UNIVERSITY OF THE PUNJAB

First Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Elementary Mechanics **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-101 **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

(SUBJECTIVE)

Q.1: Write the answers of the following questions. **(2 x 10 = 20)**

i. State Stoke's theorem in vector calculus and give its mathematical form.
ii. What do you mean by the co-efficient of kinetic friction?
iii. Can two vectors having different magnitudes be combined to give zero resultant? Can three vectors?
iv. State and prove work-energy theorem.
v. What is conservative force? Give two examples.
vi. What is meant by pseudo force? Why is centrifugal force a pseudo force?
vii. Differentiate between elastic and inelastic collision.
viii. Why the earth does not fall towards the sun due to its attraction?
ix. State parallel axis theorem.
x. In conical pendulum, what happens to the period and the speed when $\Theta=90^0$. Discuss the case for $\theta=0$.

Q.3: (2+5, 3)

a) State and prove Gauss's Divergence theorem.
b) A conical pendulum is formed by attaching a 53g pebble to a 1.4m string. The pebble swings around in a circle of radius 25cm.
   a) What is the speed of pebble?
   b) What is acceleration?
   c) What is tension in string?

Q.4: **(5, 5)**

a) Explain work done by the variable force in one dimensional case with an example of spring force.
b) A child pulls a 5.6kg sled a distance of 12m along a horizontal surface at a constant speed. What work does the child do on the sled if the coefficient of kinetic friction μ_k is 0.20 and the cold makes an angle of 45^0 with the horizontal?

Q.5: **(6, 4)**

a) Calculate rotational inertia of a solid cylinder about an axis passing through its center and perpendicular to its axis of symmetry.
b) A Chrysler of mass 2210kg is moving along a straight road at 105 kmh^{-1}. It is followed by a ford with mass 2080kg moving at 43.5kmh^{-1}. How fast is the center of mass of two cars moving?

UNIVERSITY OF THE PUNJAB

Roll No. .....

First Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Elementary Mechanics **TIME ALLOWED: 30 mins.**

Course Code: PHY-101 **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

(Objective)

Tick the correct statement. **(1 x 10 = 10)**

1. A car is taking a turn on level road. It may be thrown outward because of the
   (a) Reaction of ground (b) Frictional force
   (c) Lack of centripetal force (d) Weight
2. If distance covered by a particle is zero, then what can we say about its displacement?
   (a) it cannot be zero (b) it is negative
   (c) it must be zero (d) it may or may not be zero
3. Stock's theorem gives the relationship between:
   (a) line integral and density (b) line integral and Area integral
   (c) line integral and surface integral (d) line integral and volume integral
4. A body of mass 4.5g is dropped from rest at a height 10.5m above surface of earth. What will be its speed just before it strikes the ground?
   (a) 14.345m/s (b) 13.534m/s (c) 14.540m/s (d) 40.5m/s
5. The unit of angular momentum is:
   (a) Js (b) kgm^2s^{-1} (c) kg (d) a & b both
6. Center of mass of uniform rod of length L lies at
   (a) L/3 (b) 2L/3 (c) L/2 (d) None of the above
7. A tangential speed to prevent an object from slipping is given by
   (a) $v = \sqrt{(\frac{gR}{\mu_s})}$ (b) $v = \sqrt{(\frac{R}{g\mu_s})}$ (c) $v = \sqrt{(\frac{g}{R\mu_s})}$ (d) None of the above
8. The moment of momentum is called:
   (a) impulse (b) angular momentum (c) coupled (d) torque
9. The work done will be maximum when θ =:
   (a) 0^0 (b) 45^0 (c) 90^0 (d) 180^0
10. A body is rotating with angular frequency 5 radian per sec in a circular path of radius 2 m. its tangential linear velocity is:
    (a) 5 ms^{-1} (b) 2 ms^{-1} (c) 7 ms^{-1} (d) 10 ms^{-1}

UNIVERSITY OF THE PUNJAB

First Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Waves, Oscillations and Optics **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-102 **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Section II

Question No. 2

Write short answers of the following questions. (2×10)

i. If taken to the moon would there be any change in the frequency of oscillation of torsional pendulum? A simple pendulum?

ii. Derive the total mechanical energy in case of simple harmonic motion.

iii. In case of diffraction grating draw the phasors to show the conditions for the central maximum and minimum for zero intensity if (a) N=2 , (b) N=5 (n is no. of slits)

iv. Spherical waves travel from a source of waves whose power output is assumed to be constant. How does the wave intensity depend on the distance from the source?

v. Explain the special case for which the physical pendulum becomes a simple pendulum.

vi. A spring has a force constant k and an object of mass m is suspended from it. The spring is cut in half and the same object is suspended from one of the halves. How the frequencies of oscillations before and after the spring is cut, related?

vii. For a damped oscillator m=250g, k =85N/m, what is the time period of motion?

viii. Does dispersion and resolving power depends upon spacing grating d, explain with expressions.

ix. In polarization what is the Brewster's angle?

x. Two polaroids have their axes of transmission parallel so that intensity of transmitted light is maximum. Through what angle must either Polaroid be turned to make the intensity fall by one half of its maximum value?

Section III

Question No. 3

(a) Derive in detail the average power, which is an average rate at which energy is transmitted by the wave, is given by

$$P_{avg} = \frac{1}{2}\mu v \omega^2 {y_m}^2$$

P.T.O.

(b) A transverse wave is generated on the string, wave moves up and down through a distance of 1.30cm. The motion is repeated 125 times per second. If string has linear

mass density of 0.251 Kg/m and is kept under tension of 96 N, Find (a) amplitude (b) frequency (c) speed (d) wavelength.

(6+4)

Question No. 4

(a) Describe the concept of diffraction from multiple slits assuming an idealized diffraction-grating containing five slits. Also calculate the angular width for the principal maximum corresponding to the order m.

(b) A light of wavelength 630 nm illuminates a certain grating. The grating has 10^4 slits with a spacing of 2100 nm. Find

(i) The angular position of all principal maxima observed

(ii) The angular width of the largest-order maximum.

