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SUBJECT CODE NO:- CB-2333
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. F.Y. (Sem-I)
Examination December/January-2022-23
Physics Paper-I PHY-011
Mechanics & Properties of Matter

[Time: 1:30 Hours] **[Max. Marks: 40]**

"Please check whether you have got the right question paper."

N.B.
1. All questions are compulsory.
2. Use of logarithm is allowed.

Q.1 Derive an expression of gravitational potential at a point outside to spherical shell? **10**

OR

a. State Young's Modulus, Bulk Modulus, Modulus of Rigidity, Hook's Law and Bending moment? **05**
b. A uniform circular cross section of iron bar having geometrical moment of inertia 0.7855, is rigidly fixed at one end, the other end is at distance of 100 cm is loaded by 4 Kg produces depression of 1.6 cm. Calculate the Young's Modulus of iron bar? **05**

Q.2 Explain applications of Bernoulli's theorem as (I) Law of hydrostatic pressure (II) Filter Pump. **10**

OR

a. Define Surface Tension and Write various factors affecting on it? **05**
b. Calculate the excess pressure inside a soap bubble of radius 3×10^{-3} m, if surface tension of soap solution is 30×10^{-3} Nm^{-1}. Also calculate surface energy? **05**

Q.3 Solve any two of the following. **10**

a. A Solid Sphere has mass 5 Kg, Calculate magnitude of the gravitational potential at a distance 50 cm away from center? ($G = 6.67 \times 10^{-11}$ Nm^2 / Kg^2)
b. Derive an expression for the depression of beam supported at two ends and loaded in the middle?
c. Calculate the potential energy per unit volume of liquid having density 1000 Kg/m^3 flowing from height 50 meter?
d. Write a short note on angle of contact for a liquid in contact with solid.

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Q.4 Multiple Choice Questions. **10**

1. Which of the following shape of the body can be considered as Compound Pendulum?
   a) Cuboidal
   b) Cubical
   c) Cylindrical
   d) All of above

2. The formula $V = -GM/r^2$ is used to define the physical quantity at a point in the field region.
   a) Gravitational field intensity
   b) Gravitational potential
   c) Gravitational potential energy
   d) Gravitational force

3. A rectangular brass rod having breadth b = 2 cm and depth d = 1 cm then calculate moment of inertia of brass rod
   a) 3.166 cm^4
   b) 2.166 cm^4
   c) 1.166 cm^4
   d) 0.166 cm^4

4. What is the unit of Young's Modulus?
   a) N/m
   b) N^2/m^2
   c) N
   d) N/m^2

5. The twisting couple acting on a solid cylinder of length X having inner circumference of radius r is
   a) $\frac{\pi\theta\eta y^4}{4X}$
   b) $\frac{\pi\theta\eta y}{4X}$
   c) $\frac{\pi\theta\eta r^4}{2X}$
   d) None of these

6. Volume of liquid that flows per unit time through any cross section is called
   a) Viscosity
   b) Surface Tension
   c) Young's Modulus
   d) None of these

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7. Bernoulli's principle states that, for streamline motion of an incompressible non – viscous fluid
   a) Pressure + kinetic energy = Constant
   b) Pressure + potential energy = Constant
   c) Pressure + kinetic energy + potential energy = Constant
   d) None of these

8. Which of the following parameter of liquid does not effect it's Reynold's number?
   a) Mean fluid velocity
   b) Density of fluid
   c) Temperature of fluid
   d) None of these

9. The rise of liquid in a Capillary tube and Working of ball point pen shows the principle of
   a) Viscosity
   b) Boyle's Law
   c) Gravitational force
   d) Surface Tension

10. The Surface Tension of a liquid is due to
    a) Cohesive force between molecules
    b) Adhesive force between molecules
    c) Nuclear force between molecules
    d) None of these

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SUBJECT CODE NO: - CB-2334
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y. (Sem-I)
Examination December/January-2022-23
Physics Paper-II PHY-021
Heat and Thermodynamics

[Time: 1:30 Hours] **[Max. Marks: 40]**

Please check whether you have got the right question paper.

N. B
1) All questions are compulsory.
2) All questions carry equal marks.
3) Draw neat diagrams and give labels wherever necessary.
4) Figures to the right indicate full marks.

Q1 a) Explain the comparison of thermal conductivities of different metal by using Ingen-Hansz experiment. **10M**

Or

Explain in brief.

a) Explain the reason for modification of Perfect gas equation. **05M**

b) Vander Waals constants for a gas are $a = 6.9 \times 10^{-2}\ Jm3\ mole^{-2}$ and $b = 2.9 \times 10^{-5}\ m^3 mole^{-1}$. The Universal gas constant $R = 8.31\ J\ mole^{-1}\ K^{-1}$. Calculate the critical temperature of the gases. **05M**

Q2 a) Derive relation for coefficient of thermal conductivity. **10M**

Or

a) State and explain zeroth law of thermodynamics **05M**

b) Find the efficiency of the Carnot's engine working between the steam paint and ice point. **05M**

Q3 Solve any two questions.

a) The opposite faces of a metal plate of 0.2cm thickness are at a difference of temperature of $l00°C$ and area of plate is 200 sq. cm. Find the quantity of heat that will flow through the plate in one minute if $K = 0 \cdot 2$ CGS units. **05M**

b) Derive an expression for constant of Van-der-Waals equation. **05M**

c) The diameter of nitrogen molecule is $3.2 \times 10^{-10}\ m$ pressure is 2.69×10^{25} per m^3. Calculate mean free path for nitrogen molecules. **05M**

d) What is isothermal process? Derive an expression for work done during isothermal process. **05M**

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Q4 Multiple choice questions **10M**

1. The dimensions of coefficient of thermal conductivity are ----------
   a) $[MLT^3\theta^{-1}]$ b) $[MLT^{-1}\theta^{-1}]$) c) $[MLT^{-1}\,\theta^{-3}]$ d) None of these

2. The value of critical volume V_c according to Vander Waals gas equation is--------
   a) V_c=b b) V_c=2b c) V_c=3b d) none of above

3. The coefficient of thermal conductivity of a gas is directly proportional to
   a) T b) T^2 c) $\sqrt{T}$ d) none of these.

