Question Paper

Exam Date & Time: 26-May-2022 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
II SEMESTER B.Sc.(Applied Sciences) in Engg.
END SEMESTER THEORY EXAMINATION-MAY/JUNE 2022

PHYSICS - II [IPH 121 - S2]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed

Useful constants

Speed of light in vacuum= 3.00×10^{8} m/s	Electron charge = 1.60×10^{-19} C	Mass of proton / neutron= 1.67×10^{-27} kg
Electron mass = 9.11×10^{-31} kg	Boltzmann constant= 1.38×10^{-23} J/ K	Planck's constant = 6.63×10^{-34} J-s
Permittivity of vacuum = 8.85×10^{-12} F/m	Rydberg constant = 1.10×10^{7}/m	Permeability of vacuum = $4\pi \times 10^{-7}$ H/m
Avogadro constant = 6.02×10^{23} /mol		

1) A) State Gauss' law in electrostatics and Using it, obtain an expression for the electric field at a distance of 'r' from an infinite line of charge. (4)

B) Three charges of +122 mC each are placed on the corners of an equilateral triangle, 1.72 m on a side. If energy is supplied at the rate of 831 W, how many days would be required to move one of the charges onto the midpoint of the line joining the other two? (4)

C) Two parallel, flat conducting surfaces of spacing d = 1.0 cm have a potential difference ΔV of 10.3 kV. An alpha particle is projected from one plate directly toward the second. What is the initial velocity of the electron if it comes to rest just at the surface of the second plate? Ignore relativistic effects. (2)

2) A) Derive an expression for the change in potential energy when a test charge moves from a point 'a' to point 'b' subject to the force due to another charge at rest. Discuss when does energy increase or decrease, for like and unlike charges. (4)

B) What is the capacitance of a drop that results when two mercury spheres, each of radius R = 2.00 mm, merge? Calculate the energy that can be stored in a parallel plate capacitor having this capacitance, when subjected to a potential difference of 100 V? (3)