Total Marks: 60 **Time: 2.5 Hours**

(Answer any four (4) of the following questions)

1. a) Draw the field orientation of an electromagnetic wave (EMW). 3
   b) Calculate the electric potential due an electric dipole. 6
   c) Discuss how travelling EMW radiates from an antenna. 6

2. a) Define Gauss's law. Deduce Coulomb's law from Gauss's law. 5
   b) A hypothetical cylinder of radius R is immersed in a uniform electric field **E**, and the cylinder axis being parallel to the field. What is ϕ_E for the surfaces? 5
   c) Find the electric potential for points on the axis of a uniformly charge circular disk whose surface charge density is σ. 5

3. a) A parallel plate capacitor consists of two parallel conducting plates of area A separated by a distance d. If you connect each plate to the terminal of a battery, a charge $+q$ will appear on one plate and a charge $-q$ on the other. Calculate the capacitance of this device. 6
   b) Figure (a) shows a dielectric slab of thickness b and dielectric constant k placed between the plates of a parallel-plate capacitor of plate area A and separated d. A potential difference V_0 is applied with no dielectric present. The battery is then disconnected and the dielectric slab inserted. Assume that $A = 100\ cm^2$, $d = 1$ cm, $b = 0.50$ cm, $k = 7$, and $V_0 = 100$ volts. 9
      (i) Calculate the capacitor C_0 before the slab is inserted.
      (ii) Calculate the free charge q.
      (iii) Calculate the electric field strength in the gap.
      (iv) Calculate the electric field strength in the dielectric.
      (v) Calculate the potential difference between the plates.
      (vi) Calculate the capacitance with the slab in place.

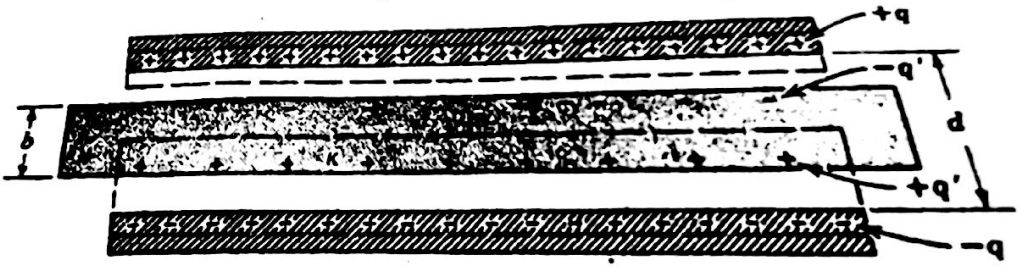


Figure (a). A parallel-plate capacitor containing a dielectric slab.

4. a) Define Ampere's law and Faraday's law. 5
   b) A flat strip of copper of width 'a' and negligible thickness carrying a current i. Find the magnetic field at a distance R from the center of the strip, at right angles to the strip. 6
   c) Derive the expression of capacitor charging and discharging for RC circuit and calculate how much time is required to charge one-third of the capacitor. 4

5. a) What is first law of thermodynamics? 2
   b) Derive steady flow energy equation for control volume system. 7
   c) A gas of mass 1.5 kg undergoes a quasi-static expansion which follows a relationship P=a+bV, where 'a' and 'b' are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.2 m^3 and 1.2 m^3. The specific internal energy of the gas is given by v=1.5 pv-85 kJ/kg, where p is in kPa and v in m^3/kg. Calculate the net heat transfer and the maximum internal energy of the gas during expansion. 6

6. a) What is heat engine? Explain its operation. 4
   b) State Carnot's theorem. Explain Carnot cycle. 7
   c) The efficiency of a Carnot engine is 1/6. If on reducing the temperature of the sink by 65^{0}C, the efficiency becomes 1/3. Find the temperature of the source and the sink in which the engine is working. 4

University of Dhaka
Department of Computer Science and Engineering
1st Year 1st Semester B.Sc. Examination 2011
PHY - 1122 : Physics

Time: 2.5 Hours

Total Marks: 60

[Answer any four (4) of the following Questions.]

