B. Sc. Part – I Semester-II

PHYSICS-Paper-IV

DSC- B2 ELECTRICITY AND MAGNETISM-II

UNIT_I: 1.A.C.Circuits

Select correct alternative:

1. The operator j on multiplication turns the vector through ---------.
   a) 180^O **b) 90^O** c) 0^O
2. At resonance the LCR circuit is purely -------
   a) Resistive b) Capacitive c) Inductive
3. At resonance the current in LCR circuit is ----------
   a) maximum b) mimimum c) zero
4. At resonance the impedance of LCR circuit is ----------
   a) minimum b) maximum c) zero
5. Phase difference in LCR circuit is given by ----------
   a) $\tan\theta = \frac{X_L - X_C}{R}$ b) $\tan\theta = X_L - X_C$ c) $\tan\theta = \frac{R}{X_L - X_C}$
6. The impedance of LCR circuit is given by -------
   a) $Z = \sqrt{R^2 + (X_L - X_C)^2}$ b) $Z = \sqrt{R^2 - (X_L - X_C)^2}$ c) $Z = R^2 + (X_L - X_C)^2$
7. Sharpness of resonance is given by ----------
   a) $Sharpness = \frac{f_2 - f_1}{f_0}$ b) $Sharpness = \frac{f_2 + f_1}{f_0}$ c) $Sharpness = f_2 - f_1$
8. Ownes's bridge is used to determine ----------
   a) self inductance b) capacitance c) resistance

9. in a purely resistive circuit, the current with the applied alternating e.m.f. is .....

(a) in phase (b) out of phase (c) lagging by π/2 (d) lagging by π/2

10. In a purely inductive circuit, the phase of the alternating current, over the applied e.m.f. is .....

(a) lagging by π/2 **(b) leading by π/2** (c) out of phase (d) in phase

11. In a purely capacitive circuit, the phase of the alternating current, over the applied e.m.f. is ----------

(a) lags by π/2 (b) leads by π/2 (c) is out of phase.(d) is in phase.

12.The S.I. unit of impedance is....

(a) ampere (b) volt (c) ohm (d) mhos

13.. The S.I. unit of admittance is.....

(a) ampere (b) volt (c) ohm (d) mhos

14. The S.l. unit of susceptance is.....

(a) ampere (b) volt (c) ohm (d) mhos

15. Voltage amplification in series resonant circuit is.....

$(A)\frac{\omega_0 R_1}{L}$ $(B)\frac{RL}{\omega_o}$ $(C)\frac{\omega_0 L}{R}$ $(D)\frac{\omega_0}{R.L}$

16. Q factor of a L-C-R series resonant a.c. circuit is....

$(A)\frac{\omega R}{L}$ $(B)\frac{\omega L}{R}$ $(C)\frac{\omega C}{L}$ $(D)\frac{\omega}{LC}$

17. In a.c. bridges --------- source is used

(A) d.c. (B) a.c. (C)fluctuating (D) both d.c. and a.c.

18.Ownes bridge is used to determine ---------

(A) self-inductance (B) mutual inductance(C)capacitance(D) resistance

19. Self-inductance in Owne's bridge is given by ---------

$(A) L = R_1 R_4 C_3$ $(B) L = \omega R_1 R_4 C_3$ $(C) L = R_1 R_4$ $(D) L = R_1 R_4 C4$

20. Resonance frequency does not depend on --------

(A)L (B)C (C) R (D) both L,C

21. Current at resonance in LCR circuit is controlled by ------

(A)L (B)C (C) R (D) both L,C

Topic 2

8. According to Biot Savart law magnetic field at a point due to small element of current carrying conductor is ----------

(A) directly proportional to the the current flowing through it
(B) inversely proportional to the current flowing through it
(C) inversely proportional to the length of the conductor
(D) directly proportional to the the R^2

9. Magnetic field due to straight current carrying conductor of infinite length at a point at a distance R is ----------

(A) $\frac{\mu_o iR}{2\pi}$ $(B)\ B = \frac{\mu_o . i}{2\pi . R}$

$(C)\ B = \mu_o . i . R$ $(B)\ B = \frac{\mu_o . R}{2\pi . i}$

10. Magnetic field at a point on the axis of solenoid of infinite length is ----------

(A) $\frac{\mu_o iR}{2\pi}$ $(B)\ B = \frac{\mu_o n . i}{2}(\cos\theta_2 + \cos\theta_1)$

$(C)\ B = \frac{\mu_o n . i}{2}$ $(D)\ B = \frac{\mu_o n . i}{2}(\cos\theta_2 - \cos\theta_1)$

