OMR Answer Sheet No.

Question Booklet Number

7080

M.Sc. (Semester-I) Examination, 2022-23

Booklet Series

A

PHYSICS

(Electrodynamics)

(To be filled in by the Candidate / निम्न पूर्तियां परीक्षार्थी स्वयं भरें)

Roll No. (in figures)

अनुक्रमांक (अंकों में)

Roll No. (in words)

अनुक्रमांक (शब्दों में)

Enrolment No. (in figures)

Name of College

कॉलेज का नाम

[Time : 1 : 30 Hours

[समय : 1 : 30 घण्टे

[Maximum Marks : 75

[अधिकतम अंक : 75

Signature of Invigilator

कक्ष निरीक्षक के हस्ताक्षर

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 75 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. In case Examinee attempts more than 50 Questions, ***first*** 50 attempted questions will be evaluated. All Questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be immediately replaced.

(Remaining Instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 75 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को दी गई OMR उत्तर-पत्रक पर ही हल करना है। परीक्षार्थी द्वारा 50 से अधिक प्रश्नों को हल करने की स्थिति में ***प्रथम*** 50 उत्तरों को ही मूल्यांकित किया जाएगा। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR उत्तर-पत्रक को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका, जिसमें कुछ भाग छपने से छूट गये हों या प्रश्न एक से अधिक बार छप गये हों या किसी भी प्रकार की कमी हो, उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. The Lorentz condition is:

(A) $\text{div}\,\vec{J} + \frac{\partial\rho}{\partial t} = 0$

(B) $\text{grad}\,\phi + \frac{1}{c^2}\frac{\partial\vec{A}}{\partial t} = 0$

(C) $\text{div}\,\vec{A} + \frac{1}{c^2}\frac{\partial\phi}{\partial t} = 0$.

(D) None of the above

2. The Lorentz condition in covariant form is:

(A) $\square . J_\mu = 0$

(B) $\square . A_\mu = 0$.

(C) $\square . x_\mu = 0$

(D) None of the above

3. Equation of continuity in covariant form is:

(A) $\square . J_\mu = 0$.

(B) $\square . A_\mu = 0$

(C) $\square . x_\mu = 0$

(D) None of the above

4. Lorentz transformations of electro-magnetic four potentials are expressed as:

(A) $A_\mu = \alpha_{\mu\nu} A'_\nu$.

(B) $A'_\mu = \alpha_{\mu\nu} A_\nu$

(C) $A_\nu = \alpha_{\mu\nu} A'_\mu$

(D) None of the above

5. Lorentz transformations of current four vectors are expressed as:

(A) $J'_\mu = \alpha_{\mu\nu} J_\nu$

(B) $J_\mu = \alpha_{\mu\nu} J'_\nu$.

(C) $J_\nu = \alpha_{\nu\mu} J_\mu$

(D) None of the above

6. D' Alembertian ($\square^2$) and Laplacian operators (∇^2) are related as:

(A) $\square^2 = \nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}$.

(B) $\square^2 = \nabla^2 + \frac{1}{c^2}\frac{\partial^2}{\partial t^2}$

(C) $\square^2 = \nabla^2 - \frac{1}{c^3}\frac{\partial^2}{\partial t^2}$

(D) None of the above

7. If $\underline{R}$ be the difference vector defined as $\underline{R} = r_2 - r_1$ where r_1 and r_2 are position vectors of two world points. Then R will be space like if:

(A) $|r_2^2 - r_1^2|^2 > c^2(t_2^2 - t_1^2)$

(B) $|\vec{r}_2 - \vec{r}_1|^2 < c^2(t_2^2 - t_1^2)$

(C) $|\vec{r}_2 - \vec{r}_1|^2 > c^2(t_2^2 - t_1^2)$.

(D) None of the above

8. Lorentz transformations of space and time in Four-vector form are:

(A) $x'_\mu = \alpha_{\mu\nu} x_\nu$

(B) $x_\nu = \alpha_{\nu\mu} x'_\mu$.

