

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

Mid Semester Examination
Course Number: PHY 4253
Course Title: Physics II

Summer Semester A. Y. 2022 - 2023
Full Marks: 75
Time: 1.5 Hours

There are 4 (Four) questions. Answer 3 (Three) questions. The symbols have their usual meanings. Marks of each question and corresponding CO and PO are written in the brackets. Programmable calculators are not allowed.

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1. (a) Justify the statement – “Like charges repel and unlike charges attract”. (05)
(CO1)
(PO1)
 - (b) i) Deduce an expression of the electric field E due to An electric dipole at a distance r along the perpendicular bisector of the line joining the charges of the dipole. (Assume that the dipole consists of charges $+q$ and $-q$, their separation is $2a$ and $r \gg a$.) (15)
(CO2)
(PO2)
 - ii) A particle of mass m and charge q is placed at rest in a uniform electric field and released, then describe its motion.
 - (c) The electric field between the plates of a cathode-ray oscilloscope is 1.2×10^4 N/C. What deflection will an electron experience if it enters at right angles to the field with a kinetic energy of 2000 eV? The deflecting assembly is 1.5 cm long. (05)
(CO3)
(PO2)
2. (a) What do you understand by equipotential surface? Define electric quadrupole moment. (05)
(CO1)
(PO1)
 - (b) Find the expressions of electric potential due to (i) a dipole and (ii) a quadrupole. Make your comments how the potential varies with distance in case of a point charge, a dipole and a quadrupole. (15)
(CO2)
(PO2)
 - (c) Two protons in a nucleus of U^{238} are 6.0×10^{-15} m apart. What is their mutual potential energy? (05)
(CO3)
(PO2)
3. (a) State with examples what you mean by a single crystal and a polycrystal. (05)
(CO1)
(PO1)
 - (b) Describe space lattice, translation vectors, primitive unit cell, and Wigner-Seitz cell. Calculate the number of atoms in hexagonal closed packed structure. (15)
(CO2)
(PO2)

- (c) The lattice parameter and atomic mass of a diamond crystal are 3.57\AA and 12, respectively. Calculate the density of the diamond. (05)
(CO3)
(PO2)
4. (a) State what you understand by atomic packing factor of a crystal structure. (05)
(CO1)
(PO1)
- (b) Find the atomic packing factor for simple cubic and hexagonal close-packed crystal structures. (15)
(CO2)
(PO2)
- (c) Calculate the volume of the unit cell of a hexagonal closed packed crystal structure. (05)
(CO3)
(PO2)