4. In Carnot cycle, the second step is ------
   a) Isothermal expansion b) Isothermal Compression
   c) Adiabatic expansion d) Adiabatic compression.

5. The quantity $\frac{d\theta}{dx}$ is called as ----------
   a) Temperature coefficient b) Temperature
   c) Temperature gradient d) none of these

6. Critical volume is----------
   a) $V_c = 3b$ b) $V_c = -3b$ c) $V_c = 27b$ d) $V_c = 0$

7. Viscosity of a gas is directly proportional to ---------
   a) Temperature b) Density of gas c) pressure d) T^3

8. The physics underlying the working of a refrigerator closely resembles the physics underlying -
   a) Ice formation b) Vapour compression
   c) Heat engine d) Vaporization of water

9. Correction for volume in Vander Waal's is ----------
   a) $V + b$ b) $V - b$ c) $V + b^2$ d) $v - b^2$

10. The flow of heat in the steady state does not depends on ----------
    a) The area of cross section of the sod b) the temperature gradient
    c) The mass of the rod d) The time of flow of heat.

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SUBJECT CODE NO:- B-2025
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. F.Y. (Sem-II)
Examination November/December- 2022
Physics Paper- IV
Geometrical & Physical Optics

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

Please check whether you have got the right question paper.

N.B
1. Attempt all questions.
2. Use of logarithmic table and electronic pocket calculator is allowed.

Q.1 a) Explain co-axial system for equivalent focal length and determine its cardinal points. 10

b) Explain the phenomenon of reflection of light in thin film due to transmitted light. 10

OR

c) Explain Fraunhofer diffraction at double slit. 10

d) Discuss Fresnel theory of optical rotation. 10

Q.2 a) Write a note on Ramsden's eyepiece. 05

b) Two thin convex lens having focal lenses 5cm and 2cm are co-axial and separated by a distance of 3cm. find the equivalent 05

c) Write a note on resolving power of prism. 05

d) A plane transmission diffraction grating has 40,000 lines. Determine its resolving power in the second order for the wavelength of 6000 Å 05

OR

a) Give the theory of Newton's ring. 05

b) In Michelson's interferometer 200 fringes cross the field of view. When the movable mirror is moved through 0.0589 mm. calculate the wavelength of light used. 05

c) Write a note on optical activity. 05

d) A 20 cm long tube containing sugar solution rotates the plane of polarization by 11^0. If the specific rotation of sugar in 66^0. Calculate the strength of the solution. 05

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Q.3 Multiple choice questions. 10

1) In Ramsden's eyepiece the distance of first focal point from the field lens is given by
   a) $\frac{3}{2}$f b) $-\frac{f}{4}$ c) $\frac{-3}{2}$ f d) $\frac{f}{4}$

2) The lens used in Huygens eyepiece ----------
   a) Convex b) Concave c) Plano convex d) Concave Plano

3) Newton's rings are due to ---------
   a) Polarization b) Diffraction c) Interference d) Double refraction

4) Interference of two light waves is constructive if two waves are --------
   a) In same phase b) In opposite phase
   c) Perpendicular to each other d) None of the above

5) R.P. of prism is --------
   a) $\frac{1}{t}\frac{d\mu}{d\lambda}$ b) $t.\frac{d\mu}{d\lambda}$ c) $\frac{1}{t}\frac{d\lambda}{d\mu}$ d) $t.\frac{d\lambda}{d\mu}$

6) Grating element of plane transmission grating is
   a) a b) b c) (a + b) d) a-b

7) If light is incident along optic axis then phenomenon of double refraction is ------
   a) Absent b) Present c) Doubled d) Tripled

8) In Lorentz half-shade polarimeter source of light used is ----------
   a) Mono-chromatic b) Chromatic c) Continuous d) Gamma-ray

9) Colours of thin film result from ----------
   a) Dispersion of light b) Interference of light
   c) Absorption of light d) Scattering of light

10) The plane of polarization is that plane in which ----------
   a) Vibration occurs b) Vibration does not occurs
   c) Circular vibration occurs d) Elliptical vibration occurs

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SUBJECT CODE NO:- B-2026
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. F.Y. (Sem-II)
Examination November/December- 2022
Physics Paper-V
Electricity & Magnetism

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

Please check whether you have got the right question paper.

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

Q.1 (a) Explain scalar triple product and give its geometrical interpretation. 10

(b) Derive an expression for potential at a point due to a point charge 10

OR

(a) State Biot-Savart's law and obtain expression for magnetic induction due to straight conductor carrying current. 10

(b) Derive the expression for lime constant when condenser discharge through resistor. 10

Q.2 (a) Explain line and surface intigrals 05

(b) prove that $\nabla \times (\nabla \emptyset) = 0$. 05

(c) Write the principle and construction of moving coil ballistic galvanometer. 05

(d) Calculate magnetic Induction along axis of a solenoid of length 1.5m carry mg current of 2amp. and having 500turns. 05

OR

(a) Write short note on polarization of dielectric. 05

(b) Calculate the electric field when force of $9x10^9$ N is acting on a charge of $20\mu C$ 05

(c) Write a note on LR circuit. 05

(d) Find resonant frequency of LCR circuit if R=10KΩ, L= 10mH and C=20μF. 05

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Q.3 Multiple choice questions. 10

(1) Amperes circuital law is applicable to

(a) Open Loop (b) close Loop

(c) Only straight conductor. (d) Both open and closed loop

(2) The relation between $\vec{D}, \vec{E}$ and $\vec{P}$ is

(a) $\vec{D} = \frac{\vec{E}}{\vec{P}}$ (b) $\vec{D} = \vec{E} + \frac{\vec{P}}{\vec{K}}$ (c) $\vec{D} = E_0\,(K-1)\vec{E}P$ (d) $\vec{D} = r_0\vec{E} + \vec{P}$

(3) Magnetic field at a distance of 2m at right angles to a long avire of radius R and carrying current I is

(a) $\frac{\mu oI}{2\pi}$ (b) $\frac{\mu oI}{4\pi}$ (c) $\frac{\mu oI}{8\pi}$ (d) $\frac{\mu oI}{16\pi}$

(4) The equation of decay of charge in RC circuit is given by

(a) $Q = Q_0 e^{-\frac{R}{C}t}$ (b) $Q = Q_0 e^{\frac{-t}{RC}}$

(c) $Q = RC\ e^{\frac{-t}{RC}}$ (d) $Q = \frac{R}{Ce^{-t/RC}}$

(5) Which of the following is true.