(6+4)

Question No. 5

(a) How the polarization occurs by the process of reflection?

(b) We wish to use a plate of glass (n=1.50) in air as a polarizer. Find the polarizing angle and the angle of refraction.

(5+5)

UNIVERSITY OF THE PUNJAB

Roll No. .....

First Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Waves, Oscillations and Optics **TIME ALLOWED: 30 mins.**

Course Code: PHY-102 **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Section 1

Question No. 1 Choose the right answer: (10)

i. The torsional oscillator is also known as
   a) Simple pendulum
   b) Torsional pendulum
   c) Physical pendulum

ii. In oscillatory motion when body passes through its origin its velocity becomes
   a) Maximum
   b) Minimum
   c) None

iii. In double slit interference, intensity of the resultant wave at any point P varies from
   a) 0 to 8 I_0
   b) 0 to 6 I_0
   c) 0 to 4 I_0

iv. In case of diffraction By increasing No. of slits for given wavelength ~~the~~ width the central maximum becomes
   a) Broader
   b) Sharper
   c) Disappears

v. Wave speed in non dispersive medium depends upon
   a) Linear mass density
   b) Tension in the string
   c) Both a and b

P.T.O.

vi. In case of damped harmonic oscillation for the highest value of "b" i.e b=$2\sqrt{(km)}$, the life time τ has

a) Lowest value equal to 2m/b
b) Highest value equal to 2b/m
c) Zero value

vii. 0.25 kg of mass is oscillating with time period of 0.34 sec. the value of spring constant of its spring is

a) 58.3N/m
b) 76.3 n/m
c) 85.3N/m

viii. In Doppler effect there is an apparent change in

a) Frequency
b) Wavelength
c) Velocity

ix. The condition for interference from thin films, the maxima occurs at

a) $2dn=(m+1/2)\lambda$
b) $2dn=m\lambda$
c) $2d=m\lambda_n$

x. Yellow light of wavelength 589 nm illuminates a Michelson-interferrometer. If the mirror is moved through 1.00 cm the no. of bright fringes will be

a) 33700 fringes
b) 35098 fringes
c) 33956 fringes

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First Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Physics-I (Mechanics & Optics) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-111 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Q. 2 **Write short answers to the following questions:-** (10x2)

1. What happens to the period and speed of conical-Pendulum when $\theta = 0$.
2. If $\vec{A} = 2\vec{i} - \vec{j}$ and $\vec{B} = 4\vec{i} + \vec{j}$. Find the cross product $\vec{A} \times \vec{B}$.
3. State Gauss's divergence theorem.
4. What is meant by vector differential operator?
5. A spring has a spring constant 15 Ncm^{-1}. How much work is needed to extend through 7 cm.
6. State Kepler's law of area.
7. What is use of Fresnel biprism?
8. Sate and prove Torricelli's theorem.
9. Explain briefly the relation between torque and angular momentum.
10. Sate parallel axis theorem.

(Essay-type questions)

Q. 3 (a) What is diffraction grating? Derive a relation for wavelength of light used. Also calculate angular separation between spectral lines, per unit wavelength? (9)

(b) A pipe of diameter 30 cm carrying water moves with a speed of 2.5 ms^{-1}. How much time will it take to discharge 2000 m^3 of water? (6)

Q. 4 (a) What is moment of inertia? Calculate the moment of inertia of a solid sphere about its diameter. (9)

(b) A conical pendulum is formed by attaching a 53 g pebble to a 1.4 m string. The pebble swings around in a circle of radius 25 cm. (6)

(i) What is the speed of pebble?
(ii) What is its acceleration?
(iii) What is tension in string?

UNIVERSITY OF THE PUNJAB

Roll No. .....

First Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Physics-I (Mechanics & Optics) **TIME ALLOWED: 30 mins.**

Course Code: PHY-111 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Q. 1 Encircle the correct option:-

1. The curl of a gradient of a scalar function is always equal to

(a) unity (b) zero (c) constant (d) non-zero

2. If a scalar function $\phi = \frac{1}{r}$ where $\vec{r} = n\hat{\imath} + y\vec{j} + z\vec{k}$ then Grad ϕ is

(a) $\frac{\vec{r}}{r^2}$ (b) $-\frac{\vec{r}}{r_3}$ (c) $\frac{r}{r^4}$ (d) $-\frac{\vec{r}}{r}$

3. Stock's theorem gives the relationship between

(a) line integral and density (b) line integral and Area integral

(c) line integral and surface integral (d) line integral and volume integral

4. A body rotates about an axis, its different particles have

(a) same angular and different linear velocity (b) Same angular and same linear velocity

(c) different angular and same velocity (d) different angular and same linear velocity

5. Bernoulli's theorem deals

(a) law of conservation of mass (b) law of conservation of energy

(c) law of conservation of momentum (d) law of conservation of charge

6. If a student standing on a turn table with dumbbells in his hands, he suddenly with draws his hand to his chest, the angular velocity of table will

(a) increase (b) decrease (c) remain the same (d) become double

7. A body of mass 50 kg is allowed to fall under the action of gravity 10 ms^{-1}. Its weight will be

(a) 500 N (b) 50 N (c) zero (d) 1000 N

8. The velocity of light was determined accurately by

(a) Newton (b) Huygen (c) Michelson (d) Young

9. The angle between viscous drag force and direction of flow of fluid is

(a) 0^0 (b) 45^0 (c) 90^0 (d) 180^0

10. The dimension of centripetal force is equal to

(a) MT^2/L (b) ML/T^2 (c) MT/L^2 (d) MT^2/L

UNIVERSITY OF THE PUNJAB

First Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Mechanics and Wave Motion (IT) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-121 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Section-II (Subjective Type) (10 × 2 = 20)

Question no. 2: Write short answers of the following questions.

