SUBJECT CODE NO:- B-2050
FACULTY OF SCIENCE
B.Sc. T.Y (Sem-V) Examination March/April 2018
Physics Paper-XV
Classical and Quantum Mechanics

[Time: 1:30 Hours]   **[Max.Marks:50]**

Please check whether you have got the right question paper.

N.B
1. All questions are compulsory.
2. All questions carry equal marks.

Given data

$K = 1.38 \times 10^{-23} \, J/K,$ $h = 6.63 \times 10^{-34} JS$
$R = 8.31 \times 10^{3} J/Kmolek,$ $m_e = 9.1 \times 10^{-31} \, Kg$
$\mu_o = 4\pi \times 10^{-7} Wb/Amp$ $e = 1.6 \times 10^{-19} \, C$
$C = 3 \times 10^{8} m/s$ $leV = 1.6 \times 10^{19} \, J$

Q.1 a) What are constraints? Explain Holonomic and Non- Holonomic constraints in detail.   10

b) Obtain an expression of Plank's radiation law. Deduce Rayleigh's law from plank's law.   10

OR

a) State and explain Heisenberg's uncertainty Principle.   10

b) Explain the term 'Operator'. Derive expression for i) linear momentum operator. ii) energy operator   10

Q.2 a) Write a note on Virtual work.   05

b) A point mass moves in a vertical plane along a given curve in a gravitational field. The equation of motion in parametric form is x = x(s), z = z(s) write down the Lagrange equation.   05

c) Explain phase velocity and group velocity.   05

d) Show that the de- Broglie wavelength associated with an electron V electron volts is approximately $\left(\frac{1.227}{\sqrt{V}}\right) nm.$ 05

OR

a) State Einstein's Photoelectric equation explain work function.   05

b) The photoelectric threshold for a metal is 3000A°. Find the kinetic energy of an electron ejected from it by radiation of wavelength 1200A°.   05

c) Write a note on expectation values.   05

d) Compute the energy of the lowest three levels for an electron in a square well of width 3A°.   05

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Q.3   Multiple choice questions.   10

1) Lagrangian equations are applicable when the system is --------
    a) Non conservative
    b) Conservative
    c) Both a and b
    d) None of these

2) The equation of motion of one dimensional harmonic oscillator is -------
    a) $mx + k\ddot{x} = o$
    b) $\ddot{m} x + kx = o$
    c) $m\ddot{x} + kx = o$
    d) $mx + \ddot{k}x = o$

3) The Einstein photoelectric eq^n is -----
    a) $E = \phi + Kmax$
    b) $h\nu = \phi + Kmax$
    c) $\frac{hc}{\lambda} = \phi + Kmax$
    d) All above

4) To increase the kinetic energy of ejected photoelectrons, there should be an increase in --------
    a) I
    b) λ
    c) ν
    d) Both λ and I

5) The kinetic energy of the oscillator assigned by Rayleigh is --------.
    a) $\frac{1}{2} KT$

    b) $\frac{3}{2} KT$

    c) $\frac{2}{3} KT$

    d) 2KT

6) Davisson and Germer experiment proved
    a) Wave nature of light
    b) Particle nature of light
    c) Neither a nor b
    d) Both a and b

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7) If the kinetic energy of a free electron doubles , its de- Broglie wave length changes by the factor-----

   a) $\frac{1}{\sqrt{2}}$

   b) $\sqrt{2}$

   c) $\frac{1}{2}$

   d) 2

8) If the uncertainty in the position of an electron in zero, the uncertainty in its momentum would be ----
   a) Zero
   b) Greater than $h/4\Pi$
   c) Less than $\frac{h}{4\Pi}$
   d) Infinite

9) Which of the following is Schrodinger's time dependent Schrodinger wave equation?
   a) $\nabla^2 \psi + \frac{2m}{h^2}(E - V)\psi = o$

   b) $\nabla^2 h (E - V) = o$

   c) $\frac{2m}{h^2}(E - V)\psi = o$

   d) $i\hbar \frac{\partial \psi}{\partial t} = (\frac{-\hbar^2}{2m}\nabla^2 + V)\psi$

10) The energy of a particle in a one dimensional closed box is
   a) Inversely proportional to the mass of particle
   b) Inversely proportional to square of natural number
   c) Inversely proportional to the square of the length of box.
   d) Both a and c

SUBJECT CODE NO:- B-2051
FACULTY OF SCIENCE
B.Sc. T.Y (Sem-V) Examination March/April 2018
Physics Paper- XVI
(Electrodynamics)

[Time: 1:30 Hours]   [Max. Marks: 50]

Please check whether you have got the right question paper.
N.B   1.   Attempt all question.

