THE OPEN UNIVERSITY OF SRI LANAKA
BACHELOR OF TECHNOLOGY – LEVEL 05
FINAL EXAMINATION – 2008
MPJ5231 – NATURE OF SCIENCE
FOUR HOURS (ESSAY TYPE PAPER)
OPEN BOOK EXAMIANTON

062

Date: 06th April 2009 **Time: 1330 hr. – 1730hr.**

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.

Please answer a total of 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 $x^2 + y^2 + z^2 - c^2t^2$ is invariant under Lorentz Transformation.
   (ie. $x'^2 + y'^2 + z'^2 - c^2t'^2 = x^2 + y^2 + z^2 - c^2t^2$)
   (vii). The two inertial frames of reference S and S′ are such that S′ moves with uniform velocity V along x-axis relative to frame S. The space-time coordinates of the two events as measured by frame S are
   $x_1 = 6 \times 10^4$m, $y_1 = z_1 = 0$ m, $t_1 = 1 \times 10^{-4}$ s
   $x_2 = 12 \times 10^4$m, $y_2 = z_2 = 0$ m, $t_2 = 2 \times 10^{-4}$s
   What must be the velocity of S′ w.r.t. S, if an observer in S′ measure the two events occur simultaneously?

2. (i). Derive the Lorentz velocity transformation equations for the x, y, z directions.

(ii). F_1, F_2 and F_3 are three inertial frames. The velocities of F_2 relative to F_1 and F_3 relative to F_2 are (v, o, o) and (o, v′, o) respectively. Using the Lorentz velocity transformation, show that the velocity of F_3 relative to F_1 is $\left(v, v'\sqrt{1-\frac{v^2}{c^2}}, o\right)$.

(iii). Explain briefly the twin paradox.

SECTION B

3. (i). What was the critique of Francis Bacon regarding the scholars of his era (17^{th} century A.D)?

(ii). Explain briefly the following

(a). Method of Inductivism (b). Empiricism

(c). Method of Hypothetico – Deductivism (d). Rationalism

(iii). Compare and contrast the views of Inductivists and Hypothesists regarding 'theoretical terms'.

(iv). (a). What was the problem raised by David Hume regarding the principle of induction?

(b). Explain briefly as to how the above problem raised by Hume affects causality (cause and effect relationship). Give an example from science to justify your answer.

4.(i). Compare and contrast the views of Logical Positivists and Karl Popper regarding the following

(a). observations (b). theories (c). the methodology of science

(ii). (a) Why did Popper reject ad-hoc modifications to theories?

(b). Give two examples of ad-hoc modifications to theories from the history of science

(iii). How did Karl Popper explain the progress of science using the criterion he introduced namely 'Verisimilitude'?

5. Give a brief critique of the following views of Karl Popper citing one example each from the history of science to justify your answer.

(a). The method of science is the falsification of theories.

(b). The growth of science shows continuity in the sense that the old theory becomes a limiting case of the succeeding theory.

(c). When a fundamental theory change (shift) takes place, the meaning of the key terms remain invariant.

6. (i). State five (05) important roles played by paradigms in the practice of science.
   (ii). Explain briefly the role of 'scientific community' during a revolutionary period in science, according to Thomas Kuhn.
   (iii). "Two successive paradigms are incommensurable".
   Explain the above claim by Thomas Kuhn taking into consideration the two successive paradigms namely, Newtonian and Einsteinian.

7. (i). Compare and contrast the views of Thomas Kuhn and Paul Feyerabend regarding the 'uniqueness of science' among other areas of knowledge.
   (ii). Explain briefly how Paul Feyerabend advocates to give up the very idea of the scientific method. (ie. Methodological anarchism) by rejecting the methodological norms like 'consistency condition' and 'correspondence condition' accepted by most of his contemporary philosophers.

SECTION C

8. In many modern western medical practices, only the material body is treated. There are many diseases which also have a psychological cause. Describe a process by which both causes could be considered and treated.

9. Why would you consider a critique of modern science by eastern cultures to be radical, say more than a New left critique of the same?

10. Why would you consider the history of western scientific growth to be important? Explain by an example.

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