(i) Give the statement of parallel-axis theorem.
(ii) Briefly explain scalar product and vector product.
(iii) An object is launched into the air with an initial velocity given by $\vec{V} = 4.9\hat{i} + 9.8\hat{j}$ m/s. Ignore air resistance, find the magnitude of the velocity at the initial point and at the highest point.
(iv) Derive the rotational form of Newton's second law of motion.
(v) State the law of conservation of linear momentum.
(vi) The angle turned through by the flywheel of a generator during a time interval t is given by, $\Phi = at + bt^3 - ct^4$, find the expression of angular velocity and angular acceleration.
(vii) State the work-energy theorem.
(viii) What are nonconservative forces?
(ix) State the Newton's law of universal gravitation and write its vector form.
(x) What is interference of waves and explain interference of waves with the help of phase difference.

Question No. 3: (6+4)

(a) Find the acceleration of center of mass of a two particle isolated system.

(b) If an electron (mass m = 9.11×10^{-31} kg) in copper near the lowest possible temperature has a kinetic energy of 6.7×10^{-19} J, what is the speed of the electron?

Question No. 4: (6+4)

(a) Define and explain momentum, also describe impulse-momentum theorem.

(b) What are the direction cosines? Calculate the value of each.

Question No. 5: (6+4)

(a) Differentiate between longitudinal and transverse wave. Also discuss standing waves and find the equation of a standing wave.

(b) What should be the length of a simple pendulum whose period is 1.0 second at a place where g is $9.8 m/s^2$. What is the frequency of such pendulum?

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Roll No. .....

First Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Mechanics and Wave Motion (IT) **TIME ALLOWED: 30 mins.**

Course Code: PHY-121 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Section – I (Objective Type)

Question no. 1: Choose the correct answer from the given options. Overwriting, cutting and erasing is not allowed.

1. Angle between two vectors A and B can be determined by
   (a) their dot product (b) their cross product
   (c) head to tail rule (d) none

2. Projectile motion is a
   (a) One dimensional motion (b) Two dimensional motion
   (c) Three dimensional motion (d) None

3. Suppose the net force F on an object is a nonzero constant. Which of the following could also be constant?
   (a) Position. (b) Speed.
   (c) Velocity. (d) Acceleration.

4. $\vec{\alpha} \times \vec{r}$ gives us
   (a) Linear acceleration (b) Radial acceleration
   (c) Tangential Acceleration (d) None

5. A field in which the work done in a moving a body along closed path is zero is called
   (a) Electric field (b) Conservative field
   (c) Gravitational field (d) None

6. Torque is defined as
   (a) cross product of position vector and force (b) turning effect of force
   (c) product of force and moment arm (d) all a, b and c are correct

7. During simple harmonic motion of mass-spring when block is at equilibrium position, its
   (a) P.E is Maximum (b) K.E is Maximum
   (c) P.E and K.E are equal (d) P.E and K.E both are zero

8. The time period "T" of physical pendulum is given
   (a) $2\pi\sqrt{k/I}$ (b) $2\pi\sqrt{I/k}$
   (c) $\frac{1}{2\pi}\sqrt{k/I}$ (d) $\frac{1}{2\pi}\sqrt{I/k}$

9. For a simple pendulum the restoring force is caused by
   (a) gravity (b) spring
   (c) hand (d) none

10. The wave form of S.H.M. is
    (a) square wave (b) standing wave
    (c) sine wave (d) none

UNIVERSITY OF THE PUNJAB

Roll No. .....

Second Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Electricity & Magnetism **TIME ALLOWED: 30 mins.**

Course Code: PHY-103 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Section –I (Objective Type)

Q.1. Each question has four possible answers, select the correct answer and encircle it. Overwriting, cutting, erasing or use of lead pencil will carry zero credit. **(1×10 = 10)**

(i) Electric field inside a uniform shell of charge is

(a) zero (b) negative (c) positive (d) infinity

(ii) A conductor of resistivity ρ has current density $\vec{J}$. If $\vec{E}$ is the electric field intensity applied inside, then its value is equal to

(a) $\frac{\rho}{\vec{J}}$ (b) $\frac{\rho}{\varepsilon_0}$ (c) $\rho\vec{J}$ (d) $\frac{\vec{J}}{\rho}$

(iii) The electric field intensity between two oppositely charged plates is

(a) $E=\frac{\sigma}{2\varepsilon_0}$ (b) $E=\frac{\varepsilon_0}{2\sigma}$ (c) $E=\frac{\sigma}{\varepsilon_0}$ (d) $E=\frac{\sigma\varepsilon_0}{2}$

(iv) The SI unit of magnetic induction is

(a) Gauss (b) Orested (c) Weber (d) Tesla

(v) A moving charge will produce

(a) electric field (b) magnetic field (c) both (a)and(b) (d) none as above

(vi) The value of Bohr magneton is

(a) $\frac{e}{4\pi m}$ (b) $\frac{eh}{2\pi m}$ (c) $\frac{eh}{4\pi m}$ (d) $\frac{eh}{\pi m}$

(vii) Which of the following law was modified by Maxwell by introducing displacement current

(a) Ampere's law (b) Faraday's law (c) Gauss's law (d) Biot-Savart's law

(viii) The integral involved in the expression of Ampere's law is of the form of

(a) volume integral (b) surface integral (c) line integral (d) none as above

(ix) In an electromagnetic wave the average energy density associated with magnetic field will be

(a) $\frac{1}{2}LI^2$ (b) $\frac{B^2}{2\mu_0}$ (c) $\frac{1}{2}\mu_0 B^2$ (d) $\frac{\mu_0}{2B^2}$

(x) Electromagnetic waves are produced by

(a) an accelerating charge (b) a stationary charge

(c) chargeless particles (d) a moving charge

UNIVERSITY OF THE PUNJAB

Second Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Electricity & Magnetism **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-103 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Section –II (Subjective Type)

Note: Attempt all Questions

Q.2. Write short answers of the following questions: **(2×10 = 20)**

i. State shell theorems for electric field.
ii. In the median plane of an electric dipole, is the electric field parallel or antiparallel to the electric dipole moment $\vec{p}$.
iii. Differentiate between semiconductor and superconductor.
iv. Define the term "motional EMF".
v. Show that, the capacitance with dielectric is given by $C' = K_e C$
vi. Is there any way to set up a magnetic field other than by causing charge to move?
vii. Define current density and Lorentz force?
viii. State Gauss law for magnetism.
ix. In Faraday's law of induction does the induced EMF depend on the resistance of the circuit?
x. Write down mathematical forms of Maxwell's equations.