Q.1   a)   State Gauss law and explain how it is used to find the electric field intensity due to the charged   10
cylinder.

   b)   Derive the Maxwell's equations $\text{div}\vec{B} = o \text{ and } curl \vec{H} = \vec{J}\frac{\partial \vec{D}}{\partial t}$ 10

OR

   a)   State and prove pointing theorem.   10

   b)   Determine the boundary condition at the interface for $\vec{H}$.   10

Q.2   a)   Derive the Poisson's equation using the differential form of Gauss law.   05

   b)   A point charge of 11C is located at the center of sphere of radius 5 cm. find the electric flux   05
through the sphere.
($\in_o= 8.85 \times 10^{-12}N/m^2$)

   c)   State any five characteristics of electromagnetic wave.   05

   d)   On the surface of the earth, the energy received is 1.33 kw/m^2 from the sun calculate the   05
electric field associated with sunlight assuming that it is essentially monochromatic ($\lambda =$
$6000A^o$),(given $\in= 9 \times 10^{-12}SI \text{ units}$)

OR

   a)   Write short note on Maxwell's displacement current.   05

   b)   The back emf in the inductance coil is 200V, when the current in the coil changes from 0 to   05
2A in 0.01 sec. calculate the self-inductance of the coil.

   c)   Derive the snell's law of refraction in case of electromagnetic wave.   05

   d)   If the angle of reflection is 60° its refractive index is 1.1 and if the angle of transmission is   05
30°, find the refractive index of transmission.

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Q.3   Multiple choice questions   10
    1)   The equation $\vec{\nabla}.\vec{\in} = ۹/\in_0$ is
        a) The divergence theorem
        b) Stoke's theorem
        c) Gauss law in differential form
        d) Amperes law

    2)   Electric intensity is directed along the direction at which electric potential
        a) Increases
        b) Decreases
        c) Remains constant
        d) Above a & c

    3)   The electric force experienced by a unit positive charge placed at that point is called
        a) Magnetic field
        b) Gravitational field
        c) Electromagnetic field
        d) Electric field

    4)   When it is essential to distinguish between ϕ/I and $d\phi/dI$ then it is called
        a) Self-inductance
        b) Mutual inductance
        c) Incremental inductance
        d) None of these

    5)   The property of coil by which a counter emf is induced in it when the current in the coil
        changes is known as --------
        a) Capacitance
        b) Inductance
        c) Self-inductance
        d) Mutual inductance

    6)   The rate of change of displacement vector with time is called
        a) Current
        b) Emf
        c) Eddy current
        d) Displacement current

    7)   The relation between $\vec{E}$ & $\vec{H}$ is
        a) $\vec{E} = \dfrac{\mu_0}{\in_0} \vec{H}$

        b) $\vec{E} = \sqrt{\dfrac{\mu_0}{\in_0}} \vec{H}$

        c) $\vec{E} = \dfrac{\mu_0}{\in_0} \sqrt{\vec{H}}$

        d) $\vec{E} = \sqrt{\dfrac{\mu_0}{\in_0} \vec{H}}$

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8) Which one of the following have highest wavelength
   a) Infrared
   b) Gamma rays
   c) Radio waves
   d) Ultraviolet

9) Snell's law represents the equation
   a) $n_1 \sin \theta_1 = n_2 \sin \theta_2$
   b) $n_2 \sin \theta_1 = n_1 \sin \theta_2$
   c) $n_1 \sin \theta_1 > n_2 \sin \theta_2$
   d) $n_1 \sin \theta_1 < n_2 \sin \theta_2$

10) The normal component of magnetic induction $\vec{B}$ is ----- across the boundary.
   a) Continuous
   b) Dis continuous
   c) Both a and b
   d) None of these

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Total No. of Printed Pages:3

[Time: 1:30 Hours]   **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
  i) Attempt all questions.
  ii) Use of logarithm table and electronic pocket calculator is allowed.