1. (a) Mention how Miller index is set for any plane of a crystal structure. 4
   (b) Mention and explain different kinds of defects in a crystal structure with proper diagram. 5
   (c) Define angle of contact. Find out a general expression for pressure inside a liquid drop. 2+4

2. (a) Show that the potential at a point r distance away from a point charge is as follows: 5
$$V = \frac{q}{4\pi\varepsilon_0 r}$$
   (b) Express the current equation for an RC circuit when it is in charging phase. 5
   (c) What is form factor? Prove that r.m.s. voltage of an AC signal is 5
$$V_{r.m.s} = \frac{V_{max}}{\sqrt{2}}$$

3. (a) Find out the general solution of a damped system when it is in critical damping condition. 5
   (b) Prove that an object moving in a simple harmonic way has the total energy of $E = \frac{1}{2}KA^2$, where A is the maximum displacement from the rest position of the object. 5
   (c) A horizontal spring is found to be stretched 2 cm from its equilibrium position when a force of 50 gram note on it. A 100 gram body is attached to the end of the spring and it is pulled 5 cm along a horizontal frictionless table from the equilibrium position. The body is then released and executes simple harmonic motion. Find out the following parameters: 5
   - What is the force constant of the spring?
   - What is the force exerted by the spring on the 100 gram body just before it is released?
   - What is the period of oscillation after release?

4. (a) What is coherence light source? How it can be achieved? 2
   (b) Prove that the fringe width for a double slit interference mechanism is 5
$$\beta = \frac{\lambda D}{d}$$
   where β = fringe width, D = distance between slit and screen and d = slit distance.
   (c) State and explain Brewster's law. 3
   (d) Write a short note about Michelson Interferometer. 5

5. (a) Find the mass of an electron whose velocity is 0.99 c, where $c = 3 \times 10^8 ms^{-1}$. 3
   (b) What are the postulates of special theory of relativity? What is an inertial frame of reference? 4
   (c) What is time dilation? Defend the statement "a moving clock ticks more slowly than a clock at rest". 3

6. (a) State the 2nd law of thermodynamics.
   (b) Show that the efficiency of a Carnot's engine is $\eta = 1 - \frac{T_2}{T_1}$, where T_1 and T_2 are the temperatures of the source and the sink respectively.
   (c) Define isobaric and isochoric process with proper figure.

University of Dhaka
Department of Computer Science and Engineering
1st Year 1st Semester B.Sc. Examination 2011
CSE - 1101 : Computer Fundamentals

Total Marks: 60 Time: 2.5 Hours

[Answer any four (4) of the following Questions.]

1. (a) Discuss the classification of computers on the basis of size and capacity.
   (b) Describe the capabilities and limitations of computers.
   (c) Clearly describe the impact of computerization on modern society.
   (d) Differentiate between data and information.

2. (a) Draw a block diagram of a digital computer. Explain how the CPU and memory work together.
   (b) Briefly discuss the bus architecture of a digital computer.
   (c) What is generation of computers? Explain different generations of computers.
   (d) How is a PC different from a workstation? Explain the different types of portable computers.

3. (a) What is the benefit of using 'QWERTY' layout keyboard? What are the different types of mice used in a computer system?
   (b) What is the difference between OCR and OMR?
   (c) Define resolution and refresh rate of a monitor. To display an image with 640 x 480 resolution with 8 bit colors, how many bytes must be sent from the computer to the monitor?
   (d) What are the advantages and disadvantages of CRT and LCD monitors?
   (e) Compare dot matrix, ink jet and laser printers in terms of performance.

4. (a) Draw the memory hierarchy based on the capacity, cost per bit and access time.
   (b) Mention the difference between SRAM and DRAM.
   (c) Compare hard disk and magnetic tapes in terms of advantages and disadvantages.
   (d) Define the parameters for measuring the performance of a hard disk?
   (e) What is the purpose of using cache memory? What is the difference between CD-R and CD-RW?

5. (a) Briefly discuss the different types of system software with examples. Compare compiler and interpreter.
   (b) What is operating system? Explain the major functions of operating systems.
   (c) What is programming language? Distinguish between machine language and high-level language.
   (d) Explain the features of Linux and MS-DOS. Compare multitasking and multiprocessing operating systems.
   (e) Define the application software with examples. Mention the characteristics of application software.
   (f) Briefly discuss the basic concepts of database.

6. (a) Describe the different topologies of a LAN network.
   (b) What is computer network? Explain the main features of different internet services.
   (c) What is email? Distinguish between LAN and WAN.
   (d) Define the bandwidth with examples. Discuss the features of different transmission media.
   (e) Discuss the necessities of network protocol.

PHY - 1122 : Physics

Time: 2.5 Hours

Total Marks: 60

[Answer any four (4) of the following Questions.]

