



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PHYSICS
2025_2 EXAMINATIONS

COURSE CODE: PHY 303
COURSE TITLE: SPECIAL RELATIVITY
CREDIT UNIT: 2
TIME ALLOWED: (2 HRS)
INSTRUCTION: *Answer question 1 and any other two questions*

QUESTION 1

- (a) Define the term inertial frame of reference? **(5marks)**
- (b) State the Einstein's postulate of special theory of relativity **(10marks)**
- (c) What is the meaning of Doppler effect. **(5marks)**
- (d) Define the term four vector **(5marks)**
- (e) Explain Briefly what is special theory of relativity **(5marks)**

QUESTION 2

- (a) Define the term invariance in physics **(4marks)**
- (b) Using Newton's 2nd law of motion, show that the equation is invariant under Galilean transformation. **(9marks)**
- (c) If a rod travels with a speed $v = 0.8c$ along its length, how much does it shrink? **(7marks)**

QUESTION 3

- (a) Explain the term time dilation **(6marks)**
- (b) State the time dilation formula and explain the symbols **(5marks)**
- (c) At the time a spaceship moving with speed $v = 0.5c$ passes a space station located near mars, a radio signal is sent from the station to earth. This signal is received on earth 1,123s later. How long does the spaceship take to reach the earth according to the observers on earth? **(9marks)**

QUESTION 4

- (a) Explain the mass-energy equivalence **(4marks)**
- (b) Write clearly the Einstein's mass energy equation and explain the symbols **(6marks)**
- (c) Find the effective mass of a photon for
 - (i) $\lambda = 5,000\text{\AA}$ (X-ray region)
 - (ii) $\lambda = 0.1\text{nm}$ **(10marks)**

QUESTION 5

- (a) Explain the twin paradox **(6marks)**
- (b) Explain briefly the following terms (i) relativistic invariance **(3marks)**
 - (ii) Equivalence of mass and energy **(3marks)**
- (c) Show that $\vec{E} \cdot \vec{B}$ is relativistically invariant **(8marks)**