(a) $\vec{P}.(\vec{Q} \times \vec{R}) = \vec{R}.(\vec{P} \times \vec{Q})$ (b) $\vec{P}.(\vec{Q} \times \vec{R}) = \vec{Q}.(\vec{R} \times \vec{P})$

(c) $\vec{P}.(\vec{Q} \times \vec{R}) = \vec{Q}.(\vec{P} \times \vec{R})$ (d) Both a, and b,

(6) If $(\vec{A} + \vec{B}) = \vec{A} - \vec{B}$ then angle between $\vec{A}$ and $\vec{B}$ is

(a) $3\pi/4$ (b) $\pi/4$ (c) $\pi/2$ (d) $\frac{3\pi}{2}$

(7) Dipole moment of electric dipole is

(a) q = P x 2l (b) P = q x 2l (c) d = q x 2P (d) P = 2q x 2l

(8) The S.I unit of $\frac{1}{4\pi\varepsilon_0}$ is

(a) C^2/Nm^2 (b) C/Nm (c) Nm/C (d) Nm^2/C^2

(9) The blux of the electric field is

(a) Sealar (b) Tensor (c) Vector (d) Both a and b

(10) The resonant frequency in series LCR circuit when L=1H and $C = 2\mu F$ is

(a) $\frac{1}{\pi\sqrt{8}}$ (b) $\frac{100}{\pi\sqrt{8}}$ (c) $\frac{1000}{\pi\sqrt{8}}$ (d) $\frac{10}{\pi\sqrt{8}}$

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SUBJECT CODE NO:- B-2033
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y. (Sem- IV)
Examination November/December- 2022
Physics Paper-XI
(General Electronics)

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

Please check whether you have got the right question paper.

N.B
1. Attempt all questions.
2. Use of logarithmic table & electronic pocket calculator is allowed.

Q.1
a) Explain the internal structure & action of a JFET. How will you obtain its characteristics? 10
b) Draw the circuit diagram & C.E Amplifier. Explain its working & derive an expression for its voltage gain. 10

OR

a) Discuss the working of monostable multivibrator using transistors. Draw the necessary waveforms. 10
b) Define modulation. Drive an expression for amplitude modulated wave. 10

Q.2
a) Write short note on D-MOSFET 05
b) A JFET has the drain current of 5mA. If I_{DSS} = 10mA, $V_{GS\ (off)}$ = - 6v Find the value of V_{GS} & V_P. 05
c) Discuss the basic principle of oscillator. 05
d) Determine the frequency of oscillation for sable multivibrator if R= 10K Ω C =0.01μF 05

OR

a) Describe the frequency response of RC coupled amplifier. 05
b) Calculate the output of non-inverting amplifier for values of Vi= 4v, R_F= 10K Ω & R_1 = 50 K Ω 05

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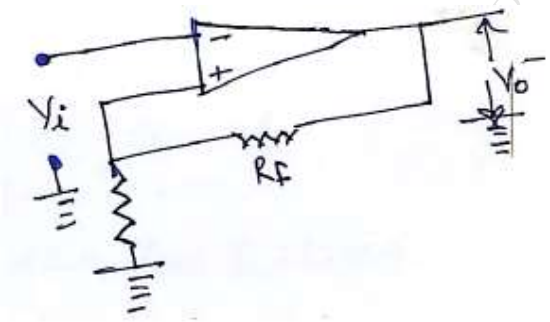

c) Write short note on phase modulation. 05

d) What is the modulation index of FM carrier having a carrier swing of 80 KHZ and modulating signal of 4 KHZ? 05

Q.3 Multiple choice questions (Attempt all questions) 10

1) In a transistor, collector current is controlled by
   A. Base current
   B. Collector voltage
   C. Collector resistance
   D. None of the above

2) A zener diode is always _____ connected
   A. Reverse
   B. Forward
   C. Either reverse of forward
   D. None of the above

3) A certain transistor has I_C= 15mA & I_B =167μA; B for it is
   A. 0.015 B. 16 C. 90 D. 170

4) Which is higher gain provided by CE configuration
   A. Voltage
   B. Current
   C. Power
   D. Resistance

5) The value of negative feedback fraction is always_____
   A. Less than one
   B. More than one
   C. Equal of one
   D. None of the above

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6) The best frequency response is of _____ coupling
   A. RC
   B. Transformer
   C. Direct
   D. None of the above

7) The frequency of oscillation for Hartely oscillator is given by
   A. $f_o = \frac{1}{2\pi\sqrt{LC}}$
   B. $f_o = \frac{1}{2\pi\sqrt{RC}}$
   C. $f_o = \frac{1}{2\pi R\sqrt{C}}$
   D. $f_o = \frac{1}{\sqrt{2\pi RC}}$

8) In a phase shif oscillator, we use _____ RC sections
   A. Two
   B. Three
   C. Four
   D. None of the above

9) Modulation is done in _____
   A. Transmitter
   B. Radio receiver
   C. Between transmitted radio receiver
   D. Oscillator

10) A carrier wave of 100V is made to vary between 150V and 50V by the signal. The percentage modulation is
   A. 100%
   B. 50%
   C. 60%
   D. 40%

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SUBJECT CODE NO:- B-2029
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI)
Examination November/December- 2022
Physics Paper-XIX
(Atomic, Molecular Physics & Laser)

[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.

