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) $\lambda = 5{,}000$Å(X- ray region)
(ii) $\lambda = 0.1nm$ **(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 $\overline{E} \cdot \overline{B}$ is relativistically invariant **(8marks)**