B Sc Eng.IPE/1st Sem.

Date:9 October 2023
02:30 pm - 4:00 pm [Afternoon]

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF NATURAL SCIENCES

Course Number: PHY 4113
Course Title: Structure of Matter, Electricity, Magnetism and Modern Physics
Semester: Midterm Examination

Winter Semester: 2022 - 2023
Full Marks: 75
Time: 1 Hr 30 Mins

Answer all the 3 **(Three)** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in the brackets.

1.a) List seven crystal systems with examples and state how they differ from each other. (5) (CO1) (PO1)

b) Demonstrate a relation between interplanar spacing and Miller indices for orthorhombic, tetragonal, and cubic systems. (15) (CO2) (PO2)

c) Calculate the distance between (111) planes in a crystal of Ca. Repeat the calculation for (222) planes. (05) (CO3) (PO2)

2. a) NaCl or CsCl which structure is more stable? Justify your statement. (5) (CO1) (PO1)

b) Describe Bragg's law for X-ray diffraction. Express the Bragg's equation as $n\lambda = 2dsin\theta$. (5+10) (CO2) (PO2)

c) In a certain X-ray diffraction experiment the first-order image is observed at an angle of 5° for a crystal plane spacing of $2.8\times 10^{-10}m$. Apply Bragg's law for the wavelength of the X-ray used. (05) (CO3) (PO2)

3.a) State Coulomb's law. How the Coulomb's force can be compared with gravitational force? (3+2) (CO1) (PO1)

b) For an electric dipole, demonstrate that if you double the distance of a point from a dipole center, the electric field at the point drops by a factor of 8. (15) (CO2) (PO2)

c) An electron is released 8.0 cm from a very long nonconducting rod with a uniform charge density 6.0 μ C/m. Calculate the magnitude of the electron's initial acceleration? (05) (CO3) (PO2)