11. The SI unit of intensity of magnetisation is ---------

(A) A-m (B) m/A (C)A/m (D) Wb/m

12. Susceptibility of ferromagnetic material is —---

(A) Positive but small (B) negative but small (C) zero (D)positive but large

13. Susceptibility of ------- material is independent of temperature.

9A) Diamagnetic (B) paramagnetic (C) ferromagnetic (D)antiferromagnetic

Unit II Topic 1

14. Scientist ------ gives laws of electromagnetic induction.

(A) Newton (B) Maxwell (C) Farady and Lenz (D)Tesla

15. Lenz law gives ------ of induced emf.

(A) magnitude (B) direction (C) both magnitude and direction (C) unit

16. Self inductance is measured in -------

(A) Ohm (B) Farad (C) Henry (D) Weber

17. Self-inductance per unit length oof a solenoid with n turns per unit length and cross sectional area 'A' is ----------

(A) $\mu_o nA$ (B) n^2A (C) $\mu_o n^2A^2$ (D) $\mu_o n^2A$

18. Energy stored per unit volume in magnetic field is --------

(A) $\frac{\mu_o B^2}{2}$ (B) $\frac{B^2}{2\mu_o}$ (C) $\frac{2\mu_o}{B^2}$ (D) $\frac{2}{\mu_o B^2}$

Topic 2

19. Mathematical formulation empirical loss electricity and Magnetism are known as ---------

(A) Maxwell's equations 9B) Faraday's equations

(B) Lorentz equations (D) Biot and Savaort's equations

20. The equation of continuity is in accordance with the law of conservation of ---------

(A) energy (B) momentum (C) charge (D) mass

21. The statement 'magnetic poles do not exist' is justified by Maxwell's equation --------

(A) $\nabla.\vec{D}=\rho$ (B) $\nabla.\vec{B}=0$ (C) $\nabla X.\vec{E}=-\frac{\partial\vec{B}}{\partial t}$ (D) $\nabla X.\vec{H}=\vec{J}+\frac{\partial\vec{D}}{\partial t}$

22. The electromagnetic energy crossing unit area in unit time is called ----------

(A) poynting vector (B) polarization vector

(C) energy density (D) intensity

23. The nature of electromagnetic wave is ---------

(A) transverse (B) longitudinal

(C) stationery (D) both transverse and stationary

24.For dielectric medium electric and magnetic field waves are ----------

(A) out of phase (B) in same page (C) differ in phase by $\pi/2$

(C) differ in phase by $\pi/4$

25. Transverse nature of electromagnetic waves is proved by observation of ----------

(A) Refraction (B) interference (C) diffraction (D) polarization

2. Magnetism

QUESTIONS

1. Select correct alternative.

(i) According to Biot-Savart's law, magnetic field at a point due to a small element of current carrying conductor is.....

(a) directly proportional to the current flowing through it

(b) inversely proportional to the current flowing through it

(c) inversely proportional to the length of the conductor

(d) directly proportional to the r^2

(ii) According to Biot-Savart's law, magnetic field at a point due to a small element of current carrying conductor is.....

(a) inversely proportional to the current flowing through it

(b) inversely proportional to the r^2

(c) inversely proportional to the length of the conductor

(d) directly proportional to the r^2

(iii) Magnetic field due to straight current carrying conductor of infinite length at a point at a distance R is, B =.....

(a) $\frac{\mu_0 iR}{2\pi}$ (b) $\frac{\mu_0 i}{2\pi R}$ (c) $\mu_0 iR$ (d) $\frac{\mu_0 R}{2\pi i}$

(iv) Magnetic field at the centre of the current carrying circular coil of radius r is, B =.....

(a) $\frac{\mu_0 i}{2r}$ (b) $\frac{\mu_0 i}{3r}$ (c) $\frac{\mu_0 ri}{2}$ (d) $2\mu_0 ri$

(v) Magnetic field at a point on the axis of a solenoid of finite length is...

(a) $B = \mu_0 ni$

(b) $B = \frac{\mu_0 ni}{2}(\cos\theta_2 + \cos\theta_1)$

(c) $\frac{\mu_0 ni}{2}$

(d) $B = \frac{\mu_0 ni}{2}(\cos\theta_2 - \cos\theta_1)$

(vi) Magnetic field at a point on the axis of a solenoid of infinite length is...

(a) $B = \frac{\mu_0 ni}{2}$

(b) $B = \frac{\mu_0 ni}{2}(\cos\theta_2 - \cos\theta_1)$

(c) $B = \mu_0 ni$

(d) $B = \frac{\mu_0 ni}{3}$

(vii) The line integral of the magnetic field around any closed path in the free space is equal to the absolute permeability (μ_0) times the net steady current enclosed by the path. This is..... law

(c) Gauss (d) Stokes

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(viii) Integral form of the Ampere's circuital law is.....