Q. 1
a) Draw energy level diagram and explain series of spectral line in Bohr's theory of hydrogen atom. 10
b) Discuss "Vector atom model" in detail. 10

OR

a) What is Raman effect. Explain stokes and antistokes lines in Raman spectrum. 10
b) What is LASER? Explain construction and working of CO_2 LASER. 10

Q. 2
a) Write a short note on Thomsons atom model. 05
b) Write a short note on Rayleigh's law of scattering. 05
c) Calculate the radius of electron in Bohr's first orbit of hydrogen atom. Given 05
$-e = 1.6 \times 10^{-19}\ C, m = 9.1 \times 10^{-31} kg, h = 6.625 \times 10^{-34} J.s,$
$\epsilon_0 8.85 \times 10^{-12} C^2/Nm^2$
d) Calculate the rotational energy of diatomic molecule corresponding to J=2 level, it the rotational energy corresponding to J=1 level is $0.7 \times 10^{-32} J$. 05

OR

a) Explain L-S coupling scheme with vector diagram. 05
b) What are properties of LASER beam? 05
c) Calculate the wavelength separation between component lines of wavelength 6000 A.U. in normal Zeeman Effect. The magnetic field used is 0.2 wb/m^2 , specific charge is $1.76 \times 10^{11}\ c/kg$ 05

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d) Find the ratio of population inversion of the two states in a He-Ne LASER, that produces a light of wavelength 6328 A. U at 27° C. 05

Q. 3 Choose the correct answer. 10

1. The splitting of the spectral lines under the influence of magnetic Field is _____

a) Stark effect b) Photoelectric effect c) Zeeman effect d) Compton effect

2. The wavelength of Lyman series is obtained in _____

a) Visible region
b) Infrared region
c) Ultraviolet region
d) Far-infrared region

3. The value of magnetic spin quantum number are_____

a) $\frac{+1}{2}, 0$ b) $\frac{-1}{2}, 1$ c) $1, -1$ d) $\frac{-1}{2}, \frac{+1}{2}$

4. The Zeeman effect is a _____phenomenon in which spectral lines are split-up into several components.

a) Magnetic b) Optical c) Electrical d) Magnetooptical

5. In rotational spectra all frequency lines are_____

a) Equally spaced b) Unequally spaced

c) an integral multiple of ν_0.

d) equally spaced and an integral multiple of ν_0.

6. Rotational spectra are observed in _____

a) Visible region
b) Microwave region
c) Far infrared region
d) Microwave and far infrared region.

7. The process by which atoms are raised from lower level to upper level is called_____

a) Light amplification
b) Population inversion
c) Laser pumping
d) Stimulated emission

8. A LASER beam consist of _____

a) Light material particles
b) Electrons
c) Highly coherent photons
d) Cosmic rays

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9. If 'r' is radius of first Bohr's orbit then the radius of second Bohr's orbit is _____

a) r b) 2r c) 3r d) 4r

10. If $L = 1, S = \frac{3}{2}$ *then* $j =$?

a) $\frac{3}{2}$ b) $\frac{5}{2}$ c) $\frac{7}{2}$ d) 3

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SUBJECT CODE NO:- B-2030
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI)
Examination November/December- 2022
Physics Paper-XX
(Non -Conventional Energy Sources and Optical Fiber)

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

Please check whether you have got the right question paper.

N.B 1) Solve all Questions
2) Draw the neat diagram whenever necessary

Q.1 a) Discuss in detail 'Biomass as source of non-conventional energy. Give it's merits and demerits 10

b) Explain with suitable diagram the generation of electron –hole pairs in solar cell by photon absorption. 10

OR

a) What is optical Fibre? State types of optical fibre. Explain in detail with suitable diagrams 10

b) Describe with suitable sketch the external CVD technique of optical fibre fabrication. Give it's characteristics. 10

Q.2 a) Give merits of geothermal energy. 05

b) Write short note on Halide fibres. 05

c) What do you mean by 05
i) Wind farm ii) Propeller iii) Wind mill iv) wind turbine generator unit

d) Calculate numerical aperature and acceptance angle for symmetrical fibre having refractive index of core as 3.5 and that of cladding as 3.45 surrounding medium is air ($\mu_o = 1$) 05

OR

a) Give merits and demerits of storage batteries 05

b) Discuss in brief criteria of optical fibre cable selection 05

c) Calculate maximum power of a solar cell giving short circuit current 4A and open circuit voltage 0.6V 05

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d) Estimate the strain produced in optical fibre when it bends along a circumference of 6cm [Given :radius of cladding 150 μm] 05

Q.3 Choose the correct answer 10

1) Ocean tides occurs due to ----------
   a) Gravitational force b) Electrostatic force c) Magnetic force d) Nuclear force

2) In fixed dome type digester biogas plant the digester and gas collector are ------
   a) Enclosed in same chamber
   b) Enclosed in different chamber
   c) Connected to each other
   d) None of these

3) PV solar cell's are the standard source of power for ----------
   a) Space vehicles b) submarines c) Radio communication d) None of these

4) In intrinsic semiconductors the fermi energy is ----------of band gap energy
   a) One half b) one third c) one fourth d) one fifth

5) Optical fibre was invented in year ----------
   a) 1950 b) 1970 c) 1960 d) 1975

6) Light is guided within the core of a stepped index fibre by ----------
   a) Refraction b) reflection c) total internal reflection d) diffraction

7) For fabrication of highly pure optical fibres which of the following technique is preferred.
   a) External CVD b) Internal CVD c) AVD d) None of these

8) As per the norms OFC should be laid at a depth of ----------the road surface.
   a) 1.5m b) 1m c) 1 feet d) 1.5 feet

9) Refractive index of graded index optical fibre ----------outwards from the axis.
   a) Increases gradually b) Decreases gradually c) both a & b d) none of these

10) The electrons in the outer most shell of the atom are called as ----------
   a) Free electrons
   b) Valence electron
   c) Conduction electrons
   d) All of the above

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SUBJECT CODE NO:- B-2034
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y. (Sem-IV)
Examination November/December- 2022
Physics Paper- XII
Solid State Physics

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

Please check whether you have got the right question paper.