Q.3: (a) By using Gauss' law find out electric field intensity at a point lying inside a spherical volume distribution of uniform charge density.
(b) Describe briefly the process of calculating the electric field from the electric potential.
(6, 4)

Q.4: (a) State Lenz's law. Show that Lenz's law is in accordance with the law of conservation of energy.
(b) Derive an expression for torque acting on a current carrying loop placed in a uniform external magnetic field $\vec{B}$. **(5, 5)**

Q.5: (a) How do you distinguish between $\varepsilon_\circ$ and $\mu_\circ$? How are they related with velocity of electromagnetic waves in free space.
(b) Describe in details energy transport in terms of Poynting vector.
(4, 6)

UNIVERSITY OF THE PUNJAB

Roll No. .....

Second Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Thermodynamics and Kinetic Theory **TIME ALLOWED: 30 mins.**

Course Code: PHY-104, **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Section I (Objective Type)

Choose the best option (1×10)

1. The internal energy of one mole of an Ideal gas depends upon:
   i) Temperature
   ii) Pressure
   iii) Volume
   iv) None of above
2. Work done by an expanding gas under adiabatic condition results in
   i) Decrease in temperature
   ii) Increase in temperature
   iii) No change in temperature
   iv) First increase then decrease in temperature
3. White clothes in Hot climate are recommended as these are good
   i) Emitter
   ii) Absorber
   iii) Radiator
   iv) Reflector
4. Which of the following is not a State Function of the system
   i) Pressure
   ii) Temperature
   iii) Internal Energy
   iv) Heat
5. Cloud formation in the atmosphere is an example of
   i) Isothermal process
   ii) Adiabatic process
   iii) Isochoric process
   iv) Cyclical process
6. In Carnot Engine, change in internal energy in one Cycle is
   i) Positive
   ii) Negative
   iii) Constant
   iv) Zero

P.T.O.

7. The efficiency of the Carnot engine in terms of Q_1 (Heat absorbed) and Q_2 (Heat rejected) is:
   i) $1-(Q_2/Q_1)$
   ii) $1-(Q_1/Q_2)$
   iii) $1+(Q_2/Q_1)$
   v) $1+(Q_1/Q_2)$
8. Ten identical particles are to be divided up into two containers, how many microstates belong to the configuration of three particles in one container and seven in the other
   i) 120
   ii) 30240
   iii) 3628800
   iv) 6.3×10^9
9. Which type of ideal gas will have the largest value of $C_p - C_v$
   i) Monoatomic
   ii) Diatomic
   iii) Polyatomic
   iv) The value will be the same for all
10. Which of the following is a necessary condition for a process involving an ideal gas to do work
   i) $\Delta T \neq 0$
   ii) $\Delta P \neq 0$
   iii) $\Delta V \neq 0$
   iv) $Q \neq 0$

UNIVERSITY OF THE PUNJAB

Second Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Thermodynamics and Kinetic Theory **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-104, **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

Section II

Give short answers to the following questions: (4×5)

1. State the zeroth law of thermodynamics and write conversion formulae between centigrade and Kelvin and also between centigrade and Fahrenheit scales. (2+1+1)
2. Write the expressions for
   i) Tthe Ideal gas law
   ii) The Virial Expansion
   iii) The van der Waals equation of state of real gases. (1+1+2)
3. Define the following and write their units
   i) Molar Heat capacity
   ii) Peltier Coefficient (2+2)
4. Drive the first TdS equation explaining the quantities involved. (4)
5. The turbine in the steam power plant takes steam from a boiler at 427^0C temperature reservoir and rejects at 77^0C , calculate its efficiency. (4)

Section III (10×3)

1. Explain the Cycle of the Carnot Heat Engine with the help of Temperatue-Entropy and Pressure-volume diagrams and also derive expression of its efficiency. (10)
2. Explain the Seebeck Effect and the Seebeck coefficient also briefly explain its reverse effect. (10)
3. Write brief notes on the following (5+5)
   i) Thermal Expansion of Solids
   ii) Properties of the Ideal Gas

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Roll No. .....

Second Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Physics-II (Waves & Oscillation) **TIME ALLOWED: 30 mins.**

Course Code: PHY-113 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

(Objective Type)

Q1. Encircle the correct answer out of the four given options. No mark will be given for cutting, over-writing, use of lead pencil and ink-remover. (1x10=10)

(i) Sounds of frequency lower than 20 Hertz are called
(a) supersonics (b) infrasonics
(c) ultrasonics (d) audible sound waves

(ii) A thermodynamic process in which volume remains constant is called
(a) isobaric (b) isochoric
(c) isothermal (d) adiabatic

(iii) If the temperature of source increases, the efficiency of Carnot engine
(a) decreases (b) increases
(c) remains constant (d) first increases then decreases

(iv) A particle is moving in a circular path with constant angular speed. The motion of its projection along its any diameter is,
(a) projectile motion (b) translatory motion
(c) vibratory motion (d) circular motion

(v) A wave has wave speed 243m/s and the wavelength 3.27cm its frequency is,
(a) 7.43KHz (b) 7.43Hz
(c) 74.3Hz (d) 134.6Hz

(P.T.O.)

