**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE AND APPLIED SCIENCE**

**2021_2 EXAMINATIONS**

**COURSE CODE:** **PHY303**

**COURSE TITLE:** **SPECIAL RELATIVITY**

**CREDIT UNIT:** **2**

**TIME ALLOWED:** **(2 HRS)**

**INSTRUCTION:** ***Answer question 1 and any other three questions***

**QUESTION 1**

(a) Highlight the logic behind ether hypothesis? (6 marks)

(b) Write the principle of interference. (2 marks)

(c) What do you understand by optical path? (3 marks)

(d) Calculate the time interval of the signal using Lorentz transformation when a spacecraft S is crossed by another spacecraft S', the captain of S' sends a signal that lasts for 1.25 (5marks)

(e) State Lorentz theorem. (2 marks)

(f) Is charge Lorentz invariant? (3 marks)

(g) Explain the concept of Length contraction (4 marks)

**QUESTION 2**

(a) State Galilean transformation equation (4 marks)

(b) What is the physical significance of the Galilean transformation equations? (3 marks)

(c) Differentiate between Galilean transformation and Lorentz transformation (5 marks)

(d) (i) Under what condition does Galilean transformation reduce to Lorentz transformation? (1.5mks)

(ii) What is Galilean invariance? (1.5mks)

**QUESTION 3**

(a) Write down Newton's second law of motion in terms of the X, Y, Z components (3 marks)

(b) State whether Newton's second law of motion is variant or invariant under Galilean transformation (6 marks)

(c) Consider an event with space time coordinates (t = 2.00s, X = 2.50 x $10^8$m) in an inertial frame of reference moving in the positive X direction with speed 2.70 x $10^8$m/s relative to S frame. Find the value of - gamma that will be needed to transform the coordinates between S and S' using c = 3 x $10^8$m/s (6 marks)

**QUESTION 4**

(a) Suppose that S & S' share the same origin i.e. t = t' = 0, x = x' = 0, using gamma as 2.294 x $10^8$, find x' when x = 2.50 x $10^8$ and t = 2.00 secs (6marks)

(b) State Lorentz transformation equations (5marks)

(c) List the meaning of the following: event, space-time interval (4 marks)

**QUESTION 5**

(a) List four characteristics of Lorentz transformation (2 marks)

(b) Write short notes on any three properties of Lorentz transformation (9 marks)

(c) State the Lorentz FitzGerald contraction equation and give the meaning (4 marks)