N.B
1. Attempt all questions.
2. Use of logarithmic table and electronic pocket calculator is allowed.

Q.1 a) Explain symmetry operations. Explain rotational symmetry and why crystal cannot have fivefold symmetry. 10

b) Explain in detail Vander Waal's bond and hydrogen bond with suitable examples. 10

OR

a) Derive the expression for density of modes in three dimension. 10

b) What is electrical conductivity? Derive an expression for electrical conductivity. 10

Q.2 a) What are Miller indices? How they are determined? 05

b) Lead has a face centre cubic structure with an atomic radius of 1.746 Å. Find the spacing of (2 2 0) plane 05

c) What are the merits and demerits of Einstein's Theory of specific heat capacity? 05

d) The Einstein temperature of carbon (diamond structure) is 1850k. Calculate highest lattice frequency involved in a Debye theory. ($K_B = 1.38 \times 10^{-23}$ J/k, h $= 6.63 \times 10^{-34}$ JS) 05

OR

a) Calculate the value of Madelung constant for one dimensional linear chain of NaCl 05

b) Calculate the band length ε_0 for a stable configuration of two atoms having m=3 and n=10. 05

c) Explain the importance of Hall Effect. 05

d) The Hall coefficient of a certain silicon specimen was found to be $-7.35 \times 10^{-5} m^3 c^{-1}$ from 100^0k to 400^0k. Determine the density of the sample. 05

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Q.3 Attempt all 10

1) Atomic radius of simple cubic (SC) cell is

a) $\frac{a}{2}$ b) $\frac{a\sqrt{3}}{4}$ c) $\frac{a}{2\sqrt{2}}$ d) $\frac{a\sqrt{3}}{8}$

2) A two dimensional square lattice has -------- rotational symmetry.

a) 2-fold b) 4-fold c) 0-fold d) 5-fold

3) In a crystal, the miller indices of a given plane is 3:2:1. What are the intercepts?

a) 1a, 2b, 3c b) 2a, 1b, 3c c) 2a, 3b, 6c d) 3a, 2b, 1c

4) Vander Waal's bonds are ----------

a) very weak bond b) Very strong bond
c) very very strong bond d) Does not exists

5) The first Brillouin zone extended from

a) $\frac{-4\pi}{a} to \frac{4\pi}{a}$ b) $\frac{-2\pi}{a} to \frac{3\pi}{a}$
c) $\frac{-3\pi}{a} to \frac{3\pi}{a}$ d) $\frac{-\pi}{a} to \frac{\pi}{a}$

6) At very low temperature specific heat varies as, ----------

a) $\frac{1}{T}$ b) $\frac{1}{T^3}$ c) T^3 d) T

7) If the Debye's temperature of metal is 450k, the Debye's frequency is

a) 10^{13}Hz b) 10^{2}Hz c) 10^{23}Hz d) 10 Hz

8) If Y is the young's modulus and ९ be the density of string, then the velocity of wave along the string is ---------

a) $V_s = \frac{९}{y}$ b) $V_s = \frac{y}{९}$ c) $V_s = \sqrt{y/९}$ d) $V_s = \sqrt{९/y}$

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9) If Hall coefficient is positive, then the material is called

a) Insulator
b) P-type semiconductor
c) n-type semiconductor
d) conductors

10) The electrical conductivity σ =----------

a) $\frac{ne^2\lambda v}{2K_BT}$
b) $\frac{ne^2\lambda v}{4K_BT}$
c) $\frac{ne^2\lambda v}{6K_BT}$
d) $\frac{ne^2\lambda v}{8K_BT}$

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SUBJECT CODE NO:- B-2013
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-I)
Examination November/December- 2022
Physics Paper-I
Mechanics Properties of Matter and Sound

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

Please check whether you have got the right question paper.

N.B
1) Attempt all question
2) Use of logarithm table and electronic pocket calculator is allowed.

Q. 1 (a) What is a compound pendulum? Find an expression for it's periodic time and show that the centre of suspension and the centre of oscillation can be interchanged 10

(b) Explain young's modulus, Bulk modulus, and modulus of rigidity. State it's S.I units and dimensions with figure. 10

OR

(a) Derive and expression for difference of pressure across curved surface. 10

(b) Define magnetostriction effect and explain magnetostriction oscillator with a circuit diagram. 10

Q. 2 (a) Write a short note on gravitational field 05

(b) A sphere of mass 40kg is attached by another sphere of mass 80kg with a force equal to the weight of $\frac{1}{6}$ milligram. If their centres are 40cm apart. Calculate the constant of gravitation. (If g= 9.81 m/s^2) 05

(c) Write a short note on "surface tension" with example. 05

(d) Calculate the excess of pressure between the inside and outside of a soap bubble of radius 0.01m. surface tension of soap solution is 3.5×10^{-2} N/m. 05

OR

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(a) Explain the term "Cantilever loaded at center" 05

(b) A steel wire of 0.01cm diameter is bent to form a circle of 10cm. radius. What is the bending moment and maximum stress, if $Y=2\times10^{12}$ dyne/cm^2 05

(c) Briefly explain an Acoustical demands of and auditorium 05

(d) Calculate fundamental frequency of resonance for quartz crystal with thickness 0.001m, if velocity of longitudinal wave in crystal is 6×10^3 m/s 05

Q. 3 Multiple choice questions 10

1. The gravitational force between two bodies is

a) Attractive at all places. c) Attractive at short distances.

b) Repulsive at large distances d) Repulsive at short distances

2. If the distance between two point masses is doubled, the gravitational attraction between them

a) Is double c) Reduced to half

b) Become four time d) Is reduced to quarter.