(vi) A thermodynamic process in which pressure remains constant is called

(a) isobaric process (b) isothermal
(c) isochoric (d) adiabatic

(vii) In Doppler effect ,the apparent frequency of sound waves(having speed v)when observer moves towards a stationary source with speed v_o is,

(a) $(v+v_o/v)f$ (b) $(v/v- v_s)f$
(c) $(v+ v_s/v)f$ (d) $(v- v_o/v)f$

(viii) When heat is added to a system the entropy change is

(a)zero (b)negative
(c)positive (d)none of these

(ix) A particle on a spring executes simple harmonic motion. If the mass of the particle and the amplitude are both doubled then the period of oscillation will change by a factor of

(a) 4 (b) 2
(c) 8 (d) $\sqrt{2}$

(x) A pulse on the string is inverted when it is reflected from

(a) a free end (b) rubber cord
(c) fixed end (d) both a & b

UNIVERSITY OF THE PUNJAB

Second Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Physics-II (Waves & Oscillation) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-113 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

(Subjective Type)

Note: Attempt all questions.

Q.2: Give short answers to the following questions **(2x10=20)**

1) Find the length of pendulum whose period is 3s at a location where g is $9.82ms^{-2}$.
2) Why we reduce pressure in tyres while moving on motorway?
3) Show that entropy remains constant during reversible process.
4) Explain principle of superposition of waves
5) How the efficiency of a heat engine can be increased?
6) Why sounds travel faster in hydrogen than in oxygen?
7) A wave has a wave speed of 263 m/s and a wavelength of 3.27m. Calculate the frequency and the period of the wave.
8) Show that the kinetic energy and potential energy of a simple harmonic oscillator ,oscillates with time whereas the total mechanical energy remains constant. Also draw the graphs.
9) Define a cyclic process.
10) State first law of thermodynamics.

Q.3 (a) Define simple harmonic motion. Derive equation of motion of the simple harmonic oscillator and also write its solution.

(b) Show that the general formula for a traveling wave, $y(x,t)=f(x\pm vt)$, is the solution of wave equation given below,

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$$

(5+5)

Q4: (a) Prove that the pressure exerted by an ideal gas in a cubical container of edge length L,with perfectly elastic walls,depends on the root-mean-square speed of the molecules.

(b) Calculate root-mean-square speed of hydrogen molecules at 0.00 °C and 1.00atm pressure, assuming hydrogen to be an ideal gas. Under these conditions hydrogen has a density ρ of 8.99×10^{-2} kg/m^3.

(7+3)

Q5 (a) Explain Carnot cycle in detail and show that the efficiency of a Carnot engine depends only on the temperature of the two reservoirs between which it operates.

(b) The turbine in a steam power plant takes steam from a boiler at 520° C and exhausts it into a condenser at 100°C. What is maximum possible efficiency?

(6+4)

UNIVERSITY OF THE PUNJAB

Roll No. .....

Second Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Electricity & Magnetism (IT) **TIME ALLOWED: 30 mins.**

Course Code: PHY-122 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

SECTION I
Objective Part

Question no.1: Choose the best option. **(10×1=10)**

1) Which of the following laws are applicable for the behavior of perfect gas?
   a) Boyle's Law
   b) Gay-Lussac's Law
   c) Charles's Law
   d) All of these.

2) The internal energy of the ideal gas depends upon _____.
   a) Temperature b) Pressure c) Volume d) None of these

3) In Carnot engine, change in internal energy per cycle is _____.
   a) Positive b) Negative c) Zero d) Changes at every cycle

4) What is a process during which the pressure remains constant?
   a) Adiabatic process
   b) Isochoric process
   c) Isothermal process
   d) Isobaric process

5) The sum of all the microscopic form of energy is called _____.
   a) Total energy b) Internal energy c) System energy d) None of these.

6) The electric field intensity between two oppositely charged plates is _____.
   a) $E = \sigma / 2\,\varepsilon_o$ b) $E = \varepsilon_o / 2\,\sigma$ c) $E = \sigma / \varepsilon_o$ d) $E = \sigma\,\varepsilon_o / 2$

7) The product ($\vec{P} \times \vec{E}$) is equal to _____.
   a) Electric dipole b) Force c) Torque d) Electric potential

8) The surfaces are called equipotential surfaces, if they have _____.
   a) Same potential
   b) Different field
   c) Different potential
   d) All of these

9) The centers of two identical conducting spheres of radius R are separated by a distance d. A charge q is on one sphere, and –q is on the other. The capacitance of the system is Co. Half of the charge is now removed so that charge on each sphere is half. The new capacitance C' is,
   a) C' = 2Co
   b) C' = 4Co
   c) C' = Co
   d) None of these

10) In Biot-Savart's law, magnitude of magnetic field is inversely proportional to _____.
   a) Applied current
   b) Apparent length
   c) $1 / r^2$
   d) r^2

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Second Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Electricity & Magnetism (IT) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-122 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

SECTION II
Subjective Part

Question no.2: Write short answers of the following questions. **(10×2=20)**

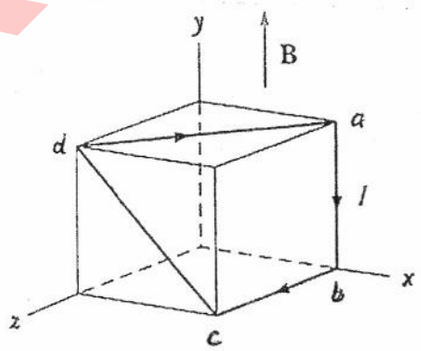
1. State the zeroth law of thermodynamics.
2. Is it possible to construct a heat engine that will not expel heat into atmosphere? Why?
3. What is a Carnot engine? Which processes are involved in Carnot cycle?
4. What is irreversible process? Give an example of irreversible process.
5. Compare Isothermal Expansion and Adiabatic Expansion.
6. A proton moves perpendicularly to a uniform magnetic field B with velocity 1.0×10^7 m/s and experiences an acceleration of 2.0×10^{13} m/s^2 in the +x direction when its velocity is in the +z direction. Determine the magnitude and direction of the field. Mass of proton is 1.67×10^{-27} kg and charge of proton is 1.6×10^{-19} C.
7. Show the mechanism of insulator in an electric field with the help of diagrams.
8. What are capacitors? Briefly explain.
9. What should be the orientation of a current carrying coil in a magnetic field so that the torque acting upon the coil is,
   a) maximum b) minimum
10. State Faraday's law. How can we find the direction of induced current with the help of Lenz's law?