Q.1	a)	Derive an expression for gravitational of a mass M.	10
	b)	Obtain an expression for the depression of a beam, when loaded at centre	10

OR

	c)	Determine coefficient of viscosity by using Poiseuille's method..	10
	d)	Explain Piezo-electric generator give it's merits and Demerits.	10

Q.2	a)	Derive an expression for interchangeability of centre of suspension and oscillations.	05
	b)	A spherical shell has mass 10gm and radius 60cm. Calculate potential at a point 10 cm.	05
	c)	Write a short note on pressure difference across a liquid surface.	05
	d)	Calculate rate of flow of water through a horizontal capillary of radius 5×10^{-2} cm and length 5×10^{-1} m the pressure difference is equivalent to 10^{-2} cm of water column is maintained between two ends of tube. Consider viscosity of liquid as 10^{-3} Ns/m^2.	05

OR

	a)	Define stress? Explain young's modulus	05
	b)	A Force of 2 kg wt stretches steel wire having diameter 1 mm and length 2 cm. Calculate increase in length of wire ($Y=2 \times 10^{11}$ N/m^2)	05
	c)	Write a short note on Acoustical demands of an auditorium.	05
	d)	Calculate velocity of longitudinal wave in magnetostriction rod of length 0.5 m. At resonance the value of inductance is 2H and that of capacitor is 0.02 µF.	05

Q.3   Multiple Choice questions.   10

1. The rate of change of gravitational potential at a point is called
   (a) Gravitational potential
   (b) Gravitational field
   (c) Gravitational constant
   (d) None of these

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2. Time period for compound pendulum is

   (a) $T = 2\pi\sqrt{\dfrac{I}{mgl}}$

   (b) $T = 2\pi\sqrt{\dfrac{l}{g}}$

   (c) $T = 2\pi\sqrt{\dfrac{mgl}{I}}$

   (d) $T = 2\pi\sqrt{\dfrac{mg}{I}}$

3. Shearing strain is given by
   (a) Deforming force
   (b) Shape of shear
   (c) Angle of shear
   (d) Change in volume of the body

4. The Bending moment of the bar is ....

   (a) $\dfrac{Y}{R}I_g$

   (b) $\dfrac{Y}{R^2}I_g$

   (c) $\dfrac{Y}{r^2}I_g$

   (d) $\dfrac{y^2}{r^2}I_g$

5. Viscosity of liquid is given by formula

   (a) $\dfrac{P\pi r^4}{8lJ}$

   (b) $\dfrac{\pi r^4}{8lJ}$

   (c) $\dfrac{4P\pi}{lJr^4}$

   (d) None of this

6. Volume of liquid that flows per unit time through any cross – section is called
   (a) Ultrasonic
   (b) Viscosity
   (c) Surface tension
   (d) Reverberation

7. For very high frequency Ultrasonic generation following method is used
   (a) Jager's method
   (b) Piezo electric method
   (c) Bernoulli's method
   (d) Magnetostriction method

8. Magnetostriction Oscillator produces frequency upto
   (a) 300 MHz
   (b) 400 MHz
   (c) 800 MHz
   (d) 820 MHz

9. Geometrical moment of inertia of circular bar whose radius is 0.05 cm is
   (a) 4.9062×10^{-6}
   (b) 8.70×10^{-6}
   (c) 7.888×10^{-6}
   (d) 5.5×10^{-6}

10. Calculate excess pressure in a water drop and water bubble of same radius 10^{-4}m. Consider that surface tension of water is 6.8×10^{-2} N/m
    (a) 2.7×10^{-6} N/m^2
    (b) 27.2×10^{-6} N/m^2
    (c) 272.2×10^{-6} N/m^2
    (d) 0.27×10^{-6} N/m^2

Total No. of Printed Pages:3

SUBJECT CODE NO: B-2152
FACULTY OF SCIENCE
B.Sc. F.Y (Sem-I) Examination March/April 2018
Physics Paper-II
Heat and Thermodynamics

[Time: 1:30 Hours]   **[Max.Marks:50]**

Please check whether you have got the right question paper.
N.B   i) Attempt all questions.
             ii) Use of logarithmic table and electronic pocket calculator is allowed.

Q.1   a) Define coefficient of thermal conductivity. Deduce expression for conductivity by using   10
          spherical shell method.

      b) Derive an expression for coefficient of viscosity.   10
                                                OR
      a) Describe Carnot's cycle. Obtain an expression for workdone by the engine per cycle.   10

      b) Explain general notation of entropy. Derive expression for change in entropy.   10

Q.2   a) Write short note on comparison of conductivities of different metals.   05

      b) The opposite faces of metal plate of 0.2 cm thickness are at a difference of temperature of   05
          100°C & the area of the plate is 200 sq.cm. Find the quantity of heat that will flow through
          the plate in one minute if K=0.2 C.G.S. units.

      c) Write a short note on Indicator diagram.   05

      d) Carnot's engine working as a refrigerator between 260°K and 300°K receives 500 calories of   05
          heat from the reservoir at the lower temperature. Calculate the amount of heat rejected to the
          reservoir at higher temperature. Calculate the amount of workdone in each cycle to operate
          the refrigerator. (1 calorie = 4.2 Joules)
                                                OR
      a) Write short note on Mean free path.   05

      b) The molecular diameter of nitrogen is 3.5×10^{-8} cm. Calculate the mean free path at   05
          temperature 27°c and pressure is 1 atm.

      c) Show that $Tds = C_v dT + T \left(\frac{\partial P}{\partial T}\right)_T dv$ 05

      d) Water boils at a temperature of 101°C at a pressure of 787mm of Hg.1gm of water occupies   05
          1.601 cm^3 on evaporation. Calculate the Latent heat of steam. J = 4.2×10^7 ergs/cal.