3. The modulus of elasticity is dimensionally equivalent to

a) Strain b) Stress c) Surface tension d) Poisson's ratio

4. If by applying a force, the shape of a body is changed then the corresponding stress is known as

a) Tensile stress b) Bulk stress c) Shearing stress d) Compressive stress

5. Volume of liquid that flows per unit time through any cross-section is called

a) Reverberation b) Surface tension c) Viscosity d) Ultrasonic

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6. If velocity of liquid is less than critical velocity then this flow is called

a) Stream line b) Gas flow c) Turbulent d) Water flow

7. K.E per unit volume of liquid flow is given as

a) $\frac{1}{2}\rho V^2$ b) ρV^2 c) $\frac{1}{2}MV^2$ d) $\frac{1}{2}V^2$

8. Ultrasonic frequencies are

a) Less than 20 KHZ
c) Less than 18 KHZ
b) Equal to 19 KHZ
d) Greater than 20KHZ

9. Piezo electric effect is observed in

a) Diamond b) Nickel c) Quartz crystal d) Gold

10. Ultra-sonography is an application of

a) x-rays
c) Reverberation
b) Supersonic waves
d) Digital photography

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SUBJECT CODE NO:- B-2014
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. F.Y (Sem-I)
Examination November/December- 2022
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 logarithm table and electronic pocket calculator is allowed.

Q.1 (a) Explain in detail the spherical shell method of radial flow of heat. 10

(b) Derive Vander Waal's equation of state, with correction for pressure and volume. 10

OR

(c) Define an isothermal process. Derive an expression for work done during an isothermal process. 10

(d) Derive following Maxwell's thermodymanical relations. 10

(i) $(\frac{\partial T}{\partial V})_S = -(\frac{\partial P}{\partial S})_V$ ii)$(\frac{\partial S}{\partial V})_T = (\frac{\partial P}{\partial T})_V$

Q.2 (a) Write a short note on coefficient of thermal conductivity. 5

(b) In an Ingen – Hausz experiment wax melted over 8cm of copper rod and over 5cm of iron rod. What is the conductivity of iron when the conductivity of copper is 0.90 5

(c) Describe Carnot's ideal heat engine. 5

(d) A gas occupying 1 liter at 80cm of Hg pressure is expanded adiabatically to 1200cc. If the pressure fall to 60cm of tlg in the process. Deduce the value of γ 5

OR

(a) Write short note on sphere of Influence. 5

(b) The r.m.s. velocity of a gas molecule is 450 m/sec and the density of gas is 1kg /m^3. Calculate the viscosity of the gas if the mean free path of the gas molecule is 1.5 x 10^{-8}m. 5

(c) Prove that in complete reversible process, the total change in entropy is always zero. 5

(d) Water boils at a temperature 101℃ and at a pressure of 787mm of Hg. If lgm of water occupies 1601cm on evaporation, then calculate the latent heat of steam (J=4.2 x 10^7 ergs/cal) 5

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Q.3 Multiple choice questions. 10

1. The S.I. unit of thermal resistivity is

(a) $\mathrm{Jm.\,s/^{\circ}C}$ (b) $\mathrm{m-s^{\circ}C/J}$ (c) $\mathrm{watt/ms^{\circ}C}$ (d) $\mathrm{ms/J^{\circ}C}$

2. Two rods of length l and 2l, thermal conductivities 2k and k are connected end to end. If cross section areas of two rods are equal, then equivalent thermal conductivity of system is

(a) $(\frac{5}{6})$K (b) $(\frac{6}{5})$K (c) $(\frac{3}{5})$K (d) 1.5K

3. Viscosity of gas is due to transport of

(a) momentum (b) energy (c) mass (d) Both a and b

4. The mean free path of a gas molecule is inversely proportional to

(a) square of the diameter of the molecule

(b) square root of the diameter of the molecule

(c) molecular diameter

(d) Fourth power of the molecular diameter.

5. The S.I. unit of coefficient of viscosity (η) is

(a) Nm^{-2}/S (b) N/m^2S (c) NS/m^3 (d) NS/m^2

6. The amount of work done in Carnot's heat engine working between 2100J & 1660J is.

(a) 420J (b) 410J (c) 440J (d) 430J

7. The device which convert heat into mechanical work is

(a) Motor (b) generator (c) heat engine (d) energy converter.

8. For adiabatic expansion of an ideal gas the equation is

(a) $TV^{\gamma-1} = \text{constant}$ (b) $TV^{\gamma} = \text{constant}$

(c) $T^{\gamma}V^{\gamma-1} = \text{constant}$ (d) $VT^{\gamma-1} = \text{constant}$

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9. The unit of entropy is

(a) Joule / Kelvin (b) Cal / Kelvin (c) Both a & b (d) Watt / Kelvin

10. When 10kg of water heated at 100℃ is converted into steam at same temperature. The increase in entropy is.

(a) 14477 cal / k (b) 17,240cal / k (c) 27 cal /k (d) 3730 cal / k

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SUBJECT CODE NO:- B-2021
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y (Sem-III)
Examination November/December- 2022
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) Explain second order differential equation with constant coefficient of real and unequal roots and real and equal roots. 10

b) Derive Maxwell-Boltzmann's Law of energy distribution. 10

OR

a) Distinguish between Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics. 10

b) Derive Lorentz transformation equations. 10

Q.2 a) What is exact differentiation? Explain. 05

b) If $F = x^3y + x^2y + xy^2$ find dF. 05

c) Explain basic postulates of Fermi-Dirac Statistics. 05

d) Five bosons are distributed in two compartments, first having 3 cells and second having 4 cells. Find thermodynamic probability of the macro state (3, 2) 05

OR

a) Explain the term phase space. 05

b) A card is drawn from a well shuffled pack of 52 cards. Find the probability for this card is king or queen. 05

c) Explain Galilean transformation equation 05

d) At what speed is a particle moving if its mass is $5/4$ times its rest mass. (Velocity of light $C = 3 \times 10^8 m/sec$) 05

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Q.3 Multiple choice questions. 10

