WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 5th Semester Examination, 2020, held in 2021

ELSACOR12T-ELECTRONICS (CC12)

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP-A

1. **Answer any *five* questions from the following:**   2×5 = 10

(a) Two points $A(3, 2, 5)$ and $B(2, -1, 3)$ are given in the Cartesian system. Obtain a vector from *A* to *B* and a unit vector directed from *A* to *B*.

(b) Given the two co-planar vectors:

$$A = 3\hat{i} + 4\hat{j} - 5k$$
$$B = -6\hat{i} + 2\hat{j} + 4k$$

Obtain the unit vector normal to the plane containing vectors.

(c) State Ampere's Circuital Law.

(d) State Biot-Savart's Law.

(e) What is meant by a solenoidal vector?

(f) Discuss briefly the effect of polarization in capacitor.

(g) Write down Maxwell's equations in electromagnetic field.

(h) Distinguish between conduction current and displacement current.

GROUP-B

Answer any *six* questions from the following   5×6 = 30

2. Write down Maxwell's field equations and explain the physical significance of each.   5

3. Establish the electrostatic boundary conditions for tangential components of electric field and electric displacement at the boundary of two linear dielectrics.   5

4. State Faraday's Law of electromagnetic induction. How did Maxwell improve upon the field equation as obtained from Faraday's Law?   1+4

5. Define electric potential. Calculate electric potential due to a charged shell or conducting sphere.   1+4

6. (a) Show that the equation of continuity is contained in Maxwell's equation.   3+2

   (b) Starting from Maxwell's equation establish Coulomb's Law.

7. Derive Poisson's equation from Gauss's law in point form. Verify that the potential field given below satisfies the Laplace's equation.   5
$$V = 2x^2 - 3y^2 + z^2$$

8. Find the displacement current density within a parallel plate capacitor having a dielectric with $\varepsilon_r = 10$, area of plates $A = 0.01\,\text{m}^2$, distance of separation $d = 0.05\,\text{m}$. Applied voltage is   2+3
$$V = 200\sin 200\,t.$$

9. Given $E = E_m \sin(\omega t - \beta t)\hat{a}y$, in free space, find **D, B and H**. Sketch **E** and **H** at $t = 0$.   4+1

10. What is magnetic vector potential? Obtain the magnetic potential **A** when $\mathbf{H} = \dfrac{k}{2}\hat{a}_x$ for $z > 0$ 2+3

11. State and prove Uniqueness theorem.   5

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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