

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

WINTER SEMESTER, 2018-2019

DURATION: 1 Hour 30 Minutes

FULL MARKS: 75

Phy 4141: Physics I

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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| 1. a) | State Coulombs law in electrostatics. With the help of a suitable example show that charge is conserved | 7 |
| b) | Define electric field E . Obtain an expression for the electric field E at a distance y from an infinitely long line charge of linear charge density λ . | 10 |
| c) | The electric field between the plates of a cathode-ray oscilloscope is 1.2×10^4 nt/coul. What deflection will an electron experience if it enters at right angles to the field with a kinetic energy of 2000 ev ($= 3.2 \times 10^{-16}$ joule)? The deflecting assembly is 1.5 cm long. | 8 |
| 2. a) | Discuss electric potential V. How is electric potential V related to the electric field E? | 7 |
| b) | Derive an expression for the electric potential V at any point of space due to an electric dipole provided only that the point is not too close to the dipole. Describe how V changes for different values of θ (from $\theta = 0, 90, 180$) | 10 |
| c) | Calculate the dipole moment of a water molecule under the assumption that all ten electrons in the molecule circulate symmetrically about the oxygen atom, that the OH distance is 0.96×10^{-8} cm, and that the angle between the two OH bonds is 104° . | 8 |
| 3. a) | Discuss Einstein's photo-electric effect. Draw a schematic diagram of the photo-electric experiment and explain the working of this device | 7 |
| b) | Define interaction of radiation with matter. Discuss Compton effect. How does Compton effect differ from the Einstein's photo-electric effect? | 10 |
| c) | Write short notes on:
i. Photo-current
ii. Stopping potential
iii. Threshold frequency
iv. AND work function | 8 |
| 4. a) | Discuss Special theory of relativity. Write down the postulates of Special theory of relativity. What are inertial and non-inertial frame of reference? Give example for each | 8 |
| b) | Derive Lorentz transformation equations. Also write down their inverse form. What are time dilation and length contraction? | 10 |
| c) | A certain particle has a lifetime of 1.00×10^{-7} s when measured at rest. How far does it go before decaying if its speed is $0.99c$ when it's created? | 7 |