1) Order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 + y = x$ are.

   a) 1, 2 b) 2, 1 c) 2, 3 d) 3, 2

2) 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) $-2\cos x.$

3) If a die is thrown, then the probability that the die coming up with an even number is.

   a) $\frac{1}{6}$ b) $\frac{1}{3}$ c) $\frac{1}{2}$ d) $\frac{2}{3}$

4) Thermodynamic probability of the macro-state (1,3) is

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

5) The value of probability of an event cannot be...

   a) zero b) 1 c) negative d) $\frac{1}{2}$

6) Plank's radiation law is derived using _____ Statistics.

   a) Fermi-Dirac b) Maxwell-Boltzmann c) Bose-Einstein d) Classical

7) Particles obeying Bose-Einstein Statistics are.

   a) Identical, in distinguishable with integral spin.

   b) Identical, distinguishable without any spin.

   c) Identical, indistinguishable without any spin.

   d) Identical, distinguishable with $\frac{1}{2}$ integral spin.

8) Rest mass energy of electron of mass 9.1×10^{-31} kg is _____

   a) 8.19×10^{-16} J. b) 8.19×10^{-14} J. c) 81.9×10^{-16} J. d) 81.9×10^{-14} J.

9) According to Fermi-Dirac Statistics $n_i =$

   a) $\frac{gi}{e^{\alpha+\beta ui-1}}$ b) $\frac{gi}{e^{\alpha+\beta ui+1}}$ c) $\frac{gi}{e^{\alpha-\beta ui+1}}$ d) $\frac{gi}{e^{\alpha-\beta ui-1}}$

10) According to Michelson-Morley experimental setup, A beam of light falls on a half silvered glass plate which is placed at an angle of _____ to the beam.

   a) 45° b) 30° c) 60° d) 90°

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SUBJECT CODE NO:- B-2022
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. S.Y (Sem-III)
Examination November/December- 2022
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 calculations allowed

Q.1 a) Explain laws experiment for x-ray diffraction 10

b) Explain the construction and working a photovoltaic cell 10

OR

c) Describe construction and working of nuclear reactor 10

d) Explain construction and working of linear accelerator 10

Q.2 a) Write a short note on photo emissive cell 05

b) The stopping potential is 2.3 V for light of frequency $1 \times 10^{15} HZ$,When light of frequency $2 \times 10^{15}$is used ,the stopping potential is 6.5V. calculate the value of planks constant 05

c) write a short note on chain reaction 05

d) calculate the energy released by the fission of 2gm of 92 U^{235} in Joule if energy released per fission is 200 MeV 05

OR

a) Write a short note on characteristics X-ray spectra 05

b) An X-ray tube operated at 30kv emits a continuous X-ray spectrum with a short wavelength limit λ min=0.414 A^0calculate plancks constant h,if $e = 1.602 \times 10^{-19} C$ and $c = 3 \times 10^8 m/s$ 05

c) Write a short note on cyclotron 05

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d) A 10 MeV alpha particle loses all its energy in proportional counter ,one electron ion pair is produced for each 30 ev of energy loss.the proportional counter has a multiplication A=500 and the total capacitance between wire and ground is 30pf.calculate the voltage pulse height. 05

Q.3 Multiple choice question 10

1. Which of the following has the highest frequency

a) Visible light

b) Ultra violet light

c) X-rays

d) infra-red rays

2. absorption coefficient is equal to the fractional decrease in the intensity of x-ray per unit _____of absorber sheet

a) intensity

b) length

c) thickness

d) current

3. If an electron can be stopped by a potential of 5 volts, it kinetic energy is

a) 5 volt

b) 5 Joules

c) 5 call

d) 5 ev

4. The phenomenon which points towards the corpuscular nature of electromagnetic ware is

a) Interference

b) Diffraction

c) Polarization

d) Photoelectric effect

5. Energy liberated when one U^{235} undergoes fission reaction is_____

a) 200MeV

b) 40Mev

c) 30Mev

d) 20Mev

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6. Which of the following force is strong force

a) Magnetic

b) Nuclear

c) Electrostatic

d) Gravitational

7. In cyclic Accelerator particles are forced by_____

a) Magnetic Field

b) Electric Field

c) Gravitational Field

d) Electrostatic Field

8. A Cyclotron uses two dees while there is only _____ dee in a synchro Cyclotron

a) Two

b) One

c) Three

d) Four

9. Neutrons and protons commonly knows as,

a) Mesons

b) Bosons

c) Nucleons

d) Pions

10. The strength of photoelectric current is directly proportional to

a) Intensity of incident light

b) Threshold frequency

c) None of Those

d) Intensity of Light

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Total No. of Printed Pages: 02

SUBJECT CODE NO:- B-2017
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. T.Y (Sem-V)
Examination November/December- 2022
Physics Paper-XV
(Classical & Quantum Mechanics)

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

Please check whether you have got the right question paper.

N.B i) All questions are compulsory
ii) Figure to the right indicate full marks.

Given data:-

$k=1.38\times10^{-23}$J/K
$R=8.31\times10^{3}$ J/k mole K
$\mu_o=4\pi\times10^{-7}$ Wb/Amp
$C=3\times10^{8}$ m/s
$h=6.63\times10^{-34}$ J.S.
$me= 9.1\times10^{-31}$ kg
$e=1.6\times10^{-19}$C
$1ev= 1.6\times10^{-19}$J

Q. 1 (a) Using Newtons law of motion, deduce the conservation theorem of linear momentum, angular momentum and energy for the motion of a particle. 10

(b) Obtain an expression of plank's radiation Law, Deduce Wein's displacement Law from plank's Law. 10

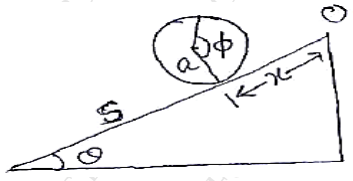
OR

(a) Show that for a de-Broglies wave group associated with a moving particle. The group velocity is equal to particle velocity. 10

(b) Explain the term operator. Derive an expression for 10
(i) Linear momentum operator (ii) Energy operator.

