THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF TECHNOLOGY – LEVEL 05
FINAL EXAMINATION – 2011
MPJ5231 – NATURE OF SCIENCE
FOUR HOURS (ESSAY TYPE PAPER)
OPEN BOOK EXAMINATION (OBE)

Date: 20th March 2012 **Time: 0930 hr. – 1330 hr.**

The questions are grouped in following manner.

Section A:1-2
Section B: 3-7
Section C: 8-10

Please ensure that answers for questions in different sections are given on separate books. Mark your index number on each book & answer sheets

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Answer any six (6) questions only

SECTION A

(1). (i). State the Galilean Transformation equations.
(ii). What was the problem with Maxwell's laws of electromagnetism with regards to Galilean Transformation?
(iii). What did Lorentz notice with Maxwell's laws of electromagnetism and the new transformation he introduced, namely Lorentz Transformation?
(iv). What did Einstein postulate regarding the laws of physics?.
(v). What was the bold decision that Einstein took with regards to Maxwell's laws of electromagnetism and Newton's laws of mechanics?
(vi). Show that $x^2 + y^2 + z^2 - c^2 t^2$ is invariant under Lorentz Transformation (where 'c' is the velocity of light)
(vii). The two inertial frames of reference S and S', are such that S' is moving with velocity V along x – axis relative to frame S. The space-time coordinates of the two events as measured by frame S are

$x_1 = 4 \times 10^4$ m, $y_1 = z_1 = 0$m, $t_1 = 2 \times 10^{-4}$s
and $x_2 = 8 \times 10^4$ m, $y_2 = z_2 = 0$m, $t_2 = 1 \times 10^{-4}$s

(a). What must be the velocity of S' with respect to S if an observer in S' measure the two events occur simultaneously?
(b). What is the spatial separation of the two events as measured by S'?

P.T.O.

(2). (i). A man in a spaceship is travelling with velocity 0.8c relative to an observer on the earth. He fires a proton in the direction of travel at a velocity of 0.9c relative to the spaceship. Calculate the velocity of the proton relative to the observer on the earth using.
(a). Relativistic velocity transformation formula
(b). Galilean velocity transformation formula

(ii). Twin brothers T_1, T_2 are each 20 years old on earth (E), when T_2 sets off on a journey to a distant star S. T_2 moves with an uniform speed V for most of the journey and returns to earth E, by same route with the uniform speed V. When T_2 arrives on earth T_1 is 61 years old and T_2 is 29 years old .
(a). Find V/c and the distance to the star in light years.
(b) How long will T_2 live after the death of his twin brother T_1, assuming that the span of life is 70 years.

SECTION B

(3). (i). Compare and contrast the views of Inductivists and Hypothetico-Deductivists regarding the following
(a) Method of science (b). Hallmarks of science (c). Theoretical terms
(ii). Explain briefly the views of Empiricists and Rationalists regarding knowledge
(iii). What was the standpoint of David Hume regarding the problem of induction and causality?

(4). (i). What are the views of Logical Positivists regarding the following?
(a). Observations (b). Theories in science
(c). Verifiability of hypotheses
(ii). What was the critique of Karl Popper regarding the above mentioned views of Logical Positivists?

(5). (i). Explain briefly the views of Karl Popper regarding the following
(a). Demarcation of science from non-science
(b). Ad-hoc modification to theories
(c). How to measure the progress of science
(ii). What is the major drawback of Popper's method of falsification?

(6). (i). How does Thomas Kuhn employ the concepts 'Paradigm' and 'Scientific Community' to explain the following
(a). Normal science (b). Revolutions in science (c). Uniqueness of science
(iii). What is the relation between the old paradigm which is overthrown and the new paradigm which succeeds it during a revolution in science?
Explain using the revolution from Newtonian paradigm to Einstein's paradigm.

P.T.O.

(7). (i). Explain briefly the views of Paul Feyerabend regarding the uniqueness of science among other knowledge systems.

(ii). "Paul Feyerabend used the term "Anything goes' to explain his position regarding the methodology of science". How does Feyerabend defend this position using the case of Galileo with regards to the Copernican hypothesis on the motion of plants?

SECTION C

(8). Describe briefly the following critiques of modern science
(a). Feminist critique
(b). New left critique
(c). Critique by the commentators of Eastern cultures
Which of these three critiques of modern science do you consider to be the most radical?

(9). Compare and contract the approaches of 'Reductionism' and 'Holism' in solving the environmental problems. Give examples to justify your answers.

(10). Disease is said to be caused by the invasion of a pathogen (Bacteria, Virus, etc.) from the outside of the human body. Alternatively, it may be thought of as an imbalance in the human body. State the medical systems that follow the above two approaches respectively. Suggest a way of incorporating both approaches in the effective control of disease.

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