(C) $x_\mu = \alpha_{\mu\nu} x_\nu$

(D) None of the above

9. Which of the following statement is true:

(A) Maxwell's field equations are not valid under Lorentz transformations.

(B) Maxwell's field equations are invariant under Lorentz transformations.

(C) Maxwell's field equations are not invariant under Lorentz transformations.

(D) None of the above.

10. In Minkowski four dimensional space time continuum, Lorentz transformation equations for x and t with $\beta = v/c$, $m = ct$ and $\lambda = \frac{1}{\sqrt{1-\beta^2}}$ are expressed as:

(A) $x' = \lambda(x - \beta m)$, $m' = \lambda(m - \beta x)$

(B) $x = \lambda(x' - \beta m')$, $m = \lambda(m' - \beta x')$

(C) $t' = \lambda(x - \beta t)$, $t = \lambda(x - t')$

(D) None of the above

11. Inhomogeneous wave equations in free space are:

(A) $\Box^2 \phi = -\rho/\epsilon_0$, $\Box^2 \vec{A} = -\mu_0 J$

(B) $\Box^2 \vec{A} = -\rho/\epsilon_0$, $\Box^2 \phi = -\mu_0 J$

(C) $\Box^2 \phi = -\vec{A}/\epsilon_0$, $\Box^2 \vec{A} = \phi/\epsilon_0$

(D) None of the above

12. The Electromagnetic fields of a point charge in motion are given as:

(A) $E(r,t) = \frac{q}{4\pi\epsilon_0}\left[\frac{(R - R\beta)(1-\beta^2)}{(R - R.\beta)^3} + \frac{R \times (R - R\beta) \times \dot{\beta}}{c(R - R.\beta)^3}\right]_{retarded}$

and $B(r,t) = \left[\frac{n \times E(r,t)}{c}\right]$

(B) $B(r,t) = \frac{\mu_0 q}{4\pi}\left[\frac{(R - R\beta)(1-\beta^2)}{(R - R.\beta)^3} + \frac{R \times (R - R\beta) \times \dot{\beta}}{c(R - R.\beta)^3}\right]_{retarded}$

and $E(r,t) = \left[\frac{n \times B(r,t)}{c}\right]$

(C) $E(r,t) = \frac{q}{4\pi\epsilon_0}\left[\frac{(R - R\beta)(1-\beta^2)}{C(R - R.\beta)^3} + \frac{R \times (R - R\beta) \times \dot{\beta}}{(R - R.\beta)^3}\right]_{retarded}$

and $B(r,t) = \left[\frac{n \times E(r,t)}{\mu_0 c}\right]$

(D) None of the above

13. Larmor's formula for the power radiated by a slowly moving (non-relativistic) accelerated charge is:

(A) $P = \frac{1}{4\pi\epsilon_0}\frac{2q^2v^2}{3c^3}$

(B) $P = \frac{1}{4\pi\epsilon_0}\frac{2q^2a^2}{3c}$

(C) $P = \frac{1}{4\pi\epsilon_0}\frac{2q^2a^2}{3c^3}$

(D) None of the above

14. Expression for relativistic generalisation of Larmor's formula is:

(A) $P = \frac{1}{4\pi\epsilon_0}\frac{2}{3}\frac{q^2\lambda^6}{c}\left|\dot{\vec{\beta}}^2 - (\vec{\beta}\times\dot{\vec{\beta}})^2\right|$

(B) $P = \frac{\mu_0}{4\pi}\frac{2}{3}\frac{q^2a^2}{c}\left|\dot{\vec{\beta}}^2 - (\vec{\beta}\times\dot{\vec{\beta}})^2\right|$

(C) $P = \frac{1}{4\pi\epsilon_0}\frac{2}{3}\frac{q^2\lambda^4}{c^3}\left|\dot{\vec{\beta}}^2 - (\vec{\beta}\times\dot{\vec{\beta}})\right|$