Q. 2 (a) What are constraints? Classify the constraints and explain any one in detail. 05

(b) Fig. shows a cylinder of radius 'a' and mass 'm' rolls down an inclined plane making and angle 'θ' with the horizontal. Set up the Lagrangian and find the equation of motion. 05



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State Heisenberg's principle. Obtain uncertainty in time and energy.

(c) 05

An electron has speed of 500 m/s with an accuracy of 0.006% calculate the certainty with which

(d) we can calculate position of electron. 05

OR

Explain plank's quantum postulates.

(a) 05

The work function of sodium metal is 3.2eV. What is longest wave length of light that can cause

(b) photoelectric emission from sodium. 05

Write a note on expectation value.

(c) 05

Calculate the energy difference between the ground state and the first excited state for an

(d) electron in a box of length $1A°$. 05

Q. 3 Multiple choice questions 10

1. The rate of change of angular momentum is _____
   a) Torque b) Moment of inertia c) Acceleration d) None of these

2. Lagrangian's equation are applicable when the system is
   a) Conservative b) Non conservative c) Linear d) Both a and b

3. $\lambda m\alpha \frac{1}{T}$ represents_____
   a) Weins law b) Plancks law c) Ruther Ford law d) Hook's law

4. The absorptive power of a perfectly black body is
   a) 0.5 b) ∞ c) Zero d) 1

5. The de-Broglies wavelength is independent of_____
   a) Mass b) Velocity c) Momentum d) None of these

6. The concept of duality is firstly proposed by _____
   a) Taylor b) Einstein c) De-Broglies d) G.P. Thomson

7. For a free particle potential energy is _____
   a) ∞ b) 0 c) 1 d) -1

8. The wave function must be_____
   a) Single valued b) Continuous c) Finite d) All above

9. Operator form the time dependent Schrodinger equation is _____
   a) $H\psi=1$ b) $H\psi= E\psi$ c) $H\psi=A$ d) None of these

10. The probability of finding a particle in a distance dx around a point x is _____
    a) ψ^* b) $\psi\psi^*$ dx c) $\psi\psi^*$ d) ψ

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SUBJECT CODE NO:- B-2018
FACULTY OF SCIENCE & TECHNOLOGY
B.Sc. T.Y (Sem-V)
Examination November/December- 2022
Physics Paper- XVI
(Electrodynamics)

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

Please check whether you have got the right question paper.

N.B i) Attempt all questions.
ii) Figure to the right indicate full marks.

Given $\mu_0 = 4\pi \times 10^{-7}\ S.I.Units$

$\epsilon_0 = 8.85 \times 10^{-12}\ S.I\ Units$

Q.1 a) State Gauss's law in electrostatics and hence derive an expression for curl of E. 10

b) Derive Maxwell's equation $\nabla.D = \quad and\ \nabla \times E = \frac{-\partial B}{\partial t}$ 10

OR

a) State Maxwell's equation for EM waves in conducting medium derive wave equation for magnetic field. 10

b) Determine the boundary conditions at the interface between two media for vector B and D. 10

Q.2 a) Derive Poisson's equation using differential form of Gauss law. 5

b) A conducting cylinder having charge per unit length of 0.15×10^{-6} coloumb per meter and radius 15mm. find the electric field intensity at a point 1m from the axis of the cylinder. 5

c) Define poynting vector. Obtain an expression for poynting vector. 5

d) Calculate the value of poynting vector for 200 watt lamp at a distance of 2.0m from it. 5

OR

a) Explain mutual induction in coil. 5

b) The inductor has inductance of 0.6H and carries the current. The current is decreasing at a uniform rate -0.04A/S. find the self induced emf in the circuit. 5

c) State Kinematic and dynamic properties of reflection and refraction. 5

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d) The angle of incidence and refraction are 60^0 and 30^0 respectively if refractive index of rarer medium is 1.35. find the refractive index of denser medium. 5

Q.3 Multiple choice questions 10

1. The electric force experienced by a unit positive charge placed at that point is called as the intensity of ------
   a) Electric field c) Electromagnetic field
   b) Magnetic field d) None of these

2. In electric field due to charged cylinder if e > R , then electric field is -----.
   a) $\frac{n\lambda}{2\pi r\epsilon_0}$ c) $\frac{\lambda}{2\pi r^2\epsilon_0}$
   b) $\frac{\lambda}{2\pi r\epsilon_0}$ d) None of these

3. According to Gauss theorem , the flux through any surface enclosing the charge is -------.
   a) $q.\epsilon_0$ c) $q_0\epsilon_0$
   b) $\frac{q}{\epsilon_0}$ d) None of these

4. The rate of change of displacement vector D with time is called ------.
   a) Displacement current c) Current
   b) Conduction current d) Displacement

5. Lenz's law is a consequence of the law of conservation of -----.
   a) Charge c) momentum
   b) Energy d) Lines of force

6. Which of the following gives direction of propagation of wave
   a) $\vec{B} \times \vec{D}$ c) $\vec{E} \times \vec{B}$
   b) $\vec{E} \times \vec{D}$ d) $\vec{H} \times \vec{E}$

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7. The rate of energy flow per unit area or power flow per unit area is

   a) $\vec{E} \times \vec{B}$ c) $\vec{E} \times \vec{D}$

   b) $\vec{E} \times \vec{H}$ d) $\vec{D} \times \vec{H}$

8. Electromagnetic wave travel through ------

   a) Conducting medium c) Non conducting medium

   b) Vaccum d) None of these

9. $n_1 sin\theta_1 = n_2 sin\theta_2$ represent ------ law of refraction.

   a) Snell's law c) Momentum

   b) Brewster's law d) None of these

10. The normal component of ------- is discontinuous across the interface.

    a) Magnetic induction $\vec{B}$ c) Electric displacement $\vec{D}$

    b) Magnetic intensity $\vec{H}$ d) Electric field $\vec{E}$

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