STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE : PH/MC/ER54

B.Sc. DEGREE EXAMINATION NOVEMBER 2009
BRANCH III - PHYSICS
FIFTH SEMESTER

REG. No._____

COURSE : MAJOR – CORE
PAPER : ELECTRODYNAMICS & RELATIVITY
TIME : 30 MINS. MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

1. The direction of the induced e.m.f of current is, such as to oppose the charge that produced it .This is also known as
   a) Faraday's law b) Lenz's law c) Laplace's law

2. The speed of propagation is (classical wave equation)
   a) $V = \sqrt{T/U}$ b) $V = T/U$ c) $V = C$

3. $\tilde{f}(z,t) = \tilde{A}\, e^{i(kz-wt)}$ is known as
   a) complex notation b) complex wave function c) complex amplitude

4. The energy per unit time, per unit area, transported by the field is called
   a) Poynting's theorem b) Vector c) Pointing vector

5. Reflection and transmission at normal incidence at (R+T) =
   a) 1 b) 1/2 c) 0.96

6. $\nabla \times E$ =
   a) $\partial D/\partial t$ b) $-\partial B/\partial t$ c) ρ

7. Einstein velocity addition rule, the velocities of the negative lines are now
   a) $\lambda\pm = \pm(\gamma\pm)\lambda_o$ b) $V = V+U/(1+V/C^2)$ c) $V\pm = V\pm U/(1 \pm UV/C^2)$

8. The complex polarization P is proportional to the complex field $\bar{E}$, and this suggests that we introduce a complex susceptibility $\overline{Xe}$, P =
   a) q^2/m b) $\varepsilon_o \overline{Xe}\ \bar{E}$ c) $X_o e^{-i\omega t}$

9. A Magnetic polarization 'M' results in a bound current J_b =
   a) $.\nabla \times M$ b) $\nabla \bullet P$ c) $\nabla \bullet \nabla$

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10. Accelerated frames are called
    a) Galilean frames b) inertial frames c) non-inertial frames

11. Lorentz's transformation equation, length contraction is given by
    a) $l_o = x_2' - x'_1$ b) $l = l_o \sqrt{1-v^2/c^2}$ c) $l = x_2 - x_1$

12. Einstein's mass-energy relation E = _____
    a) ma b) Wc^2 c) mc^2

13. Relationship between the total energy, the rest energy, and the momentum
    E^2 = _____
    a) mc^2 b) $m_o^2c^4 + p^2c^2$ c) m_oc^2

14. In Galilean transformation equation **x** = _____
    a) $x = x - vt$ b) $x = x$ c) $x = vt$

15. A Proper force analogous to proper velocity; which would be the derivative of momentum with respect to proper time $K^\mu = dp^\mu / dt$ is called.
    a) Cyclotron motion b) Minkowski force c) work energy theorem

II FILL IN THE BLANKS:

16. Michelson-Morley experiment a monochromatic source S falls on a semi silvered _____ glass plate P placed at an angle to the beam.
17. The time intervals measured by a clock at rest relative to the observer is called the _____
18. The velocity of an electromagnetic wave is equal to the velocity of _____
19. The incident reflected and transmitted wave vector from a plane is Called _____
20. The velocity of light in free space is _____

III STATE TRUE OR FALSE:

21. Faraday's law $\nabla \times B = \mu_o J$
22. Progagation in linear media $\nabla \bullet D = 0$
23. A wave is a disturbance of a continuous medium that propagated with a fixed shape at constant velocity.
24. Classical mechanics obeys the Principle of relativity.
25. Unaccelerated reference frames in uniform motion of translation relative to one antoher are called non-inertial frames.

IV ANSWER THE FOLLOWING:

26. What is Newtonian relativity?

27. Explain mass-energy equivalence.

28. Explain the Fresnel's equation.

29. Explain Poynting vector.

30. State Fleming right hand rule.

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SECTION – B

ANSWER ANY FIVE QUESTIONS: (5 x 5 = 25)

1. Calculate the rest energy of an electron in Joules and in eV. Rest mass of electron = 9.11×10^{-31} kg
2. What are eddy currents? Give their practical applications.
3. Discuss the propagation of monochromatic plane wave.
4. A particle with a proper lifetime of 1μs moves through the laboratory 2.7×10^{8} ms^{-1} (a) What is its lifetime as measured by observers in the laboratory? (b) What will be the distance traversed by it before disintegrating?
5. Derive the magnetic field of point charge in uniform motion.
6. Discuss how the e.m waves propagate through the linear medium.
7. Derive the work – energy theorem.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8. Describe Michelson – Morley experiment and explain the physical significance of negative results.
9. Derive the Lorentz's transformation equations. Show that this equations reduce to the Galilean transformation equation when $v << c$.
10. a) Give an account of Maxwell's equations with negative charge.
    b) Derive Maxwell's equations for electromagnetic waves.
11. Derive the conformation of longitudinal and transverse Doppler Effect.
12. a) Describe the energy and momentum in electro magnetic waves.
    b) State Faraday's law of electromagnetic induction. Obtain the expression for the magnitude of induced emf.

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