(D) None of the above

15. Bramsstrahalung radiations are produced from the accelerated electrons with the assumption that motion of the electron is-

(A) Non-relativistic

(B) Velocity and acceleration are collinear

(C) Velocity and acceleration are perpendicular

(D) None of the above

16. Power radiated from an accelerated charge at high velocity when its velocity and acceleration are perpendicular is given by the expression:

(A) $P = \frac{1}{4\pi\epsilon_0}\frac{2q^2a^2}{3c^3}\lambda^6$

(B) $P = \frac{1}{4\pi\epsilon_0}\frac{2q^2a^2}{3c^3}\lambda^4$

(C) $P = \frac{1}{4\pi\epsilon_0}\frac{2}{3}\frac{q^2a^2}{c^3}$

(D) None of the above

17. Abraham-Lorentz formula is:

(A) $F_{rad} = \frac{1}{4\pi\epsilon_0}\frac{2}{3}\frac{q^2}{c^3}\dot{a}$

(B) $F_{rad} = \frac{2}{3}\frac{q^2\dot{v}}{c}$

(C) $F_{rad} = \frac{2}{3}\frac{q^2a^2}{c^2}$

(D) None of the above

18. Electromagnetic fields $\vec{E}$ and $\vec{B}$ are given by:

(A) $\vec{A} = \text{curl } \vec{B}$ and $\vec{E} = -\text{div}\vec{A} - \frac{\partial\phi}{\partial t}$

(B) $\vec{B} = -\text{grad } \phi - \frac{\partial\vec{A}}{\partial t}$ and $\vec{E} = \text{curl}\vec{A}$

(C) $B = \text{curl } \vec{A}$ and $\vec{E} = -\text{grad}\,\phi - \frac{\partial\vec{A}}{\partial t}$

(D) None of the above

19. Retarded potential solution of inhomogeneous wave equation is given by:

(A) $\psi(\vec{r},t) = \frac{\mu_0}{4\pi}\int\frac{g(\vec{r}',t+R/c)}{R(\vec{r},\vec{r}')}dv'$,

(B) $\psi(\vec{r},t) = \frac{1}{4\pi\epsilon_0}\int\frac{g(\vec{r}',t-R/c)}{R(\vec{r},\vec{r}')}dv'$

(C) $\psi(\vec{r},t) = \frac{1}{4\pi}\int\frac{g(\vec{r}',t-R/c)}{R(\vec{r},\vec{r}')}dv'$

(D) None of the above

20. Differential form of Faraday's law of electromagnetic induction is:

(A) $\vec{\nabla}.\vec{D} = \rho$

(B) $\vec{\nabla}.\vec{B} = 0$

(C) $\vec{\nabla}\times\vec{E} = \frac{-\partial\vec{B}}{\partial t}$

(D) $\vec{\nabla}\times\vec{H} = \vec{J} + \frac{\partial\vec{D}}{\partial t}$

21. Maxwell's modification of Ampere's law is

(A) $\vec{\nabla}\times\vec{E} = -\partial\vec{B}/\partial t$

(B) $\vec{\nabla}.\vec{B} = 0$

(C) $\vec{\nabla}.\vec{D} = \rho$

(D) $\vec{\nabla}\times\vec{H} = \vec{J} + \frac{\partial\vec{D}}{\partial t}$

22. Differential form of Gauss law in electrostatics is

(A) $\vec{\nabla}.\vec{B} = 0$

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

(C) $\vec{\nabla}\times\vec{E} = \frac{-\partial\vec{B}}{\partial t}$

(D) None of the above

23. Maxwell's equations in free space are:

(A) $\vec{\nabla}.\vec{D} = 0, \vec{\nabla}.\vec{B} = 0, \quad \vec{\nabla}\times\vec{E} = \frac{-\partial\vec{B}}{\partial t},$

$\vec{\nabla}\times\vec{H} = \frac{\partial\vec{D}}{\partial t}$.

