SUBJECT CODE : **PH/MC/ER54**

B.Sc. DEGREE EXAMINATION NOVEMBER 2007
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.   Unit of induced emf
        a) weber/sec^2 b) weber/sec   c) Newton-mt/sec

2.   Value of the coupling constant K is
        a) $|k| > 1$ b) $|k| \le 0$ c) $|k| \le 1$

3.   In free space

        a) $\nabla \cdot D = \rho$ b) $\nabla \cdot E = 0$ c) $\nabla \cdot D = -\dfrac{\partial B}{\partial t}$

4.   Wave equation in one dimension is
        a) $\dfrac{\partial^2 f}{\partial x^2} = \dfrac{\mu}{T}\dfrac{\partial^2 f}{\partial t^2}$ b) $\dfrac{\partial^2 f}{\partial x^2} = -\dfrac{\mu}{T}\dfrac{\partial^2 f}{\partial t^2}$ c) $\dfrac{\partial^2 f}{\partial x^2} = -\dfrac{\mu}{T^2}\dfrac{\partial^2 f}{\partial t^2}$

5.   The relation between velocity v of the em wave and μ the refractive index of the
        dielectric is

        a) $v = \dfrac{c}{\eta}$ b) $v = \dfrac{c^2}{\eta}$ c) $v^2 = \dfrac{c}{\eta^2}$

6.   The direction of the induced emf is given by
        a) Faraday's law   b) Laplace law   c) Lenz's law

7.   Which of the following is correct

        a) $\ell = \ell o \sqrt{\dfrac{1-c^2}{v^2}}$ b) $\ell = \ell o \sqrt{\dfrac{1-v^2}{c^2}}$ c) $\ell_o = \ell \sqrt{\dfrac{1-v^2}{c^2}}$

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8. Galiban Transformation equation, when the frame moves along positive X direction
   a) $x^1 = x - vt$
   b) $x = x^1 - vt$
   c) $x = vt - x^1$

9. Which of the following is correct

   a) $m = mo\left(1 - \dfrac{v^2}{c^2}\right)^{\frac{1}{2}}$
   b) $m = mo\left(1 - \dfrac{v^2}{c^2}\right)^{-\frac{1}{2}}$
   c) $m = m_o\left(1 - \dfrac{v^2}{c^2}\right)$

10. Space-time diagram has
    a) 4 real axes
    b) 3 real and imaginary axes
    c) 2 real of 2 imaginary axes

11. If a rod moves along the x-direction length contraction is observed along
    a) x-axis
    b) y-axis
    c) z-axis

12. Dimensions perpendiculars to velocity are
    a) contracted
    b) expanded
    c) not contracted

13. Zeroth component of Energy-momentum 4 vector is

    a) $P^o = \dfrac{E}{C}$
    b) $P^o = EC$
    c) $P^o = EC^2$

14. If a charge q moves with a velocity u in the frame S with electric field E, then the magnetic field is

    a) $B = \dfrac{\overline{U}.\overline{E}}{C^2}$
    b) $B = \dfrac{\overline{U} \times \overline{E}}{C^2}$
    c) $\dfrac{U \times E}{C.}$

15. Expression for the transverse Doppler effect is
    a) $v^1 = v\sqrt{1 - \beta^2}$
    b) $v = v^1\sqrt{1 - \beta^2}$
    c) $v = v^1\sqrt{1 + \beta^2}$

II FILL IN THE BLANKS:

16. The direction of the induced emf is such that it always _____ the change _____ for its production.

17. For plane waves fields are _____ over every plane _____ to the direction of propagation.

18. _____ _____ is a frame of reference in which Newton's first law holds good.

19. Doppler effect confirms relativistic _____ _____.

20. The projectory of a charged particle in a uniform magnetic field is _____ motion.

III   STATE WHETHER TRUE OR FALSE:

21.   Eddy currents do not produce loss of energy.

22.   EM field carry both energy and momentum.

23.   Sum of reflection co-efficient and transmission co-efficient is always less than 1.

24.   The two mirrors in Michelson Morley experimental setup one highly silvered on their front faces to get multiple internal reflections.

25.   The world line of a light wave for which U=C is a straight line making a 45° angle with axes.

IV   ANSWER THE FOLLOWING:

26.   Define Henry.

27.   What is meant by invariant interval.

28.   Write down Einstein Relation between momentum and energy.

29.   State the principle of equivalence.

30.   What is meant by monochromatic wave.

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

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

SECTION – B

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

1.   Calculate the co-efficient of self inductance of a case of 1000 turns when a current of 2.5amp produces a magnetic flux of 0.5 micro weber.

2.   Obtain the wave equation in one dimension.

3.   Calculate the energy density of the em field.

4.   Calculate the rest energy of an electron in joules and electron volts.

5.   Calculate the electric field of a uniformly moving point charge.

6.   Obtain the mass energy equivalence.

7.   Calculate the speed of the electron which has kinetic energy 1.02 MeV. Given mass of the electron is 0.51 MeV.

SECTION – C

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

8.   Derive Maxwells equations.

9.   Calculate the Reflection and transmission co-efficient when em wave is incident normally.

10.   a) Obtain Lorentz transformation equations.

      b) A rod has of length 1mt when the rod is in a satellite moving with the velocity 0.8C relative to laboratory. What is the length of the rod as determined by an observer i) in the satellite ii) in the laboratory.

11. a) Derive the relativistic formula for variation of mass with velocity.

   b) Calculate the kE of an e⁻ moving with a velocity of 0.98 times the velocity of light in the lab system.

12. Discuss about longitudinal and transverse Doppler effect. Show term relativistic theory there is no classical transverse effect.

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