1. (a) Mention how Miller index is set for any plane of a crystal structure. 5

(b) Mention and explain different kinds of defects in a crystal structure with proper diagram. 2+3

(c) Define angle of contact. Find out a general expression for pressure inside a liquid drop. 5

2. (a) Show that the potential at a point r distance away from a point charge is as follows:

$$V = \frac{q}{4\pi\varepsilon_0 r}$$ 5

(b) Express the current equation for an RC circuit when it is in charging phase. 5

(c) What is form factor? Prove that r.m.s. voltage of an AC signal is

$$V_{r.m.s} = \frac{V_{max}}{\sqrt{2}}$$ 5

3. (a) Find out the general solution of a damped system when it is in critical damping condition. 5

(b) Prove that an object moving in a simple harmonic way has the total energy of $E = \frac{1}{2}KA^2$, where A is the maximum displacement from the rest position of the object. 5

(c) A horizontal spring is found to be stretched 2 cm from its equilibrium position when a force of 50 gram acts on it. Again 100 gram body is attached to the end of the spring and it is pulled 5 cm along a horizontal frictionless table from the equilibrium position. The body is then released and executes simple harmonic motion. Find out the following parameters: 5

- What is the force constant of the spring?
- What is the force exerted by the spring on the 100 gram body just before it is released?
- What is the period of oscillation after release?

4. (a) What is coherence light source? How it can be achieved? 2

(b) Prove that the fringe width for a double slit interference mechanism is 5

$$\beta = \frac{\lambda D}{d}$$

where β = fringe width, D = distance between slit and screen and d = slit distance.

(c) State and explain Brewster's law. 3

(d) Write a short note about Michelson Interferometer. 5

5. (a) Find the mass of an electron whose velocity is 0.99 c, where $c = 3 \times 10^8 ms^{-1}$. 3

(b) What are the postulates of special theory of relativity? What is an inertial frame of reference? 4

(c) What is time dilation? Defend the statement "a moving clock ticks more slowly than a clock at rest". 8

6. (a) State the 2nd law of thermodynamics. 3

(b) Show that the efficiency of a Carnot's engine is $\eta = 1 - \frac{T_2}{T_1}$, where T_1 and T_2 are the temperatures of the source and the sink respectively. 8

(c) Define isobaric and isochoric process with proper figure. 4

2nd In-course Exam, Dept. of CSE, DU

PHY-1122: Physics

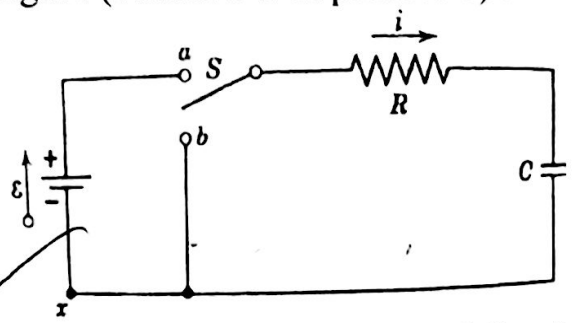
Time: 45 Minutes **Full marks: 20**

Answer any four:

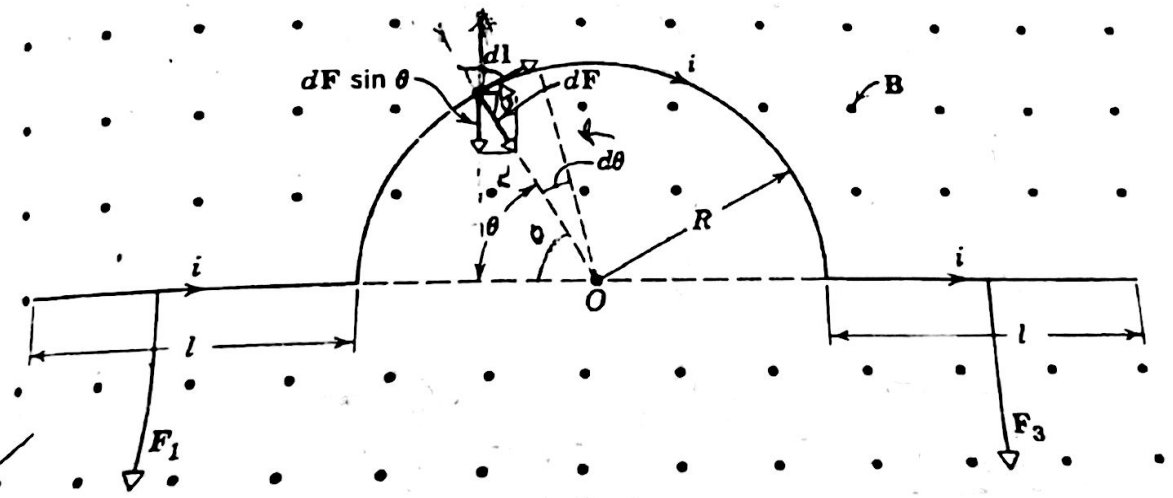
1. A parallel plate capacitor consists of two parallel conducting plates of area A separated by a distance d. If you connect each plate to the terminal of a battery, a charge $+q$ will appear on one plate and a charge $-q$ on the other. Calculate the capacitance of this device. 5