(B) $\vec{\nabla}.\vec{D} = \rho, \vec{\nabla}.\vec{B} = 0, \quad \vec{\nabla}\times\vec{E} = \frac{\mu\partial\vec{H}}{\partial t},$

$\text{Curl}\,\vec{H} = \vec{J} + \epsilon\frac{\partial\vec{E}}{\partial t}$

(C) $\vec{\nabla}.\vec{D} = 0, \vec{\nabla}.\vec{B} = 0,$

$\vec{\nabla}\times\vec{E} + i\omega\vec{B} = 0, \ \vec{\nabla}\times\vec{H} - i\omega\vec{D} = \vec{J}$

(D) None of the above

24. In case of time varying field the instantaneous value of the Poynting vector is given by-

(A) $\vec{S} = \vec{E}\times\vec{H}$.

(B) $\vec{S} = \vec{H}\times\vec{B}$

(C) $\vec{S} = \vec{E}\times\vec{D}$

(D) None of the above

25. Wave equations governing electromagnetic fields $\vec{E}$ and $\vec{H}$ in free space are:

(A) $\nabla^2\vec{E} - \epsilon_0\mu_0\frac{\partial^2\vec{E}}{\partial t^2} = 0,$

$\nabla^2\vec{H} - \mu_0\epsilon_0\frac{\partial^2\vec{H}}{\partial t^2} = 0$

(B) $\nabla^2\vec{E} + \mu_0\epsilon_0\frac{\partial^2\vec{E}}{\partial t^2} = 0,$

$\nabla^2\vec{H} + \mu_0\epsilon_0\frac{\partial^2\vec{E}}{\partial t^2} = 0$

(C) $\nabla^2\vec{E} - \mu_0\epsilon_0\frac{\partial^2\vec{H}}{\partial t^2} = 0,$

$\nabla^2\vec{H} - \mu_0\epsilon_0\frac{\partial^2\vec{E}}{\partial t^2} = 0$

(D) None of these

26. Energy flow per unit area per unit time for a plane electromagnetic wave is given by:

(A) $\vec{S} = \vec{E}\times\vec{H}$.

(B) $\vec{S} = \frac{\vec{E}}{\vec{H}}$

(C) $\vec{K}\times\vec{H} = \vec{E}$

(D) None of the above

27. In case of propagation of plane electromagnetic waves in free space:

(A) Field vectors E and H are parallel to the direction of propagation of the wave (K).

(B) Vectors E, H and K form a set of orthogonal vectors.

(C) Vectors E and K are perpendicular to each other but parallel to H.

(D) None of the above.

28. In case of propagation of electromagnetic waves in non-conducting isotropic medium, wave impedance is defined as:

(A) $Z = \left|\frac{E}{H}\right|$

(B) $Z = \left|\frac{H}{E}\right|$

(C) $Z = E \times H$

(D) None of the above

29. In case of plane electromagnetic wave propagation in Anisotropic non-conducting medium Fresnel's law for Phase velocity is:

(A) $\frac{\cos^2\alpha}{v_x^2-v^2} + \frac{\cos^2\beta}{v_y^2-v^2} + \frac{\cos^2\gamma}{v_z^2-v^2} = 0$

(B) $\frac{\sin^2\alpha}{v^2-v_x^2} + \frac{\cos^2\beta}{v_y^2-v^2} + \frac{\sin^2\gamma}{v_z^2-v^2} = 0$

(C) $\frac{\cos^2\alpha}{v_x^2-v^2} + \frac{\sin^2\beta}{v_y^2-v^2} + \frac{\sin^2\gamma}{v_z^2-v^2} = 0$

(D) None of the above

30. In case of Reflection and Refraction of Electromagnetic waves at the interface of non-conducting media, which statement is true?

(A) Incident, reflected and refracted waves all have different frequency.

(B) Incident, reflected and refracted waves all have the same frequency.

(C) Incident and refracted waves have same frequency, but refracted waves have different frequency.

(D) None of the above.

