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 2008
BRANCH III - PHYSICS
FIFTH SEMESTER

REG. No._____

COURSE : **MAJOR – CORE**
PAPER : **ELECTRO DYNAMICS & 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. Ohm's Law is given by
   a) $\vec{J} = \sigma \vec{B}$ b) $\vec{J} = \sigma \vec{E}$ c) $\vec{J} = \sigma / \vec{E}$

2. $\nabla \times \vec{E} = -\partial \vec{B} / \partial t$ is the differential form of
   a) Coulomb's Law b) Lenz's Law c) Faraday's Law

3. The significance of $\nabla . \vec{B} = 0$ is
   a) existence of electric dipole
   b) non existence of magnetic monopole
   c) non existence of magnetic dipole

4. The refractive index of a medium is given by
   a) $\frac{1}{\sqrt{\in_\gamma \mu_\gamma}}$ b) $\sqrt{\mu_\gamma}$ c) $\in_\gamma \mu_\gamma$

5. If the electric field of an electromagnetic wave is given by $\vec{E} = E_o e^{i(Kx-wt)}\ \hat{j}$ then the magnetic field is given by
   a) $\frac{1}{C} E_o e^{i(Kx-wt)}\ \hat{j}$ b) $\frac{1}{C} E_o e^{i(Kx-wt)}\ \hat{i}$ c) $\frac{1}{C} E_o e^{i(Kx-wt)}\ \hat{k}$

6. The reflection coefficient for an electromagnetic wave at the surface of a non conducting medium is 0.62, then the transmission coefficient is
   a) 0.31 b) 0.38 c) 1.24

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7. Which one of the following is not a boundary condition for the electromagnetic wave at the interface of two linear media

a) $\in_1 E_{\|} = \in_2 E_{2\|}$ b) $B_1 \perp = B_2 \perp$ c) $\frac{1}{\mu_1} B_{1\|} = \frac{1}{\mu_2} B_{2\|}$

8. In a good conductor
   a) the electric field lags behind the magnetic field
   b) the magnetic field lags behind the electric field
   c) both electric and magnetic fields are in phase

9. Twin paradox is dealing with
   a) Length contraction b) mass variation c) time dilation

10. A world line is
    a) The trajectory of a particle on a space-time diagram
    b) Slope of a trajectory in a space-time diagram
    c) Intercept of a trajectory in a space-time diagram

11. By what percentage an object moving with a velocity o.6c will contract?
    a) 80% b) 60% c) 20%

12. Hyperbolic motion means
    a) classical motion of a particle
    b) motion of a particle under the influence of a constant force
    c) Relativistic motion of a particle

13. Accelerated frames are called
    a) non inertial frames b) classical frames c) inertial frames

14. The relativity of simultaneity is
    a) Two events are simultaneous in one non inertial frames
    b) Two events are not simultaneous in two inertial frames
    c) Two events are simultaneous in two non inertial frames

15. The half life of a neutron moving at a speed of 0.866C (Given T ½ at rest = 13min)
    a) 8 min b) 20 min c) 26 min

II FILL IN THE BLANKS:

16. $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ is a consequence of _____ law.

17. The coefficient of coupling is _____.

18. The ratio of reflected intensity to the incident intensity is _____.

19. In good conductors the electric and magnetic fields have a phase difference of _____.

20. Moving objects are _____ in mass.

III STATE TRUE OR FALSE:

21. Velocity of light is not constant in accelerated frames.

22. Electromagnetic induction is a consequence of law of conservation of energy.

23. The divergence of magnetic field is always zero.

24. The transmission coefficient is always less than one.

25. Michelson experiment proved the existence of ether.

IV ANSWER THE FOLLOWING:

26. State flux rule.

27. What is Poynting's theorem?

28. Define transmission coefficient.

29. What is twin paradox?

30. State the conservation law of relativistic momentum and energy.

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TIME : **2 ½ HOURS** MAX. MARKS : **70**

SECTION – B

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

1. Calculate the coefficient of self inductance of a coil of 1000 turns when a current of 2.5 amp produces a magnetic flux of 0.5 micro weber.

2. Deduce Neumann formula for mutual inductance and discuss the significance of it.

3. Comment on the conductivity of the following materials given
   a) $\sigma = 10^{-3} mho/m \quad \in_r = 2 \quad \mu_r = 3$ at $\omega = 1000$Hz

   b) $\sigma = 10^{5} mho/m \quad \in_r = 10 \quad \mu_r = 2$ at $\omega = 10$Hz.

4. A metre stick having a mass of 150 grams gets it reduced to 60cm due to relativistic speed. Find its new mass.

5. A sodium vapour lamp is moving $(\lambda = 589nm)$ towards an observer with a speed of 0.8c. Calculate the Doppler shift.

6. Discuss the Lorentz contraction of moving objects.

7. Show that magnetism is a relativistic phenomenon.

SECTION – C

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

8. Discuss the electromagnetic wave equation in one dimension and also discuss their polarisation.

9. Write the modified wave equation in conductors. How do these waves get reflected and transmitted from a conducting surface.

10. Obtain expressions for relativistic momentum and energy.

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11. i) Derive the Lorentz transformation equations in relativity. Show that for ordinary speed they reduce to Galilean transformation.
    ii) Explain the velocity addtion rule.

12. Derive the transformation equations for electromagnetic fields.

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