Question no.3: **(5+5+5=15)**

a) State Coulomb's law. Also write its vector form.
b) Using Gauss's law, find the electric field due to spherical shell of charges.
c) A uniform charged conducting sphere of 1.22m radius has a surface charge density of $8.13\mu C/m^2$.
   i. Find the charge on sphere.
   ii. What is the total electric flux leaving the surface of sphere?
   iii. Calculate the electric field at the surface of the sphere.

Question no.4: **(10+5=15)**

a) Explain the Ampere's Law. Find the magnetic field due to a straight wire at its internal and external points by using Ampere's Law.
b) In the figure, the cube is 40.0 cm on each edge. Four straight segments of wire—ab, bc, cd, and da—form a closed loop that carries a current I = 5.00 A, in the direction shown. A uniform magnetic field of magnitude B = 0.020 0 T is in the positive y direction.



(1) Determine the magnitude and direction of the magnetic force on segment ab.
(2) Determine the magnitude and direction of the magnetic force on segment bc.

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Third Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Concepts of Modern Physics **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-201/ **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

SUBJECTIVE PART

Note: Attempt all questions. Write to the point answer of theoretical part of each question.

Q. 2 Give to the point answer / short description of each question. **(2×10 = 20)**

i) Is the Compton effect more supportive of the photon theory of light than the photoelectric effect? Explain your answer.
ii) What is meant the concept of wave-particle duality? Explain briefly.
iii) Write down three important postulates of Bohr's atomic model.
iv) In both the photoelectric effect and the Compton effect there is an incident photon and an ejected electron. What is difference between these two effects?
v) What Heisenberg uncertainty principle states? Explain briefly.
vi) Write down energy and momentum operators.
vii) Write down the time independent Schrodinger wave equation.
viii) Just define the binding energy of a nucleus?
ix) What is the origin of characteristics X-ray? Explain with the aid of diagram.
x) What is meant by p- and n-type semiconductors? Give at least one example of each.

Q. 3

a) What is de Broglie hypothesis? Describe in detail how Davisson and Germer test/verify the de Broglie hypothesis? **(2+5)**

b) Find the wavelength of the spectral line that corresponds to a transition in hydrogen atom from n = 6 state to the n = 3 state. In what part of the spectrum is this? **(2+1)**

Q. 4 What is meant by a nuclear reaction? Write down Q-value equation of a general nuclear reaction and explain what are exothermic and endothermic nuclear reactions? **(10)**

Q.5 What is Compton effect? Derive Compton shift equation. **(10)**

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Roll No. .....

Third Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Concepts of Modern Physics | **TIME ALLOWED: 30 mins.**

Course Code: PHY-201/ | **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

OBJECTIVE PART

Q. 1 Encircle the correct answer (from the given multiple choices) in each part. **(1 × 10 = 10)**

A) What is the effect of increasing the wavelength of the light that falls on the emitter in a photoelectric effect apparatus?

i) The work function decreases.
ii) The cutoff frequency decreases.
iii) The stopping potential decreases.
iv) The time delay for emission of photoelectrons increases.
v) None of the above.

B) How does the maximum Compton shift $\Delta\lambda_{max}$ depend on the incident wavelength λ?

i) $\Delta\lambda_{max} \alpha \lambda^2$
ii) $\Delta\lambda_{max} \alpha \lambda$
iii) $\Delta\lambda_{max}$ is independent of λ.
iv) $\Delta\lambda_{max} \alpha 1/\lambda$

C) Which of the following statements is a consequence of Planck's radiation law?

i) Atomic oscillators can emit and absorb energy at discrete values only.
ii) Atomic oscillators can emit and absorb energy at discrete frequencies only.
iii) Both **(i)** and **(ii)**
iv) Neither **(i)** nor **(ii)**

D) If the particles listed all have the same de Broglie wavelength, which has the largest kinetic energy?

i) Electron **ii)** α-particle **iii)** Neutron **iv)** Proton

E) For an electron trapped in an infinite one-dimensional potential well of width L, the minimum possible energy of the electron is

(i) 0
(ii) between 0 and $h^2/8mL^2$
(iii) $\approx h^2/8mL^2$, but it is not possible to find the exact value because of the uncertainty principle.
(iv) Exactly $h^2/8mL^2$

(P.T.O.)

F) Which of the following X-ray lines will have the greatest frequency in the given element?

i) K_α **ii)** K_β **iii)** L_α **iv)** It depends on the element.

G) Why are fission fragments usually radioactive?

i) They come originally from radioactive ^{235}U.
ii) They have a large neutron excess.
iii) They have large binding energy per nucleon.
iv) They are moving at high speed.

H) In a nuclear reactor, the function of the moderator is

i) To absorb neutrons
ii) To keep the reactor from going critical.
iii) To slow down the neutrons.
iv) To absorb heat from the core.

I) The decay rate of a radioactive source is measured in units of ----------, and the biological effect of that radiation on the human being is measured in units of ----------.

i) Curies **ii)** Roentgens **iii)** rads **iv)** rems

J) To make ordinary silicon into p-type semiconductor, we might add into it

i) indium **ii)** antimony **iii)** germanium **iv)** carbon

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Roll No. .....

Third Semester 2015

Examination: B.S. 4 Years Programme

PAPER: Physics-III (Electricity & Magnetism) **TIME ALLOWED: 30 mins.**

Course Code: PHY-211/ **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

SECTION – I (Objective Part)

Q.1. Each question has four possible answers, select the correct answer and encircle it, Overwriting, Cutting, erasing or use of lead pencil will carry zero credit.