2. Derive the expression of charging and discharging for RC circuit and calculate how much time is required to charge fully of the capacitor. 5

3. After how many time constants will the energy stored in the capacitor in the following figure (switch S is in position a) reach one-half its equilibrium value? 5



4. A wire bent as shown in the following figure carries a current i and is placed in a uniform field of magnetic induction **B** that emerges from the plane of the figure. Calculate the force acting on the wire. 5



5. *A flat strip of copper of width a and negligible thickness carrying a current i. Find the magnetic field at a distance R from the center of the strip, at right angles to the strip.* 5

2nd In Course Exam, 2014
PHY-1122: Physics
Dept. of CSE, DU

Total Marks: 20

e: 50 minutes
wer any four:

1. What is thermodynamics? Define thermodynamics equilibrium, and process and also PdV work. 5
2. Consider a cylinder, the pressure in the cylinder varies in the manner with volume, $p = C V^{-2}$. If the initial pressure is 500 kPa, the initial volume is 0.05 m^3, and the final pressure is 200 kPa, find the work done by the system. 5
3. Prove that $Q_{1\text{-}2} = U_2 - U_1 + W_{1\text{-}2}$. 5
4. Derive the expression of first law of thermodynamics for control volume system. 5
5. In a tank similar to Joule's experiment there are 10 kg of water. The total work input is 20 N.m (a) Find the change in specific and total internal energy (assume the system is adiabatic). (b) If a heat leak of 0.1 J/kg is noted, what is the internal energy change? 5
6. A steam turbine receives steam with a flow rate of 15 kg/s and experiences a heat loss of 14 kW. Using the steam inlet and exit properties listed below, find the power production. 5

	Inlet	*Exit*
Pressure	6205 kPa	9.859 kPa
Temperature	811.1 K	318.8 K
Velocity	30.48 m/s	274.3 m/s
Specific internal energy	3150.3 kJ/kg	2211.8 kJ/kg
Specific volume	0.05789 m^3/kg	13.36 m^3/kg
Height change	3 m	

Total Marks: 60 Time: 2.5 Hours

(Answer any Four (4) of the following Questions)
(In the following questions all symbols bear usual meaning)

1. a) State the postulates of special theory of relativity. Show that the concept of simultaneity is not absolute. 2+3

   b) Define proper time and proper length. Derive the rule for relativistic velocity transformation using Lorentz transformation. 2+3

   c) Explain how the existence of massless particle is consistent in special theory of relativity. 2

   d) Find the mass of an electron whose velocity is 0.99c. 3

2. a) Show, using planetary model of atom, that the energy of an electron inside a hydrogen atom is given by 3+2

$$E = -\frac{e^2}{8\pi\varepsilon_0 r} \qquad (1)$$

   What is the significance of the negative sign in Eq-1?

   b) State the postulates of Bohr model for atom. Explain the condition for orbital stability by incorporating de Broglie wavelength in Bohr model. 3+2

   c) What is the origin of atomic line spectrum? Show that for hydrogen atom the spectral lines obey the following relation 5

$$\frac{1}{\lambda} = -\frac{E_1}{ch}\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right) \qquad (2)$$

3. a) Show that for a double slit interference, the intensity of light on the screen obeys the following relation 5

$$I = 4I_0 \cos^2\left(\frac{ay\pi}{s\lambda}\right) \qquad (3)$$

   b) State the Huygens-Fresnel principle. 2

   c) Show that for single slit Fraunhofer diffraction the intensity pattern follows the following relation 6+2

$$I = I_0 \frac{\sin^2 \beta}{\beta^2} \qquad (4)$$

   Draw the intensity pattern for this relation.

a) State and explain the second law of thermodynamics. 3

b) Describe Carnot's cycle and deduce the efficiency of an ideal heat engine. 6

c) Define Entropy. Mention its physical significance. Show that the entropy of a perfect gas remains constant in a reversible process but increase in an irreversible process. 6

