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THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF TECHNOLOGY – LEVEL 05
FINAL EXAMINATION – 2010
MPJ5231 – NATURE OF SCIENCE
FOUR HOURS (ESSAY TYPE PAPER)
OPEN BOOK EXAMINATION (OBT)

Date: 29th March 2011 **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 Einstein's principle of relativity.
(ii). State the Galilean transformation equations for x, y, z, and t.
(iii). What was the problem with Maxwell's Laws of Electromagnetism under Galilean Transformation?
(iv). State the Lorentz Transformation equations for x, y, z, and t.
(v). Two events P and Q occur simultaneously in a frame F and 300,000 km apart on its x-axis. Find the velocity of the frame F′ moving parallel to the x-axis of F, in which the event P precedes the event Q by 10- seconds. (velocity of light (c) = 300,000 kms^{-1}).

(2). (i). State the Lorentz-Fitzgerald contraction hypothesis.
(ii). For what reason was the above hypothesis put forward?
(iii). Derive the Lorentz Relativistic Velocity Transformation formulae for x and y directions.
(iv). F_1, F_2 and F_3 are three inertial frames of reference.
The mapping $F_1 \rightarrow F_2$ and $F_2 \rightarrow F_3$ are special Lorentz Transformations in x and y directions respectively, such that the velocity of F_2 relative to F_1 is (v, 0, 0) and the velocity of F_3 relative to F_2 is (0, v′, 0).
Show that the velocity of F_3 relative to F_1 is $\left[v,\ v'\sqrt{1-\frac{v^2}{c^2}}, 0 \right]$.

SECTION B

(3). (i). Why can we classify Francis Bacon as an Empiricist?
(ii). Why can we classify Galileo as a Rationalist?
(iii). Explain briefly the method of science advocated by Francis Bacon.
(iv). What was the critique of David Hume regarding the above mentioned method of science?
(v). Explain briefly as to how the above problem raised by David 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 in science (b). Theories (c). Methodology of science
(ii). How did Popper demarcate scientific theories from non-scientific theories?
(iii). Why did Popper reject ad-hoc modifications to theories?

(5). (i). Explain briefly the concept put forward by Karl Popper to explain the progress of science.
(ii). What was the main drawback of Popper's method of falsification?

(6). (i). Explain briefly the concept of 'Paradigm' introduced by Thomas Kuhn.
(ii). How did Thomas Kuhn utilize his concept 'Paradigm' to explain the following
(a). Normal science (b). Scientific Revolutions (c). Incommensurability

(7). (i). Compare and contrast the views of Thomas Kuhn and Paul Feyerabend regarding the following
(a). Paradigm and the uniqueness of science
(b). Incommensurability and Relativism of science
(ii). How did Kuhn justify the progress of science after the revolutions in science?

SECTION C

(8). Write a brief essay on the un-sustainability of modern science and technology and whether alternative knowledge systems could make significant contributions towards sustainable sciences and technologies (about 200 words).

(9). (i). What do you understand by the term 'reductionism' in modern science?
Give an example from the history of modern science.
(ii). Explain briefly the following critiques of modern science
(a). Feminist critiques (b). Third world critiques

(10). Briefly describe the link between science and culture, giving two examples which show such a linkage.

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