(i) Intensity of electric field due to a charged metallic sphere as we move from its surface towards the center

(a) remains unchanged (b) increases
(c) decreases (d) becomes zero at all points

(ii) The electric field due to dipole at distant points in its median plane is

(a) $E=\frac{1}{4\pi\varepsilon_0}\frac{q}{x^3}$ (b) $E=\frac{1}{4\pi\varepsilon_0}\frac{q}{x^2}$ (c) $E=\frac{1}{4\pi\varepsilon_0}\frac{p}{x^3}$ (d) $E=\frac{1}{4\pi\varepsilon_0}\frac{p}{x^2}$

(iii) A dipole placed in external electric field, making an angle θ, experiences a minimum potential energy when $\vec{E}$ *and* $\vec{P}$ are

(a) Parallel (b) anti-parallel (c) normal to each other (d) none of these

(iv) Which of the following does not significantly contribute to the magnetic properties of a substance?

(a) Orbital magnetic moments of electrons (b) spin magnetic moments of electrons
(c) Magnetic moments of protons and neutrons (d) all contribute equally

(v) Gauss' law for magnetism is

(a) $\oint \vec{E}\bullet d\vec{A}=\frac{q}{\varepsilon_0}$ (b) $\oint \vec{B}\bullet d\vec{A}=0$ (c) $\oint \vec{B}\bullet d\vec{S}=\mu_0 i$ (d) $\oint \vec{E}\bullet d\vec{S}=-\frac{d\phi_B}{dt}$

(vi) Which of the following quantities increases with increasing frequency?

(a) R (b) L (c) X_C (d) X_L

(vii) Mathematical expression for Bohr magnetron is

(a) $\frac{eh}{4\pi m}$ (b) $\frac{eh}{4m}$ (c) $\frac{eh}{4\pi}$ (d) $\frac{h}{4\pi m}$

(viii) Electromagnetic waves are produced by

(a) an accelerating charge (b) a stationary charge (c) chargeless particles (d) a moving charge

(ix) $\oint \vec{J}\bullet d\vec{A}$ is equal to

(a) i (b) q (c) v (d) $\vec{E}$

(x) The magnitude of the Poynting vector is

(a) $\frac{P}{A}$ (b) $\frac{\mu_0}{c}B^2$ (c) $\frac{SA}{c}$ (d) $\frac{1}{\mu_0}\frac{dU}{dt}$

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Third Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Physics-III (Electricity & Magnetism) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-211/ **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

SECTION – II (Subjective Part)

Q.2. Write short answers of the following questions: $(2\times10=20)$

i. What is meant by an electric field of continuous charge distribution?
ii. Why can an isolated atom not have a permanent electric dipole moment ?
iii. What is Gauss law for *magnetism*?
iv. State Faraday's law & give reason for its negative sign.
v. Define current density and microscopic form of Ohm's law.
vi. What do you mean by motional EMF.
vii. If an electron is not deflected in passing through a certain region of space, can we be sure that there is no magnetic field in the region?
viii. Is there any way to set up a magnetic field other than by causing charge to move ?
ix. How do you distinguish between ε_0 *and* μ_0 ? How are they related with velocity of electromagnetic waves in the space?
x. What are superconductors?

Q.3: (a) Apply Gauss' law to a parallel plate capacitor filled with a material of dielectric constant k_e and derive the relation: $\varepsilon_0 \int k_e \vec{E} \bullet d\vec{A} = q$

(b) A plastic rod, whose length L is 220 cm and whose radius r is 3.6 mm, carries a negative charge q of magnitude $3.8\times10^{-7}\,C$, spread uniformly over its surface. What is the electric field near the midpoint of the rod, at a point on its surface?

(6, 4)

Q.4: (a) By using Biot-Savart's law derive an expression for magnetic field due to a current i in a straight wire segment of length L.

(b) A rectangular coil of length 2.10 cm and width 1.25 cm having 250 turns carries a current of 85 μA.

(i) what is the magnetic dipole moment of this coil?
(ii) The magnetic dipole moment of the coil is lined up with an external magnetic field whose strength is 0.85 T. How much work would be done by an external agent to rotate the coil through 180°?

(5, 5)

Q.5: (a) Describe the energy transport of electromagnetic waves in terms of pointing vector?

(b) Show that the expression for the electric field of a circular disk of radius R, carrying a uniform surface charge density, is given by

$$E_z = \frac{\sigma}{2\varepsilon_0}\left(1-\frac{z}{\sqrt{z^2+R^2}}\right)$$

(5, 5)

UNIVERSITY OF THE PUNJAB

Roll No. .....

Fourth Semester 2015
Examination: B.S. 4 Years Programme

PAPER: Basic Electronics **TIME ALLOWED: 30 mins.**
Course Code: PHY-203 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Section – I (Objective Type)

Q.1. Select the correct answer and encircle it. Over writing, Cutting, Erasing or use of lead pencil is not allowed and will carry zero credit. **(1×10 = 10)**

(i) Recombination occurs when
(a) an electron falls into a hole (b) a valence electron becomes a conduction electron
(c) a crystal is formed (d) a positive and a negative ion bond together

(ii) The main function of clamper circuit is to
(a) suppress variations in signal voltage (b) raise positive half cycle of signal
(c) lower negative half cycle of signal (d) introduce a dc level into ac signal

(iii) The diffusion of free electrons across the junction of an unbiased diode produces
(a) forward bias (b) reverse bias (c) depletion layer (d) break down

(iv) When a diode is forward biased, the recombination of electrons and holes may produce
(a) light (b) heat (c) radiation (d) all of above

(v) Without a dc source, a clipper circuit resembles to a
(a) clamper (b) rectifier (c) voltage doubler (d) none as above

(vi) If current through the resistor is halved, wattage developed by it would be
(a) halved (b) quadrupled (c) cut to one fourth (d) doubled

(vii) If both the emitter-base and the collector-base junctions of a bipolar transistor are forward biased, the transistor is in the
(a) active region (b) saturated region (c) cut-off region (d) inverse mode

(viii) The biasing technique that produces the most unstable Q-point is
(a) collector bias (b) emitter bias (c) base bias (d) voltage-divider bias

(ix) The JFET is
(a) a two terminal device (b) a voltage-controlled device
(c) a current controlled device (d) none as above

(x) Compared to BJT, the JFET has much high
(a) input resistance (b) voltage gain (c) current gain (d) supply voltage

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Fourth Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Basic Electronics
Course Code: PHY-203 / [illegible] 1

TIME ALLOWED: 2 hrs. & 30 mins.
MAX. MARKS: 50

Attempt this Paper on Separate Answer Sheet provided.