6. Write short notes on any three of the following: 3×5

i) Circular polarization

ii) Time dilation

iii) Charging-discharging phase in RC transient

iv) Atomic excitation

Dept. of Computer Science and Engineering
University of Dhaka

1. Show that $exp(i\,\mathbf{k}.\mathbf{r})$ represents a plane wave. 4
2. Show that for two wave interference the total irradiance is given by $I = I_1 + I_2 + 2\sqrt{I_1}\sqrt{I_2}\cos\delta$. 5
3. What is Huygens-Fresnel principle? Explain the intensity pattern of a single slit diffraction. 6
4. Explain how elliptically polarized light can be generated. 5

Department of Computer Science and Engineering
Incourse Exam-1

Course Title: Physics
Date: 06. 03. 2013

Course Code: Phy -1122
Duration: 50 min.

Answer all the questions

1. Define electric flux density Φ_E. Write down the four Maxwell's equations of classical electrodynamics. 1+4
2. Find the electric field $\vec{E}$ outside a uniformly charged solid sphere of radius R and total charge q. 5
3. Derive the charge continuity equation given by $\frac{\partial \rho}{\partial t} = -\vec{\nabla}_0 \vec{J}$ 5
4. How did Maxwell propose the correction to the Ampere's law? 5

Dept. of Computer Science and Engineering
Incourse Examination-1

Date: 10.03.2012 **Time: 50 minutes**

1.	State the postulates of special theory of relativity.	2.5+2.5
2.	Prove that the concept of simultaneity is not absolute.	5
3.	Show that a clock runs fastest in a reference frame at which it is at rest.	5
4.	Show that for massless particles, energy E and momentum p is related by E = pc.	5

Dept. of Computer Science and Engineering
Second Incourse Examination

Course Title- Physics **Course Code-112**
Time-50 minutes **Date: 08.04. 201**

Answer the following questions

1. Find the expression for the electric field a distance z above the midpoint of straight line segment of length $2L$ which carries a uniform line charge α. 5
2. Define electric flux density. Show that $\vec{\nabla}_o \vec{E} = \frac{\rho}{\epsilon_o}$. 5
3. How did Maxwell propose the correction to the Ampere's law of magnetism? 5
4. Derive the continuity equation for classical electromagnetism. 5

[Answer any Four (4) of the following Questions]

1. a) Define magnetic flux density ϕ_B. Explain the physical significance of the following equation 2+4

$$\vec{\nabla}_0 \vec{B} = 0$$

b) Explain the concept of charge conservation in terms of continuity equation given by 4

$$\vec{\nabla}_0 \vec{j} = -\frac{\partial \rho}{\partial t}$$

c) Find out the electric field intensity E outside of a uniformly charged sphere of radius R and total charge q. 5

2. a) Show that the intensity distribution I due to interference of plane monochromatic optical waves coming from two sources of equal intensity I_0 is given by 6

$$I = 4I_0 cos^2 \frac{\delta}{2}$$

b) Show that intensity of optical disturbance described by monochromatic plane wave if given by 5

$$I = \frac{1}{2} \epsilon_0 \, c E_o^2$$

c) Explain the difference between plane polarized and randomly polarized light. How circularly polarized light can be generated? 2+2

3. a) State Wilson-Sommerfeld quantization rule and derive the condition for orbital stability from it. 2+3

b) Show that the allowed energy levels in a Bohr atom is given by 6

$$E_n = \frac{-13.6\ eV}{n^2}$$

c) Calculate the value of the Rydberg constant from Bohr model. 4

4. a) Show that the relation between energy and momentum of massive particle with rest mass m_o is given by 5

$$E = \sqrt{m_o^2 c^4 + p^2 c^2}$$

b) Derive the invariant interval 4D Minkowski space in special theory of relativity. 5

c) Suppose an observer is standing still in a platform observing a moving train with constant speed u. Another observer in that train shines a beam of light along his direction of motion. Show that the speed of light measured by the observer in the platform is consistent with the second postulate of the principle of special relativity. 5

a) State and explain 2nd law of thermodynamics. 4

b) Explain isochoric process. 3

c) Deduce the efficiency of a Carnot engine. 5

d) Describe entropy. 3

a) Discuss different types of magnetic materials. 4

b) Describe Miller indices. 3

c) Explain different types of defects in solids. 4

d) Make distinction among conductor, semiconductor and insulator according to the band theory. 4

