Exam.Code:0474
Sub. Code: 3716

2021

M. Sc. (Physics) Third Semester

PHY-7001: Classical Electrodynamics – II

Time allowed: 3 Hours Max. Marks: 60

NOTE: *Attempt five questions in all, including Question No. IX (Unit-V) which is compulsory and selecting one question each from Unit I-IV.*

x-x-x

UNIT – I

I. a) Using the invariance of energy and momentum and the invariance of the scalar product of 4-vectors, obtain the expression for total energy of the first particle m_1 in the rest frame of decaying particle M. in the reaction $M \rightarrow m_1 + m_2$ (6)

b) Explain the terms:

i) Four-velocity

ii) Four acceleration

iii) Four-momentum (3x2)

II. a) Obtain the expression for threshold energy required for the reaction $m_1 + m_2 \rightarrow m_3 + m_4 + m_5$, using energy-momentum invariant principle. (6)

b) Write a note on Lorentz transformations, time-dilation and length contraction (2,2,2)

UNIT – II

III. a) Describe the motion of a non-relativist charged particle in a constant uniform magnetic field.

b) Describe the motion of relativistic charged panicle in the presence *of* a constant electric field. (6,6)

IV. a) Describe the motion of a non-relativistic charged particle in a slowly time-varying magnetic field. (6)

b) Explain the terms:-

i) Gradient drift

ii) Curvature drift (3,3)

UNIT – III

V. a) Starting from $\sum_{\nu=0}^{3} \frac{\partial F^{\mu\nu}}{\partial x^{\nu}} = -\frac{4\pi}{c} j^{\mu}$, obtain the two inhomogeneous set of Maxwell equations.

b) Define four vector. Show that J^{μ} is a four-vector. (6,6)

P.T.O.

VI. a) From principle of least action, obtain the equation of motion of a charged particle in an electromagnetic field. (6)

b) Starting from the 4-dimensional form of homogeneous Maxwell's equations $\sum_{\nu} \frac{\sum \partial F^{\mu\nu}}{\partial x^{\nu}} = 0$, obtain the wave equation for the field $A^{\wedge}$ in a vacuum in the four-dimensional form. (2x6)

UNIT – IV

VII. a) Write a note on Thomson Scattering. (6)

b) Obtain the expression for power radiated from a charged particle in a circular orbit. (2x6)

VIII. a) Discuss Rayleigh scattering.

b) Discuss the phenomena of absorbtion of electromagnetic radiation by a bound electron.

UNIT – V

IX. Answer the following:-

a) What are the two postulates of special theory of relativity

b) Write down the four Maxwell equations.

c) What are Lienard-Wiechert potentials?

d) What is the relation between power radiated in circular accelerator and in linear accelerator

e) What are the two invariants that can be constructed out of $F_{\mu\nu}$.

f) Explain term radiation reaction? When is it relevant? (6x2)

x-x-x