Attempt all Questions.

Section – II (Subjective Type)

Q.2. Write short answers of the following questions: (2×10 = 20)

i. Why diode is a non linear device?
ii. What is peak reverse voltage (PRV)?
iii. Draw the circuit diagram of common emitter (CE) self biased circuit.
iv. What are the major advantages of CE configuration of transistor over the others?
v. Why Silicon is preferred over Germanium for fabrication of semiconductor devices?
vi. Draw the circuit diagram of a voltage doubler circuit.
vii. What are the end points or the intercepts of the dc load line?
viii. Why a BJT is called current controlled device?
ix. What is the construction difference between a JFET and MOSFET?
x. Why do we limit FET operation to small signals?

Q.3: (a) Explain the formation of depletion region in a *pn* junction. Define barrier potential and discuss its significance.
(b) Discuss the circuit operation of a negative diode clipper and draw its output voltage waveform.
(6, 4)

Q.4: (a) For the common-emitter (CE) transistor amplifier draw the *h* parameter equivalent circuit, and derive an expression for voltage gain A_i .
(b) Briefly explain the working of voltage-divider common-emitter (CE) amplifier.
(6, 4)

Q.5: (a) Discuss the operation of an *n-channel* MOSFET in enhancement mode.
(b) Briefly explain the term transconductance.
(7, 3)

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Roll No. .....

Fourth Semester 2015
Examination: B.S. 4 Years Programme

PAPER: Physics-IV (CONCEPTS OF MODERN PHYSICS) **TIME ALLOWED: 30 mins.**
Course Code: PHY-213 / **MAX. MARKS: 10**

Attempt this Paper on this Question Sheet only.

Q. 1. Choose the correct answer. (1x10)

1. Which are the basic postulates of Bohr's model for the hydrogen atom?
   (a) The electron moves in a circular orbit around the proton
   (b) The electrons in stationary (stable) orbits do not emit energy as radiation.
   (c) When an electron moves from a higher energy orbit to a lower energy orbit, photons are emitted.
   (d) All of the above.
2. A body moves with velocity of $3x10^8$ m/s, its relativistic mass becomes
   (a) Zero
   (b) Infinity
   (c) Double of its rest mass
   (d) Unity
3. The wavelength of the wave associated with a moving object is given by
   (a) $\lambda=mv/h$
   (b) λ
   (c) $\lambda=h/mv^2$
   (d) $\lambda=h/mv$
4. A scientist is trying to eject electrons from a metal by shining a light on it, but none are coming out. To eject electrons, she should change the light by
   (a) Decreasing the frequency
   (b) Increasing the frequency
   (c) Increasing the intensity
   (d) Increasing the wavelength
5. A neutron has almost 2000 times the rest mass of an electron. Suppose they both have 1eV of energy. How do their wavelengths compare?
   (a) Both same
   (b) Zero
   (c) Neutron wavelength < electron wavelength
   (d) Neutron wavelength > electron wavelength

P.T.O.

6. Compton length is given by
   (a) h/m_oc^2
   (b) h/m_oc
   (c) hc/m_o
   (d) m_oh/c
7. Which is the most convenient unit for energy at the atomic level?
   (a) Joule (b)
   (b) Watt-second
   (c) Newton-meter
   (d) Electron volt
8. What happens during the alpha decay?
   (a) A neutron is emitted
   (b) An electron is emitted
   (c) A helium core is emitted
   (d) A photon core is emitted
9. Which of the following are electromagnetic waves?
   (a) α- rays
   (b) β^- - rays
   (c) β^+ - rays
   (d) γ-rays
10. The two elements with same number of electrons but different mass number are called
   (a) isotones
   (b) isobars
   (c) isomers
   (d) isotopes

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Fourth Semester 2015
Examination: B.S. 4 Years Programme

Roll No. .....

PAPER: Physics-IV (CONCEPTS OF MODERN PHYSICS) **TIME ALLOWED: 2 hrs. & 30 mins.**
Course Code: PHY-213 / **MAX. MARKS: 50**

Attempt this Paper on Separate Answer Sheet provided.

SECTION-I

Q.2. Give answers of the following short questions. (2x10 = 20)

1. State the Heisenberg Uncertainty principle.
2. Which are the experiments that support the wave theory of light and the particle theory of light?
3. What are the postulates of special theory of relativity?
4. Define half-life of radioactive element.
5. If the de Broglie wavelength of electron is 0.113 pm. What is the speed of the electron?
6. What are the momentum and energy operators?
7. Define characteristic x-ray spectrum?
8. Define probability density?
9. What is time dependent Schrödinger wave equation?
10. Define spontaneous emission?

SECTION-II

Q.3: (a) Derive radio active decay law. Hence obtain an expression for the half –life in terms of decay constant.

(b) X-rays of wavelength 100 pm are scattered from a carbon target. The scattered radiation is viewed at 90° to the incident beam. What is the Compton shift $\Delta\lambda$? (5x5)

Q. 4: (a) Describe Lorentz transformation, hence find inverse Lorentz transformation?

(b) Calculate the wavelength λ_{min} for the continuous spectrum of x-rays emitted when 35 keV electrons fall on a molybdenum target? (5x5)

Q. 5: (a) Describe the behavior of a particle trapped in an infinitely deep well using Schrödinger wave equation and show that the energy of the particle inside the well is quantized?

(b) If the wave function $\psi = A\sin(n\pi x/L)$ is normalized in $0 \leq x \leq L$, calculate the value of A?

(5x5)