BANKURA UNIVERSITY

B.Sc. 5th Semester (Honours) Examination, March 2021

Subject: *Electronics (H)*

Course ID: 51712 Course Code: SH/ELC/502/C-12(TH)

Course Title: *Electromagnetics*

Full Marks: 25 Time: 1 Hr 15 Min

(The figures in the right hand side margin indicate marks.
Answer all the questions)

1. Answer *any three* of the following questions 1×3=3
   a) Write down the expression for electric field (E) at an external point due to a large number of discrete point charges.
   b) 'Electrostatic force' is a 'conservative force'. How can you establish this?
   c) What amount of 'solid angle' is subtended by a sphere at its centre? Give its unit.
   d) What is curl of a magnetic induction (B)?
   e) What is mutual inductance (M) between two coils of self-inductance L_1 and L_2?
   f) What is mathematical form of pointing vector?

2. Answer *any three* of the following questions. 2×3=6
   a) Obtain the expression for electric field (E) at any point P for certain amount of continuous charge distribution.
   b) What is flux due to an electrostatic field (E)?
   c) What do you mean by dielectric polarisation?
   d) What is magnetic vector potential? Write down the expression for it. 1+1

e) What is the integral and differential form of Faraday's law of electromagnetic induction?

f) What is displacement current density? Who gave this concept? 1+1

3. Answer *any two* of the following questions. 5×2=10

a) Obtain the capacitance of a spherical capacitor with inner radius a and outer radius b when Q amount of charge is given to it. What happens when outer radius b tends to infinity? 4+1

b) Derive an expression for the energy stored in a charged capacitor C. In EM theory what is the importance of Fresnel's equation in describing the reflection and refraction phenomena? 3+2

c) Obtain the wave equation for electric field E and magnetic field B in a dielectric medium starting from Maxwell's equations.

d) On the basis of EM theory, prove the Snell's law of reflection by considering the solution of Maxwell's wave equation and the necessary boundary conditions.

4. Answer *any one* of the following questions. 6×1=6

a) Obtain the solution of two wave equations for electric field E and magnetic field B in an isotopic dielectric medium. Hence show that both the electric and magnetic field are perpendicular to the direction of propagation and also that they are mutually perpendicular to each other. 2+2+2

b) Prove Snell's law of refraction by considering the solution of Maxwell's wave equation and the necessary boundary conditions. Define Brewster's law. 5+1

c) On the basis of EM theory, show that without reflection, refraction is possible but refraction without reflection will never be possible. What is grazing incidence? 5+1