(a) $\oint \vec{B}.\vec{dl} = \mu_0 I$ (b) $\vec{\nabla}.\vec{B} = 0$

(c) $\vec{\nabla}\times\vec{B} = 0$ (d) $\vec{\nabla}\times\vec{B} = \mu_0 I$

(ix) Divergence of magnetic field $\left(\vec{\nabla}.\vec{B}\right)$ =.....

(a) $\mu_0 I$ (b) zero (c) infinite (d) $\frac{\mu_0}{4\pi}$

(x) Differential form of the Ampere's circuital law is.....

(a) $\oint \vec{B}.\vec{dl} = \mu_0 I$ (b) $\vec{\nabla}\times\vec{B} = 0$

(c) $\vec{\nabla}.\vec{B} = 0$ (d) $\vec{\nabla}\times\vec{B} = \mu_0 I$

(xi) Curl of magnetic field $\vec{\nabla}\times\vec{B}$ .....

(a) $\mu_0 I$ (b) zero (c) infinite (d) $\frac{\mu_0}{4\pi}$

(xii) Magnetic vector potential $\vec{A}$ is related with magnetic field $\vec{B}$ by equation

(a) $\vec{B} = \vec{\nabla}.\vec{A}$ (b) $\vec{A} = \vec{\nabla}\times\vec{B}$ (c) $\vec{A} = \vec{\nabla}.\vec{B}$ (d) $\vec{B} = \vec{\nabla}\times\vec{A}$

(xiii) Magnetic moment developed per unit volume is called as....

(a) magnetic induction (b) intensity of magnetization

(c) permeability (d) susceptibility

(xiv) S.I. unit of intensity of magnetization is.....

(a) A-m (b) m/A (c) A/m (d) Wb/m^2

(xv) S.I. unit of magnetic induction is.....

(a) A-m (b) m/A (c) A/m (d) Wb/m^2

(xvi) Permeability μ =.....

(a) $\frac{B}{H}$ (b) $\frac{H}{B}$ (c) BH (d) $\frac{M}{H}$

(xvii) S.I. unit of permeability is x = ...

(a) Wb/m^2 (b) Wb/Am (c) WbA/m (d) Am/Wb

(xviii) Magnetic susceptibility χ .....

(a) $\frac{B}{H}$ (b) $\frac{H}{M}$ (c) MH (d) $\frac{M}{H}$

(xix) The relation between magnetic induction B, magnetizing field and intensity of magnetization is.....

(a) $B = \mu_0(H+M)$ (b) $H = \mu_0(B+M)$

(c) $M = \mu_0(H+B)$ (d) $B = (H+M)$

(xx) Relation between relative permeability k and susceptibility χ is....

(a) $k = 1-\chi$ (b) $k = 1+\chi$ (c) $k = \frac{1}{\chi}$

(xxi) For paramagnetic materials.....

(a) $\mu = \mu_0$ (b) $\mu < \mu_0$ (c) $\mu > \mu_0$ (d) $\mu >> \mu_0$

(xxii) Susceptibility χ of paramagnetic materials is.....

(a) positive (b) negative (c) zero (d) infinite

(xxiii) Susceptibility of paramagnetic materials χ is proportional to....

(a) T (b) $\frac{1}{T}$ (c) $\frac{1}{T^2}$ (d) T^2

(xxiv) Susceptibility of ferromagnetic materials is.....

(a) positive but small (b) negative but small
(c) zero (d) positive but large

(xxv) For ferromagnetic materials.....

(a) $\mu > \mu_0$ (b) $\mu < \mu_0$ (c) $\mu >> \mu_0$ (d) $\mu << \mu_0$

(xxvi) Susceptibility of diamagnetic materials is.....

(a) positive but small (b) negative
(c) zero (d) positive but large

(xxvii) For diamagnetic materials....

(a) $\mu > \mu_0$ (b) $\mu < \mu_0$ (c) $\mu >> \mu_0$ (d) $\mu << \mu_0$

(xxviii) Susceptibility of.....materials is independent of temperature

(a) diamagnetic (b) paramagnetic
(c) ferromagnetic (d) antiferromagnetic

Answers: (i) a, (ii) b, (iii) b, (iv) a, (v) d, (vi) c, (vii) b, (viii) a, (ix) b, (x) c, (xi) a, (xii) d, (xiii) b, (xiv) c, (xv) d, (xvi) a, (xvii) b, (xviii) d, (xix) a, (xx) b, (xxi) c, (xxii) a, (xxiii) b, (xxiv) d, (xxv) c, (xxvi) b, (xxvii) b, (xxviii) a

UNIT-II 1. Electromagnetic Induction

QUESTIONS

1. Select the most correct alternative

(i) Faraday's law gives ..... of induced emf.

