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(Pages : 4)

Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, NOVEMBER 2016

(UG—CCSS)

Physics

PH 5B 09—ELECTRODYNAMICS—II

(2013 Admissions)

me : Three Hours

Maximum : 30 Weightage

1. Objective questions (Answer *all* questions) :

1 An inductor stores energy in :

(a) Its electric field. (b) Its magnetic field.

(c) Its electric and magnetic fields. (d) Its coil.

2 The Poynting vector is :

(a) $\frac{\mu_0}{E \times B}$. (b) $\frac{\mu_0}{E \cdot B}$.

(c) $\frac{E \cdot B}{\mu_0}$. (d) $\frac{E \times B}{\mu_0}$.

3 The speed of electromagnetic waves in free space is given by :

(a) $\mu_0 \varepsilon_0$. (b) $\sqrt{\mu_0 \varepsilon_0}$.

(c) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. (d) $\frac{1}{\mu_0 \varepsilon_0}$.

4. The relation between the vectors electric field intensity E, electric flux density D and polarization P is :

(a) $D = \varepsilon_0 E + P$. (b) $E = \varepsilon_0 D + P$.

(c) $E = \varepsilon_0 P + D$. (d) $E = \varepsilon_0 P - D$.

5 The power factor of a series resonant circuit is :

(a) 1. (b) – 1.

(c) 0. (d) Infinity.

Turn over

6 In an a.c. circuit with voltage V and current I, the power developed is :

(a) VI.

(b) $\frac{VI}{2}$.

(c) $\frac{VI}{\sqrt{2}}$.

(d) Depends on the phase relation between V and I.

7 Assuming L, C, R representing inductance, capacitance and resistance, respectively, the quantity which has the dimension of frequency is :

(a) RC. (b) $\frac{1}{RC}$.

(c) $\frac{RL}{C}$. (d) $\frac{C}{RL}$.

8 Kirchhoff's voltage law is concerned with :

(a) IR drops only. (b) Battery EMFs only.

(c) Junction voltages only. (d) Both (a) and (b).

State whether the following statements are True *or* False :

9 Self inductance of a coil depends on its geometry.

10 During one time constant, the current through a series LR circuit rises to 37 % of its final steady value.

11 An ideal constant voltage source has zero resistance.

12 Higher the resistance of a resonant circuit, better is its selectivity.

(12 × ¼ = 3 weightage)

II. Short answer questions (Answer *all* questions) :

13 Explain Lenz's law in electromagnetic induction.

14 Discuss the necessity of the term displacement current in Maxwell's equations.

15 What do you mean by intensity of electromagnetic waves ?

16 Define the terms phase and phase constant of a sinusoidal wave.

17 What do you mean by a plane wave and write down the equation for a plane wave.

18 Draw graphs representing over-damped, critically-damped and damped-oscillatory cases of the growth of charge in a series LCR circuit.

19 Discuss the term reactance of an a.c. circuit.

20 Draw the basic circuit of an a.c. bridge and write down the condition for balance.

21 Using *j*-operator, write down the voltage-current relationship in a purely inductive and a series LC circuit.

(9 × 1 = 9 weightage)

III. Short essay questions (Answer any *five* questions) :

22 Write down the Maxwell's equations and explain the terms involved.

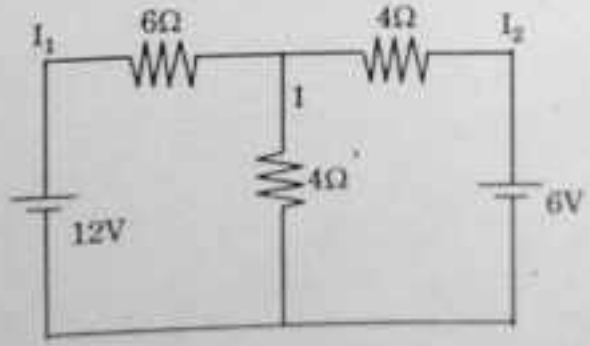
23 Write down the boundary conditions satisfied by electromagnetic fields at the interface between two media of different permeabilities and permittivities.

24 Write down the expression for energy density and momentum density of an electromagnetic wave.

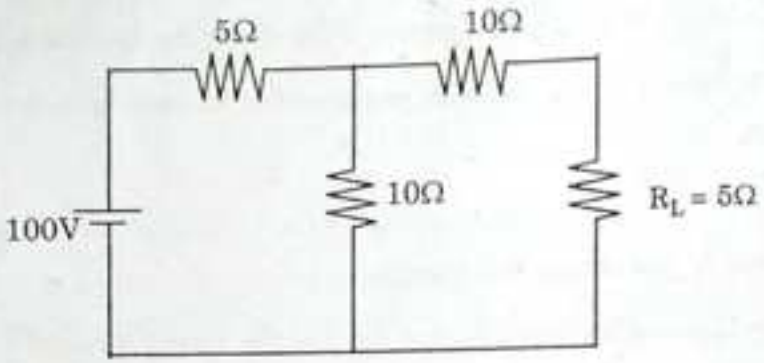
25 A series combination having R = 1 MΩ and C = 0.02 μF is connected to a d.c. voltage source of 100 V. Determine (i) The time constant of the circuit ; (ii) Capacitor voltage after 0.02 second ; and (iii) Capacitor voltage after 0.04 second.

26 A pure resistance of 50 Ω is in series with a capacitance of 100 μF. The combination is connected to a 100 V, 50 Hz supply. Determine the (i) Impedance ; (ii) Power factor ; (iii) Voltage across resistance ; and (iv) Voltage across capacitance.

27 Using superposition theorem, calculate the current in each branch of the following network :—



28 In the following figure, determine the current through the load resistance 5 Ω using Norton's theorem.



(5 × 2 = 10 weightage)

IV. Essay questions (Answer any *two* questions) :

29 Obtain the wave equation for the electric and magnetic field vectors E and B in free space. Discuss the term polarization and prove that electromagnetic waves are transverse in nature.

30 What is the working principle of a ballistic galvanometer ? Obtain an expression relating the charge flowing through a ballistic galvanometer and the corresponding deflection.

31 Obtain the relation between voltage and current in a series LCR circuit. Discuss the resonance of the circuit.

(2 × 4 = 8 weightage)