31. Fresnel's equations for non-conducting media when electric field vector E is perpendicular to the plane of incidence are

(A) $\left(\frac{E'_{01}}{E_{01}}\right)_1 = \frac{\sin(\theta_i-\theta_r)}{\sin(\theta_i+\theta_r)}$, $\left(\frac{E_{02}}{E_{01}}\right)_1 = \frac{2\cos\theta_i\sin\theta_r}{\sin(\theta_i+\theta_r)}$

(B) $\left(\frac{E'_{01}}{E_{01}}\right)_1 = \frac{\sin(\theta_i+\theta_r)}{\cos(\theta_i-\theta_r)}$, $\left(\frac{E_{02}}{E_{01}}\right)_1 = \frac{2\sin\theta_i}{\sin(\theta_i-\theta_r)}$

(C) $\left(\frac{E'_{01}}{E_{01}}\right)_1 = \frac{\sin(\theta_i-\theta_r)}{\cos(\theta_i+\theta_r)}$, $\left(\frac{E_{02}}{E_{01}}\right)_1 = \frac{2\cos\theta_i}{\sin(\theta_i-\theta_r)}$

(D) None of the above

32. Fresnel's equations for non-conducting media when $\vec{E}$ vector is parallel to the plane of incidence are

(A) $\left(\frac{E'_{01}}{E_{01}}\right)_{11} = \frac{\tan(\theta_i + \theta_r)}{\tan(\theta_i - \theta_r)}$,

$\left(\frac{E_{02}}{E_{01}}\right)_{11} = \frac{2\cos\theta_i \sin\theta_r}{\sin(\theta_i + \theta_r)\cos(\theta_i - \theta_r)}$

(B) $\left(\frac{E'_{01}}{E_{01}}\right)_{11} = \frac{\tan(\theta_i - \theta_r)}{\tan(\theta_i + \theta_r)}$,

$\left(\frac{E_{02}}{E_{01}}\right)_{11} = \frac{2\cos\theta_i \cos\theta_r}{\sin(\theta_i + \theta_r)\cos(\theta_i - \theta_r)}$

(C) $\left(\frac{E'_{01}}{E_{01}}\right)_{11} = \frac{\tan(\theta_i - \theta_r)}{\tan(\theta_i + \theta_r)}$,

$\left(\frac{E_{02}}{E_{01}}\right)_{11} = \frac{2\cos\theta_i \sin\theta_r}{\sin(\theta_i + \theta_r)\cos(\theta_i - \theta_r)}$

(D) None of the above

33. Cauchy's empirical equation expressing refractive index as a function of wavelength is given by:

(A) $n^2 = A + \frac{B}{\lambda^2} + \frac{C}{\lambda^4}$ •

(B) $n = n_0 + \frac{b}{\lambda - \lambda_0}$

(C) $n^2 = 1 + \frac{A\lambda^2}{\lambda^2 - \lambda_0}$

(D) None of the above

34. Hartmann's formula for normal dispersion is:

(A) $n^2 = A + \frac{B}{\lambda^2}$

(B) $n = n_0 + \frac{b}{\lambda - \lambda_0}$.