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Q.3 Multiple choice questions.   10

1) In the steady state of temperatures the flow of heat across the body depends
   a) Upon it's thermal capacity only
   b) Only upon it's thermal conductivity
   c) Neither upon thermal conductivity nor upon thermal capacity
   d) None of these

2) In an Ingen-Hauz experiment, Wax melted over 12 cm of copper rod and 6cm over iron rod.
   What is the conductivity of iron when the conductivity of copper is 0.90.
   a) 0.225
   b) 0.230
   c) 0.235
   d) 0.240

3) Vander waals equation is
   a) $P = \frac{R-T}{V-b} - \frac{V^2}{a}$

   b) $P = \frac{R-T}{V-b} + \frac{a}{V^2}$

   c) $P = \frac{RT}{V-b} - \frac{a}{V^2}$

   d) $P = \frac{R-T}{V-b} + \frac{V^2}{a}$

4) The mean free path of gas raises with absolute temperature (T) when
   a) T^{-1}

   b) T

   c) T^2

   d) T^3

5) Efficiency of Heat engine is
   a) $\eta = \frac{Q_1+Q_2}{Q_1}$

   b) $\eta = \frac{Q_1-Q_2}{Q_1}$

   c) Both a & b

   d) None of these

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6) In Carnot's cycle the first step is
   a) Adiabatic expansion
   b) Isothermal compression
   c) Adiabatic Compression
   d) Isothermal expansion

7) Entropy is maximum in which state
   a) Liquid
   b) Gas
   c) Solid
   d) Both a & c

8) Which of the following indicates a reversible process
   a) ds = 0
   b) ds < 0
   c) ds > 0
   d) None of these

9) Heat engine is a practical machine, which converts
   a) Mechanical work into heat
   b) Heat into energy
   c) Heat into mechanical work
   d) None of these

10) The internal energy of an ideal gas depends upon
   a) Pressure
   b) Volume
   c) Temperature
   d) b & c both

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SUBJECT CODE NO:- B-2157
FACULTY OF SCIENCE
B.Sc. S.Y (Sem-III) Examination March/April 2018
Physics –VII
Mathematical Statistical Physics and Relativity

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N.B
i) Attempt all questions.
ii) Use of logarithmic table and electronic pocket calculator is allowed.

Q.1 a) What is Chain Rule? State and prove Chain Rule. 10
b) Using M.B. energy distribution law evaluate constant $\propto$ and β. 10

OR

a) Obtain an expression for Bose-Einstein distribution law. 10
b) Describe the Michelson-Morley experiment for determining existence of ether. 10

Q.2 a) Explain exact differential equation with an example. 05
b) Write short note on Electron gas. 05
c) Solve the differential equation 05

$$\frac{d^2y}{dx^2} - 8\,\frac{dy}{dx} + 9y = e^{2x}$$

d) Find the number of ways in which three Boson may be distributed in four cells. 05

OR

a) Explain the term phase space. 05
b) Explain Phenomenon Time Dilation. 05
c) Two dice are rolled. Find the probability of an event when the sum of numbers on the dice is Eight. 05
d) Calculate the K.E. of an electron in Laboratory moving with a velocity of 0.8 times the velocity of light (rest mass of electron= 9.1×10^{-31} kg velocity of light $c = 3 \times 10^8$ m/sec) 05

Q.3 Multiple Choice Questions. 10

i) If $Y = \sin x^2$ then $\frac{dy}{dx}$ is
a) $2x\ \cos x^2$
b) $2\ \cos x^2$
c) $-2x\ \cos x^2$
d) $-2\ \cos x^2$

