAILED –ANSWER QUESTION)

NOTE: attempt 2 questions from this section.

(28)

3.

- a) Two bodies of unequal masses are attached to the ends of a string which passes over a frictionless pulley. If one body moves vertically and the second body moves horizontally surface, derive the expressions for the tension in the string and the acceleration of the bodies when the mass-string system is in motion.
- b) With the help of ray-diagram describe the construction and working of a compound microscope. Derive the formula for its magnification.

4.

- a) Defines the cross-product of two vectors. Show that the cross-product does not obey the commutative law. Also prove that.
- b) What is Doppler Effect? Explain this analytically when the source of sound moves away from a listener at rest. Write three applications of Doppler Effect.

5.

- a) A particle is in a state of uniform circular motion. Prove that its projection along any one of the diameter of the reference circle executes simple harmonic motion.
- b) Describe young's double slit experiment and derive the formula for finger-spacing.

(OR) a 15 m ladder weighting 350 N rests against a smooth vertical wall at a point 12 m above the ground. The centre of gravity is one-third the way up. A boy mass 47 kg climbs half way up the ladder. Calculate the reaction exerted by the wall and the ground.

PHYSICS

2008

TIME: 3 HOURS

MAX. Marks: 75

NOTE: attempt five question in all, selecting at least two questions from section 'A' and at least one question from each sections 'B' 'C'. Draw diagram where necessary.

SECTION "A"

1(a) selects the correct answer for each from the given option:

- i) The author of the book al-shifa was:
 - a) Al-razi
 - b) Abu rehan al-beruni
 - c) Al-beruni
 - d) Ibn-ul-haitham
- ii) Two perpendicular vectors having magnitude of 4 units and 3 units are added. Their resultant has the magnitude of:

- a) 7 units
- b) 12 units
- c) 25 units
- d) 5 units

iii) The dimension of torque are

- e) ML^2T
- f) ML^2T^{-2}
- g) ML^2T^2
- h) MLT^{-2}

(b) Describe the addition of vectors by rectangular components method

(c) Two non-rotating spheres of masses m_1 and m_2 moving along a straight line with velocities u_1 and u_2 respectively collide elastically. Derive an expression for the final velocity of mass m_2 .

(d) Two vectors A and B are such that $|A|=4$, $|B|=6$ and $A \cdot B=8$ find; (i) the angle between A and B (ii) the magnitude $|A-B|$.

2(a) selects correct answer for each from the given option:

i) The number of significant figures in 0.005040 is:

- a) 3
- b) 4
- c) 5
- d) 6

ii) An angle subtended at its centre by an arc whose length is equal to its radius is:

- a) 37.3°
- b) 47.3°
- c) 57.3°
- d) 67.3°

iii) The centre of the mass of a system of particles:

- i) Always coincides with the centre of gravity
- ii) Never coincide with the centre of gravity
- iii) Coincide with the centre of gravity in a uniform gravitational field

Coincide with the centre of gravity in a non-uniform gravitational field.

(b) Derive an expression for the acceleration of a body moving down an inclined plane when there is friction 'f'.

(c) Define a conservative field. Show that the gravitational field is a conservative field.

(d) A boy throws a ball upward from the top of a tower with a speed of 12m/s. on the way down it just misses the thrower and falls to the ground 50m below. Find how long the ball remains in the air.

3(a) selects correct answer for each from the given option:

i) Two projectile A and B are thrown up with the same speed at an angle of 60° and 30° respectively with the horizontal, then

- a) The range of A will be greater
- b) The range of B will be greater
- c) The range of A and B will be greater
- d) The range is independent of the angles

ii) Which one of the following is a spin motion:

- a) The motion of the planets round the sun

- b) The motion of the electrons round the nucleus
- c) The motion of the moon round the earth
- d) The daily rotation of the earth causing day and night

iii) If we go up from the surface of the earth to a distance equal to the radius of the earth, the value of 'g' will be:

- a) $1/2g$
- b) $1/4g$
- c) $2g$
- d) $4g$

(b) Define angular velocity and angular acceleration, show that (i) $v=r\omega$, (ii) $a=r\alpha$, when the symbols have their usual meanings.

(c) Define a couple. Show that the magnitude of the moment of a couple is given by $\tau = Fd$, when the symbols have their usual meanings.

(d) A Rocket is fired at a ground-level target 600m away with an initial velocity 85 m/s; find the two possible values of the launch angle. Calculate the minimum time to hit the target.

4(a) selects correct answer for each from the given option:

(i) The work done by the centripetal force 'F' on a body moving in a circle is zero because:

- a) The body moves parallel to F
- b) The body moves at right angle to F
- c) The body moves opposite to F
- d) The centripetal and centrifugal force balance each other

(ii) in a inelastic collision of two bodies:

- a) K.E is conserved only.
- b) Momentum is conserved only
- c) Both K.E and momentum is conserved
- d) Neither K.E nor momentum is conserved

(iii) A body moving along a circular path with an increasing speed possesses.