(C) $n^2 = 1 + A + \frac{A\lambda_0^2}{\lambda^2}$

(D) None of the above

35. The equations representing Thomson scattering formulae for differential and total scattering cross-sections are:

(A) $\sigma(\Omega) = r_0^2 \frac{1}{2}(1 + \cos^2\phi)$,

$\sigma_T = \frac{8}{3}\pi r_0^2$

(B) $\sigma(\Omega) = \frac{2r_0^2}{3}(1 + \cos^2\phi)$,

$\sigma_T = \frac{3}{8}\pi r_0^2$

(C) $\sigma(\Omega) = \frac{3}{4} r_0^2(1 + \sin^2\phi)$,

$\sigma_T = \frac{5}{7} r_0^2(1 + \tan^2\phi)$

(D) None of the above

36. Total scattering cross-section in Rayleigh scattering is given as:

(A) $\sigma_T = \frac{8}{3}\pi r_0^2 \left(\frac{\omega}{\omega_0}\right)^2$

(B) $\sigma_T = \frac{8}{3}\pi r_0^2 \left(\frac{\omega}{\omega_0}\right)^4$

(C) $\sigma_T = \frac{3}{8}\pi r_0^2 \left(\frac{\omega_0}{\omega}\right)^2$

(D) None of the above

37. Total scattering cross-section for Resonant scattering is given as:

(A) $\sigma_T = \frac{8}{3}\pi r_0^2 \left(\frac{\omega_0}{\omega}\right)^4$

(B) $\sigma_T = \frac{3}{8}\pi r_0^4 \left(\frac{\omega}{\omega_0}\right)^2$

(C) $\sigma_T = \frac{8}{3}\pi r_0^2 \left(\frac{\omega_0}{\omega}\right)^2$

(D) $\sigma_T = \frac{8\pi}{3} r_0^2$

38. In a conducting medium, H lags behind E by an angle ϕ, given by

(A) $\phi = \tan^{-1}\left(\frac{\epsilon}{\sigma\omega}\right)$

(B) $\phi = \frac{1}{2}\tan^{-1}\left(\frac{\epsilon}{\sigma\omega}\right)$

(C) $\phi = \tan^{-1}\left(\frac{\sigma}{\epsilon\omega}\right)$

(D) $\phi = \frac{1}{2}\tan^{-1}\left(\frac{\sigma}{\epsilon\omega}\right)$

39. For good conductors, skin depth δ is defined as-

(A) $\delta = \sqrt{\frac{2}{\mu\sigma\omega}}$

(B) $\delta = \frac{2}{\mu\sigma\omega}$

(C) $\delta = \sqrt{\frac{\mu}{2\sigma\omega}}$

(D) $\delta = \frac{\mu}{2\sigma\omega}$

40. Good conductors, are characterized by

(A) $\frac{\sigma}{\epsilon\omega} = 1$

(B) $\frac{\sigma}{\epsilon\omega} >> 1$,

(C) $\frac{\sigma}{\epsilon\omega} << 1$

(D) None of the above

1. A plane electromagnetic wave is travelling in an unbounded loss-less dielectric medium with relative permeability $\mu_r=1$ and relative permittivity $\epsilon_r=3$. Find the speed of wave?

(A) 1.21×10^8 m/s

(B) 1.73×10^8 m/s

(C) 1.52×10^7 m/s

(D) 1.39×10^7 m/s

42. In free space, the ratio of electrostatic and magnetic energy density is-

(A) 0.3

(B) 0.5

(C) 1.0 ·

(D) 1.3

43. Wave impedance of free space is-

(A) 276.6 Ω

(B) 376.6 Ω ʼ

(C) 476.6 Ω

(D) 576.6 Ω

44. Dimensions of Poynting vector, are same as that of-

(A) Power

(B) Energy

(C) Power/Area ,

(D) Energy/Area

45. SI unit of Poynting vector is-

(A) Watt

(B) Watt/m^2.

(C) Joule

(D) None of the above

46. When incident wave is un-polarised, the degree of Polarization of the scattered light is 1, only when –

(A) $\phi = 90°$

(B) $\phi = 60°$

(C) $\phi = 45°$

(D) $\phi = 0°$

47. In case of Rayleigh scattering, scattering is proportional to–

(A) $\frac{1}{\lambda}$

(B) $\frac{1}{\lambda^2}$

(C) $\frac{1}{\lambda^3}$

(D) $\frac{1}{\lambda^4}$.

48. In case of Thompson scattering, which of the following is not true?

(A) It depends on the frequency of incident radiation.

(B) It depends on the angle of scattering.

(C) It depends on the classical radius of electron.

(D) All of the above.

49. In normal dispersion, $\frac{dn}{d\lambda}$ is proportional to–

(A) λ

(B) $\frac{1}{\lambda}$.

