19U506S (Pages: 2) Name: ……

Reg. No: …….

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS-UG)

CC15U PH5 B06 - ELECTRODYNAMICS – II

(Physics- Core Course)

(2015 to 2018 Admissions – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

SECTION A

Answer ***all*** questions. Each question carries 1 mark.

1. The divergence of magnetic field is _____
2. State Faraday's law in differential form.
3. The electromagnetic waves travel in vacuum with a velocity equals to _____
4. Give an expression for energy density of an electromagnetic wave in free space.
5. For highly sensitive ballistic galvanometer its charge sensitivity is _____
   (a) larger (b) smaller (c) moderate (d) none
6. The time constant of an L-R circuit is the time required for the current to reach _____ % of its steady value.
7. The average power for a complete cycle across a pure inductor in an ac circuit is _____
8. In the operation by j operator a vector rotates through _____ angle in _____ direction.
9. An ideal constant current source must have the internal resistance value as _____
10. For maximum power transfer, the load impedance should be _____ compared with effective impedance of the network.

(10 × 1 = 10 Marks)

SECTION B

Answer ***all*** questions. Each question carries 2 marks.

11. Which are the four Maxwell's equations?
12. Differentiate between self inductance and mutual inductance?
13. What is poynting vector? Write down its expression and explain the symbols?
14. What is meant by polarisation of a wave?
15. What type of currents is considered as transient?
16. How inductive reactance and capacitive reactance vary with frequency of applied emf in ac circuits?
17. How can a voltage source be converted into equivalent current source and vice versa?

(7 × 2 = 14 Marks)

SECTION C

Answer any ***five*** questions. Each question carries 4 marks.

18. Derive boundary conditions for the field vectors $\vec{E}, \vec{B}, \vec{D}, \vec{H}$
19. Derive Maxwell's equations starting from the fundamental laws in electricity and magnetism.
20. An electromagnetic wave passes from one medium to another medium. Derive reflection and transmission coefficients at normal incidence and show that R + T = 1.

21. Derive phase relationship between voltage and current in an a. c. circuit containing inductance and resistance.
22. Obtain expression for the growth and decay of charge in a capacitor through a resistance.
23. Explain with the help of a neat diagram Rayleigh bridge method to measure the self - inductance of a coil?
24. State and explain Super position theorem and Norton's theorem.

(5 × 4= 20 Marks)

SECTION D

Answer any ***four*** questions. Each question carries 4 marks.

25. What must be the strength of uniform electric field if it is to have the same energy density as that possessed by 1.5 Wb/m^2 magnetic field?
26. A solenoid of 75 cm length and 5 cm diameter is wound with 1000 turns. Find (a) inductance and (b) the energy stored in the magnetic field when a current of 5 A flows in the coil.
27. A capacitor charged up to 3V is discharged through a B.G having time period of 12 seconds and current sensitivity 3 x 10^{-8} A/cm. If the first and eleventh throws of the galvanometer are 9.6 cm and 8 cm respectively, calculate the capacitance of the capacitor?
28. There is an LCR series ac circuit with L=100μH, R=5Ω and C=0.0002μF. A voltage of 0.1V is applied at resonant frequency. Find the resonant frequency and prove that magnified voltage is obtained across inductor and capacitor at resonance.
29. A resistance R and an inductance L are connected to a battery of V volts. When will be the potential difference across the inductor equals that across the resistor?
30. In a plane electromagnetic wave the electric field oscillates sinusoidally at a frequency of 20 GHz and amplitude 40 V/m. Calculate (a) wavelength of the wave and (b) amplitude of the oscillating magnetic field.
31. A battery of emf 24 V has an internal resistance of 0.01 Ω. If the total power supplied is 120 W, show that the system behaves as a constant voltage source.

(4 × 4 =16 Marks)

SECTION E

Answer any ***two*** questions. Each question carries 10 marks.

32. Obtain boundary conditions for electromagnetic field vectors. Modify it for a metal-dielectric boundary.
33. State and explain Poynting theorem. Show that the Poynting vector can be expressed as $\boldsymbol{P = E \times H}$.
34. Discuss the characteristics of an A. C. circuit containing inductance, capacitance and resistance in series.
35. Describe the experimental method for determining high resistance by leakage method.

(2 × 10 = 20 Marks)

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