- a) Tangential acceleration only
- b) Both tangential and centripetal acceleration
- c) No acceleration
- d) Centripetal acceleration only

(b) Derive an expression for the variation of 'g' only

(c) Establish work energy equation.

(d) Suppose a new planet 'X' is discovered which has a diameter 10 times bigger as compared to that of earth and a mass equal to 300 times that of earth. Compute the gravitational acceleration at the surface of the planet 'X'.

5(a) selects correct answer for each from the given option:

(i) The frequency of a simple pendulum is given by:

- a) $v=2\pi\sqrt{\frac{g}{L}}$
- b) $v=2\pi\sqrt{\frac{L}{g}}$
- c) $v=\frac{1}{2\pi}\sqrt{\frac{L}{g}}$
- d) $v=\frac{1}{2\pi}\sqrt{\frac{g}{L}}$

(ii) beats are produced due to:

- a) Diffraction
- b) Interference
- c) Polarization
- d) Refraction

(iii) When the temperature of air rises, the speed of sound waves increase because:

- a) The frequency of the wave increases
- b) The wavelength of the wave increases
- c) Both frequency and wavelength increase
- d) Neither frequency nor wavelength increase

(b) What is condition of SHM? Show that motion of project of a particle in a uniform circle motion is simple harmonic on one of its diameters of reference circle.

(c) What are stationary (or standing) waves ? a string of length 'L' is stretched between two hooks; find the frequency of the stationary waves produced in the string when it is vibrating in (i) one loop, (ii) two loop (iii) three loops.

(d) a notes of frequency 650Hz is emitted from ambulance. What frequency will be detected by a listener if the ambulance moves (i) at the speed of 18 m/s towards the listener, (ii) at the speed of 15 m/s away from the listener? (Speed of sound= 340 m/s)

6(a) selects correct answer for each from the given option:

(i) If u go on increasing the stretching force on a wire in a guitar, its frequency of vibration:

- a) Increases
- b) Decreases
- c) Neither increase nor decrease
- d) Become zero

(ii) If the mass of a body suspended from a spring is increased to 4 times, the period of vibration of the body will be:

- a) 4 times
- b) 2 times
- c) $\sqrt{2}$ times
- d) Same as before

(iii) If the fundamental frequency of vibration of a string fixed at the both ends is 50Hz, the fourth harmonic will be:

- a) 100 Hz
- b) 150 Hz
- c) 200 Hz
- d) 250 Hz

(b) Show that the total energy of a body attached to an elastic spring and executing SHM remains the same everywhere.

(c) Define intensity of sound and loudness, give weber fecher law and explain the intensity level with its unit.

(d) A body of mass 32 gm attached to an elastic spring is performing SHM. Its velocity is 0.4 m/s when the displacement is 8cm towards right. If the spring constant is 0.4 NM^{-1} , calculate (i) total energy (ii) the amplitude of its motion.

7(a) selects correct answer for each from the given option:

(i) The power of a concave lens of focal length 50cm is:

- a) 0.5 dioptre
- b) -0.5 dioptre
- c) 2 dioptre
- d) -2 dioptre

(ii) The transverse nature of light was confirmed by:

- a) Interference
- b) Diffraction
- c) Polarization
- d) Dispersion

(iii) The condition for the constructive and the destructive interference are reserved in case of thin films due to:

- a) Phase reversal of one part of a wave
- b) Phase reversal of both parts of wave
- c) Phase reversal of none
- d) Change in frequency of waves

(b) Using young's double-slit arrangement obtain the expression for the position of bright fringes. Also calculate the bright in frequency spacing.

(c) Derive the lens formula for a convex lens:

(d) Interference fringes were produced by two slits 0.25 mm apart on a screen 150 mm form the slits. If ten fringes occupy 3.27, what is the wavelength of the light- producing fringes?

8(a) selects correct answer for each from the given option:

(i) In Galilean telescope the final image formed is:

- a) Real and inverted
- b) Real and erects
- c) Virtual and inverted
- d) Virtual and erect

(ii) In case of far-sightedness the image of an object is formed:

- a) Behind the retina
- b) On the retina
- c) In front of the retina
- d) At the least distance of distinct vision.

(iii) Yellow light from a sodium lamp is used to from Newton's rings. The central spot in Newton's ring will be:

- a) Yellow
- b) Bright
- c) Dark
- d) Neither bright nor dark

(b) What is magnifying glass? Give its working and derive an expression for the magnifying power.

(c) What is the difference between Fresnel and fraunhoffer's diffraction? Derive Bragg's law for X-ray diffraction.

(d) A compound microscope has an objective with a focal length of 10mm and a tube 232mm long. The final image is produced 250mm from the eye-piece when the object is 10.5mm from the objective. What is the angular magnification?