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)
(In the following questions all symbols bear usual meaning)

1. a) State the postulates of special theory of relativity. Show that the concept of simultaneity is not absolute. 2+3

b) Define proper time and proper length. Derive the rule for relativistic velocity transformation using Lorentz transformation. 2+3

c) Explain how the existence of massless particle is consistent in special theory of relativity. 2

d) Find the mass of an electron whose velocity is 0.99c. 3

2. a) Show, using planetary model of atom, that the energy of an electron inside a hydrogen atom is given by 3+2

$$E = -\frac{e^2}{8\pi\varepsilon_0 r} \qquad (1)$$

What is the significance of the negative sign in Eq-1?

b) State the postulates of Bohr model for atom. Explain the condition for orbital stability by incorporating de Broglie wavelength in Bohr model. 3+2

c) What is the origin of atomic line spectrum? Show that for hydrogen atom the spectral lines obey the following relation 5

$$\frac{1}{\lambda} = -\frac{E_1}{ch}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) \qquad (2)$$

3. a) Show that for a double slit interference, the intensity of light on the screen obeys the following relation 5

$$I = 4I_0 \cos^2\left(\frac{ay\pi}{s\lambda}\right) \qquad (3)$$

b) State the Huygens-Fresnel principle. 2

c) Show that for single slit Fraunhofer diffraction the intensity pattern follows the following relation 6+2

$$I = I_0 \frac{\sin^2 \beta}{\beta^2} \qquad (4)$$

Draw the intensity pattern for this relation.

4. a) Define electric flux density ϕ_E. Derive the Gauss's law of electrostatics. 2+4

b) State the Faraday's law of electromagnetic induction. Show that 2+3

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

c) How Maxwell proposed the correction for Ampere's law for magneto-statics. 4

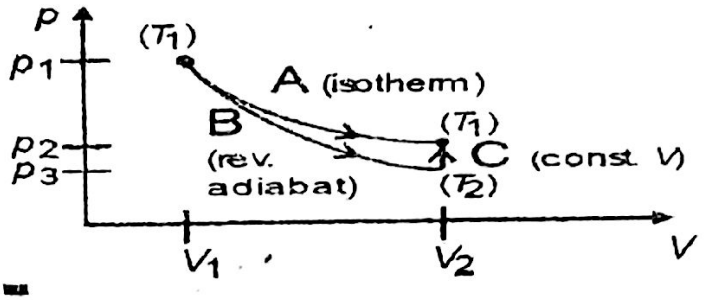
First Year First Semester B. Sc. Final Examination, 2013

PHY – 1122: Physics

Total Marks: 60 **Time: 2.5 Hours**

(Answer any Four (4) of the following Questions)

1. a) Define intensive and extensive thermodynamic variables. 2
   b) Define entropy in terms of Boltzmann relation. State third law of thermodynamics. 2+2
   c) Show that for Ideal gas $U = C_v dT$. 4
   d) Calculate $\oint \frac{dq}{T}$ for the path A– B – C and A– C. 5



2. a) Write down the postulates of Bohr model of atom. 4
   b) State Wilson-Sommerfeld quantization rule. Show that the condition for the orbital stability is $L = n\hbar$ using this rule. 3+4
   c) What is De Broglie matter wave? What is the relation between this wave and the wave function Ψ? 2+2

3. a) Write down the postulates of special theory of relativity. 2
   b) Derive the relativistic velocity addition formula using Lorentz transformation. 5
   c) Show that a moving clock ticks slower than a clock at rest. 4
   d) Suppose a train is moving with a uniform velocity $\frac{3}{4}$c with respect to an observer at S frame of reference. An observer in the moving train measures the speed of light at vacuum c. What will be the velocity of that light in free space for an observer at S. 4

4. a) Distinguish between Fraunhofer and Fresnel diffraction. 4
   b) Explain 'missing order' in Fraunhofer double slit diffraction pattern. 5
   c) Deduce radius of the nth order bright ring formed in Newton's ring experiment. 6

5. a) Write down the four Maxwell's equations of classical electrodynamics. 4
   b) Derive the continuity equation given by $\frac{\partial \rho}{\partial t} + \nabla . J = 0$. 4
   c) Find out the expression for electric field E at distance r from a midpoint of a wire of length 2L with charge density λ. 4
   d) Explain the inconsistency in Ampere's law. 3

6. Write short notes on the following topics: 3×5
   i. Simple harmonic motion
   ii. Defects in solid
   iii. Nicol Prism.