B. N. Bandodkar College of Science, Thane.
Department of Physics

T.Y.B.Sc: Physics: Paper-IV

Duration: 3 hrs Total Marks: 100

N.B. (1) Figures to the right indicate full marks.
(2) All questions are compulsory.
(3) Use of non programmable calculator is allowed.
(4) Symbols have their usual meaning unless stated otherwise.

Q.1] Attempt any two **20**

(i) Show that if the principle of conservation of linear momentum is to be true in all inertial frames then the mass of a particle moving with speed v is given by

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$, where m_0 is its rest mass.

(ii) State the postulates of special theory of relativity and Lorentz transformation equation for space – time coordinates. Using the same deduce the expression for length contraction

(iii) State the basic postulates of general theory of relativity .Explain the phenomenon of gravitational red shift of a spectral line.

Q.2] Attempt any two **20**

(i) State and explain Hubble` s law. What are the unites of Hubble `s constants?
Explain radiation background in the Universe.
Define units of, Measurement of distance, mass and time in cosmology.

(ii) State and explain cosmological principle and Weyl postulate for cosmological models ,write in brief about different cosmological models

(iii) Explain Bigbang hypothesis and relics of the Bigbang, Also formation of Helium

Q.3] **Attempt any two** **20**

a) Write down Laplace's equation in one dimension, two dimensions and three dimensions. Discuss the properties of solutions of Laplace's equations in three dimensions. Obtain average potential over a spherical surface of radius 'R' due to point charge 'q' outside the sphere.

b) What is Polarization? Obtain the expression for potential due to polarized object in terms of surface bound charge density and volume bound charge density.

c) What is Magnetisation? Obtain expression for magnetic vector potential (A), due to magnetized object; hence give the physical interpretation of bound currents.

Q.4] **Attempt any two** **20**

(i) Beginning from Maxwell's equations inside matter, obtain boundary conditions on field vectors.

(ii) Discuss reflection and transmission at normal incidence at the interface of two non conducting media and obtain the expression for reflection and transmission coefficients (R and T)

(iii) Discuss the frequency dependence of permitivity hence obtain Cauchy's formula.

Q.5] **(A)** **Any Three** **15**

(i) For what value of (u/c) will the relativistic mass of a particle exceeds its rest

(ii) Mass of a given fraction f?

(iii) A star is receding the Earth at a speed of 0.05c. Calculate the wavelength of a line of 6500A emitted by the star. Draw the inference from the shift. C = 3 X 10^8 m/s

(iv) Show that div B=0 (Hint: begin from Biot-Savart's Law)

(B) **Attempt any One** **3**

(i) What is twin paradox?

(ii) A long straight wire carrying uniform line charge' λ' is surrounded by rubber insulation out to radius 'a' find the electric displacement.

(C) **Attempt any One**

(i) Name different types of galaxies **2**

(ii) Find the total energy required to set up a uniform magnetic field of 1 Tesla in a cube of 10 cm sides.(μ=4π x10^{-7} A/m^2)

~*~*~*~*~*~*~