(a) magnitude (b) direction (c) both (d) unit.

(ii) Lenz's law gives ..... of induced emf.

(a) magnitude (b) direction (c) both (d) unit.

(iii) Self inductance is measured in.....

(a) Ohm (b) Farad (c) Henry (d) Volt.

(iv) Mutual inductance is measured in

(a) Ohm (b)Farad (c) Henry (d) Volt.

(v) Self inductance per unit length of a solenoid with n turns per unit length and cross-sectional area A is, ...

(a) $\mu_0 nA$ (b) $n^2 A$ (c) $\mu_0 n^2 A^2$ (d) $\mu_0 n^2 A$.

(vi) Mutual inductance per unit length of two windings with n_1 & n_2 turns per unit length over a frame of cross-sectional area A is .....

(a) $\mu_0 \frac{n_1 n_2}{A}$ (b) $\frac{\mu_0 A}{n_1 n_2}$ (c) $\mu_0 n_1 n_2 A$ (d) $\frac{n_1 n_2 A}{\mu_0}$.

(vii) Energy stored per unit volume in magnetic field is.....

(a) $\frac{1}{2}\mu_0 B^2$ (b) $\frac{B^2}{2\mu_0}$ (c) $\frac{2\mu_0}{B^2}$ (d) $\frac{2}{\mu_0 B^2}$.

Answer : *(i) a, (ii) b, (iii) c, (iv) c, (v) d, (vi) c, (vii) b.]*

Maxwell's Equation and Electromagnetic wave

QUESTIONS

1. Select the correct alternative from the given.

(i) Mathematical formulations of empirical laws in electricity and magnetism are known as .....

(a) Maxwell's equations *(b) Faraday's equations*

(c) Lorentz's equations *(d) Biot & Savart's equations*

(ii) differential form of Ampere's circuital law for steady state current is..

(a) $\nabla.\vec{J} = \mu_0$ (b) $\nabla.\vec{J} = 0$ (c) $\nabla.\vec{J} = -\frac{\partial \rho}{\partial t}$ (d) $\nabla.\vec{J} = \epsilon_0$

(iii) The equation of continuity is in accordance with the law of conservation of .....

(a) energy *(b) momentum* *(c) charge* *(d) mass*

(iv) Displacement current density in vacuum is .....

(a) $\frac{\partial \vec{D}}{\partial t} = 0$ (b) $\frac{\partial \vec{D}}{\partial t} = \vec{J}$ (c) $\frac{\partial \vec{D}}{\partial t} = \mu_0 \epsilon_0$ (d) $\frac{\partial \vec{D}}{\partial t} = \phi \epsilon_0 . \frac{\partial \vec{E}}{\partial t}$

(v) The statement 'magnetic free poles do not exist' is justified by Maxwell's equation.....

(a) $\nabla.\vec{D} = \rho$ (b) $\nabla.\vec{B} = 0$

(c) $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ (d) $\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$

(vi) The electromagnetic energy crossing unit area in unit time is called.....

(a) Poynting's vector *(b) Polarisation vector*

(c) Energy density *(d) Intensity.*

(vii) Velocity of electromagnetic wave in dielectric medium is given by .....

(a) $v = \sqrt{\mu \epsilon}$ (b) $v = \sqrt{\mu_0 \epsilon_0}$ (c) $v = \frac{1}{\sqrt{\mu \epsilon}}$ (d) $v = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$

(viii) Nature of electromagnetic waves is .....

(a) transverse (b) longitudinal (c) stationary (d) none of the above.

(ix) Electric $\left(\vec{E}\right)$ and magnetic $\left(\vec{H}\right)$ field vectors of electromagnetic waves are mutually perpendicular to .....

(a) polarisation vector *(b) magnetisation vector*

(c) electric displacement vector *(d) propagation vector*

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(x) For dielectric medium the electric and magnetic field waves are .....

(a) out of phase *(b) in same phase*

(c) differ in phase by $\pi/2$ *(d) differ in phase by* $\pi/4$

(xi) Transverse nature of electromagnetic waves is proved by the observation of .....

(a) refraction *(b) interference*

(c) diffraction *(d) polarization*

[**Ans :** *(i) a, (ii) b ,(iii) c, (iv) d, (v) b, (vi) a, (vii) c, (viii) a, (ix) d, (x) b, (xi) d.]*