NKT/KS/17/5202

Bachelor of Science (B.Sc.) Semester–VI (C.B.S.) Examination

RELATIVITY, NUCLEAR PHYSICS AND BIO-PHYSICS

(Physics)

Paper–1

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) All questions are compulsory.

(2) Draw neat diagram wherever necessary.

EITHER

1. (A) What are the postulates of special theory of relativity ? Obtain Lorentz transformation equations. 5

(B) (i) Derive Einstein's equation of Mass-Energy equivalence. 3

(ii) A particle of mass 10^{-24} Kg is moving with a speed of 1.8×10^8 m/s. Calculate its relativistic mass. 2

OR

(C) Derive the expression for length contraction $L = L_o \sqrt{1 - v^2/c^2}$. 2½

(D) Explain the negative results of Michelson-Morley experiment. 2½

(E) The total energy of a particle is exactly twice its rest energy. Calculate its speed. 2½

(F) Derive the relation $E = \sqrt{p^2c^2 + m_o^{2c4}}$ using relativistic mass and momentum. 2½

EITHER

2. (A) Explain the principle and working of Wilson-Cloud chamber. 5

(B) (i) Derive the expression for length of drift tubes in a linear accelerator. 3

(ii) A linear accelerator containing 50 drift tubes is connected to the radio frequency oscillator of 10 KV, 10 MHz. Calculate the maximum energy acquired by proton accelerated through it. 2

OR

(C) Calculate the mass of deuterium nucleus if the binding energy per nucleon is 1 Me V. Given M_p = 1.00758 amu M_n = 1.00898 amu. 2½

(D) Explain the Nuclear fission on the basis of liquid drop model. 2½

(E) What is mass defect ? How is it related to binding energy ? 2½

(F) Explain the p-p cycle of nuclear fusion. 2½

EITHER

3. (A) Explain the Fermi theory of β-decay. 5

(B) (i) What is α-decay ? Explain the experimental determination of energy of α-particles. 3

(ii) Calculate the B.E. per nucleon of an α-particle if its mass is 4.001265 u, M_p = 1.007277 u M_n = 1.008666 u. 2

OR

(C) Obtain the Geiger-Nuttal law assuming the expression for transmission probability P_T. 2½

(D) Calculate the energy of gamma ray photon of wave length 4.5×10^{-13} m. 2½

(E) Draw the β-ray spectrum and mark the end-point energy on it. 2½

(F) Explain the construction of a magnetic spectrograph. 2½

EITHER

4. (A) What is electro-cardioscope ? Explain the working of an electro-cardioscope. 5

(B) (i) What is the principle of sonography ? Explain the working mechanism of ultrasound machine. 3

(ii) What are the different uses of sonography ? 2

OR

(C) What is EEG ? What are its uses ? 2½

(D) Distinguish between colorimeter and spectrophotometer. 2½

(E) If the absorbance of a solution is 0.225 calculate the percentage transmittance. 2½

(F) Explain the construction and working of pH meter. 2½

5. Attempt any **TEN** :

(i) What is time dilation ?

(ii) Show that a particle moving with velocity of light has zero rest mass.

(iii) Write down the Galilean transformation equations.

(iv) Define packing fraction.

(v) What are fission fragments ?

(vi) Name the components of a nuclear reactor.

(vii) State the properties of γ-rays.

(viii) What is tunnelling ?

(ix) Name any two radioactive elements.

(x) How are Bio-electric signals generated ?

(xi) What is the principle of centrifuge ?

(xii) If the transmittance is 0.2, find the absorbance. $10 \times 1 = 10$