(C) $\frac{1}{\lambda^2}$

(D) $\frac{1}{\lambda^3}$

50. Which quantity is common in the incident, reflected and refracted waves–

(A) Speed

(B) Frequency,

(C) Phase

(D) None of the above

51. A plane electromagnetic wave travelling in free space is incident normally on a glass plate of refractive index 4/3. If there is no absorption by glass, find it's reflectivity?

(A) 6%

(B) 4%

(C) 2%

(D) None of the above

52. Snell's law of refraction is

(A) $\frac{\sin\theta_i}{\sin\theta_r} = \frac{n_2}{n_1}$

(B) $\frac{\sin\theta_r}{\sin\theta_i} = \frac{n_2}{n_1}$

(C) $\frac{\sin\theta_i}{\sin\theta_r} = n_1 n_2$

(D) $\frac{\sin\theta_r}{\sin\theta_i} = n_1 n_2$

53. The tangential component of which quantity is always continuous at the boundary-

(A) $\vec{B}$

(B) $\vec{E}$

(C) $\vec{D}$

(D) $\vec{H}$

54. Normal component of which quantity is always continuous at the boundary-

(A) $\vec{D}$

(B) $\vec{E}$

(C) $\vec{B}$

(D) $\vec{H}$

55. In electromagnetic field tensor, $F_{\mu\nu}$ the value of F is

(A) O

(B) $-E$

(C) B

(D) B

56. In electromagnetic field tensor F the value of F is-

(A) iE

(B) iE_y/c

(C) iE_x/c

(D) o

57. The electromagnetic 4-potential A is defined as-

(A) $A_\mu = (i\vec{A}, \phi^2)$

(B) $A_\mu = (i\vec{A}, \phi)$

(C) $A_\mu = (\vec{A}, i\phi)$

(D) $A_\mu = \left(\vec{A}, \frac{i\phi}{c}\right)$

58. In Minkowski space, what is the angle of rotation, that gives the Lorentz transformation equation

(A) $\tan^{-1} ir$

(B) $\tan^{-1} r$

(C) $\tan^{-1} \beta$

(D) $\tan^{-1} i\beta$

59. For differential operator $\partial/\partial t'$, which transformation is true-

(A) $\frac{\partial}{\partial t'} = r\left(v\frac{\partial}{\partial x} + \frac{\partial}{\partial t}\right)$

(B) $\frac{\partial}{\partial t'} = r\left(v\frac{\partial}{\partial x} - \frac{\partial}{\partial t}\right)$

(C) $\frac{\partial}{\partial t'} = \frac{1}{r}\left(v\frac{\partial}{\partial x} + \frac{\partial}{\partial t}\right)$

(D) $\frac{\partial}{\partial t'} = \frac{1}{r}\left(v\frac{\partial}{\partial x} - \frac{\partial}{\partial t}\right)$

60. Which type of volume element is invariant under Lorentz transformation?

(A) 3-D volume .

(B) 4-D volume

(C) Both (A) and (B)