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ii) The given differential equation
$\frac{d^2y}{dx^2} + \frac{dy}{dx} + ky = 0$ is
a) Linear
b) Non-linear
c) Circular
d) None of these

iii) Probability of occurrence of two independent event is equal to their
a) Sum
b) Difference
c) Product
d) Ratio

iv) Thermodynamic probability of a microstate is
a) Number of particles
b) Number of cells
c) Number of systems
d) Number of accessible microstate

v) Particles obeying Maxwell-Boltzmann statistics are
a) Oxygen molecule
b) Electron
c) Photon
d) Neutron

vi) From Fermi-Dirac statistic, n_i=?
a) $\frac{g_i}{e^{\propto+\beta E_i}+1}$

b) $\frac{2g_i}{e^{\propto+\beta E_i}+1}$

c) $\frac{g_i}{e^{\propto+\beta E_i}-1}$

d) $\frac{2g_i}{e^{\propto+\beta E_i}-1}$

vii) Michelson-Morley experiment proves
a) The non-existence of ether medium
b) The existence of ether medium
c) The speed of light is changing
d) None of above

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viii)   If a body of rest mass 10kg is moving with velocity of 0.6 times velocity of light, then its mass in motion is
a) 10.5 kg
b) 10 kg
c) 12 kg
d) 12.5 kg

ix)   The velocity of light is different in different inertial frames which can be explained on the basis of
a) Galilean transformation
b) Lorentz transformation
c) Length contraction
d) Time dilation

x)   The combination of position space and momentum space is known as
a) Gamma space
b) mu-space
c) Phase space
d) Phase volume

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SUBJECT CODE NO:- B-2158
FACULTY OF SCIENCE
B.Sc. S.Y (Sem-III) Examination March/April 2018
Physics -VIII
Modern and Nuclear Physics

[Time: 1:30 Hours] **[Max. Marks: 50]**

Please check whether you have got the right question paper.

N.B   i)   Attempt all questions.
         ii) Use of logarithmic table and electronic pocket calculator is allowed.

Q.1 a) Explain Richardson and Compton experiment to study the relation between photoelectric   10
         current and retarding potential.
     b) Explain Bragg's law in X-ray diffraction. Describe Bragg's X-ray spectrometer.   10
                                      OR
     a) Describe construction and working of nuclear reactor.   10
     b) Discuss in detail the Betatron with necessary figure.   10

Q.2 a) Write a short note on photoconductive cell.   05
     b) Write a short note on nuclear fission.   05
     c) What is the energy in eV of a photon of light of frequency 7.45×10^{14} Hz.   05
     d) Calculate B.E. per nucleon of helium if it's atomic weight is 4.00260 amu, mass of proton is   05
         1.007895amu , mass of neutron is 1.008665 amu.
                                      OR
     a) Write a short note on characteristics of X-ray spectrum.   05
     b) Write a short note on construction of Betatron.   05
     c) Bragg's spectrometer is set for the first order reflection to be received by the defector at   05
         glancing angle of $9^0 18^{'}$. Calculate the angle through which the detector is rotated to receive the
         second order reflection from the same face of the crystal.
     d) In a certain betatron, the maximum magnetic field at the orbit was 0.4 wb/ m^2 operating at   05
         50 Hz with a stable orbit diameter 1. 524 m. calculate the final energy of the electrons.

Q.3 Multiple Choice Questions.   10
     1) Photoelectric cell is an arrangement to covert -------------------.
         a) Light energy into electrical energy
         b) Electrical to magnetic energy
         c) Electrical to light energy
         d) Magnetic to solar energy

     2) Secondary emission of electron is found in ------------------.
         a) Photo voltaic cell
         b) Solar-cell
         c) Photoconductive cell
         d) Photomultiplier

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3) Nature of X-rays is ---------------------.
   a) Magnetic
   b) Electric
   c) Electromagnetic
   d) Plasma

4) In X-ray spectrum, the group of lines of shortest wavelength is called the ----------------.
   a) N-series
   b) M-series
   c) L-series
   d) K-series

5) The empirical law of Duane and Hunt is expressed analytically as ------------.
   a) $ev = h\Upsilon max$

   b) $2ev = h \Upsilon max$

   c) $ev = h \Upsilon_{max}^2$

   d) $2ev = h \Upsilon_{max}^2$

6) Alpha particle is also known as
   a) An electron
   b) A positron
   c) A helium nucleus
   d) A photon

7) One atomic mass unit is equal to
   a) 931 MeV
   b) 1024 MeV
   c) 980 MeV
   d) 512 MeV

8) Which of the following is not the magic number.
   a) 8
   b) 27
   c) 50
   d) 82

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9) Betatron was constructed in 1941 by ----------------.
   a) Van de Graff
   b) D. W. kerst
   c) Giger- Muller
   d) Newton

10) Giger-Muller counter consists of a metal chamber containing air or other gas at a pressure of about ----------- of Hg.
   a) 110 cm
   b) 100 cm
   c) 10 cm
   d) 1000 cm

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