(D) None of the above

61. Which of the following is the transformation equation for the charge density

(A) $\rho' = r\rho$

(B) $\rho' = \frac{\rho}{r}$

(C) $\rho' = \rho$

(D) $\rho' = r^2\rho$

62. $\vec{D}, \vec{E}$ and $\vec{P}$ are related as

(A) $\vec{D} - \vec{P} = \epsilon_0\vec{E}$

(B) $\vec{D} = \vec{P} - \epsilon_0\vec{E}$

(C) $\vec{D} = \epsilon_0\vec{E} - \vec{P}$

(D) $\vec{E} = \epsilon_0\vec{D} + \vec{P}$

63. Lorentz transformation of Magnetic field B_z

(A) $B'_z = \frac{B_z + v/c^2 E_y}{\sqrt{1-\beta^2}}$

(B) $B'_z = \frac{B_z - v/c^2 E_y}{\sqrt{1-\beta^2}}$

(C) $B'_z = \frac{B_z + v/c E_y}{\sqrt{1-\beta^2}}$

(D) $B'_z = \frac{B_z - v/c E_y}{\sqrt{1-\beta^2}}$

64. Lorentz transformation of electric field E_z

(A) $E_z' = \frac{E_z + vB_y}{\sqrt{1-\beta^2}}$

(B) $E_z' = \frac{E_z - vB_y}{\sqrt{1-\beta^2}}$

(C) $E_z' = \frac{E_z + v/c\,B_y}{\sqrt{1-\beta^2}}$

(D) $E_z' = \frac{E_z - v/c\,B_y}{\sqrt{1-\beta^2}}$

65. Which is the correct relation-

(A) $\mathrm{div}\vec{B} = 0$ and $\mathrm{div}\vec{D} = \rho$

(B) $\mathrm{div}\vec{B} \neq 0$ and $\mathrm{div}\vec{D} = 0$

(C) Curl H=0 and $\mathrm{div}\vec{D} = 0$

(D) None of these

66. For a moving point charge, the Lienard-Wiechert vector potential is:

(A) $\bar{A}(r,t) = \frac{\mu_0}{4\pi} \frac{qc\bar{v}}{(rc - \bar{r}.\bar{v})}$

(B) $\bar{A}(\bar{r},t) = \frac{\mu_0}{4\pi} \frac{qc\bar{v}}{(rc + \bar{r}.\bar{v})}$

(C) $\bar{A}(\bar{r},t) = \frac{1}{4\pi\epsilon_0} \frac{qc\bar{v}}{(rc - \bar{r}.\bar{v})}$

(D) $\bar{A}(\bar{r},t) = \frac{1}{4\pi\epsilon_0} \frac{qc\bar{v}}{(rc + \bar{r}.\bar{v})}$

67. For a moving point charge, the Lienard-Wiechert Scaler potential is-

(A) $\phi(r,t) = \frac{1}{4\pi\epsilon_0} \frac{qc}{(rc - r.v)}$

(B) $\phi(\bar{r},t) = \frac{1}{4\pi\epsilon_0} \frac{qc}{(rc + r.v)}$

(C) $\phi(r,t) = q/r$

(D) None of the above

68. In Electrodynamics, the equation of continuity is-

(A) $\nabla.\bar{j} + \frac{\partial\rho}{\partial t} = 0$

(B) $\nabla.\bar{j} - \frac{\partial\rho}{\partial t} = 0$

(C) $\nabla\times\bar{j} \neq \frac{\partial\rho}{\partial t} = 0$

(D) $\nabla\times j - \frac{\partial\rho}{\partial t} = 0$

69. Maxwell electromagnetic equation are valid under all conditions except one, that is-

(A) They do not apply to non-isotropic media

(B) They do not apply to non-homogenous media

(C) They do not apply to the media which moves w.r. to system of co-ordinates

(D) They do not apply to non linear medium

70. Dimensions of the quantity $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ are same as that of-

(A) Momentum

(B) Energy·

(C) Speed

(D) Force

71. What will be - The Magnitude of Poynting vector at the surface of the sun. If power radiated by sun= 3.8×10^{26} watt, radius of the sun= 7×10^{8} m.

(A) 6.175×10^{7} watt/m^2

(B) 2.375×10^{2} watt/m^2

(C) Zero

(D) Infinite

72. A particle can produce radiation if-

(A) The particle is in rest

(B) The particle is accelerated ·

(C) The particle moves with constant velocity

(D) All of the above

73. Poynting theorem is Mathematical statement of conservation of-

(A) Momentum

(B) Charge

(C) Electromagnetic energy ·

(D) States

74. From the given equations, which one is not a Maxwell's electromagnetic field equation-

(A) $\nabla . B = 0$

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

(C) $\nabla . E = -\dot{B}$ ·

(D) $\nabla \times \vec{H} = J + \frac{\partial D}{\partial t}$

75. According to the special theory of relativity physical laws are the same in frames of reference which-

(A) moves at uniform velocity.

(B) moves in circular

(C) accelerate

(D) moves in ellipse