



Exam Code: F4105

Calculators: *All programmable calculators should be cleared.*

ONE HOUR 15 MINS

UNIVERSITY OF PUERTO RICO, MAYAGÜEZ CAMPUS

MODERN PHYSICS MIDTERM

**SESSION 2005/2006
FIRST SEMESTER**

For candidates taking:
Theoretical Physics
Physical Sciences

Name:
Student Number:

**DATE: 14th Oct 2005
TIME: 10:45-11:30**

Answer all questions. 10 marks available per question.

SECTION A

- 1 A rod lies parallel to the x-axis of reference frame S, moving along this axis at a speed of $0.6c$. It has a rest length of 1.0m . What is its measured length in frame S?
- 2 A newborn cat is put aboard a ship leaving Earth for the Andromeda Galaxy at speed $v=0.6c$. The cat dies on the ship at age 7 years. How far from the Earth in the Earth's frame is the ship when the cat dies? If the ship sends a radio message sadly telling of the cat's passing, when will it get to the Earth by Earth time?
- 3 Draw a Minkowski spacetime diagram of the Moon orbiting the Earth. Take a lot of care when drawing this diagram to make it very clear and well labeled.
- 4 Does a blackbody have to be black? And is something black necessarily a blackbody? Explain your answers carefully.
- 5 Paint your favourite professor completely black, then estimate the power of the thermal radiation emitted from him/her. Compare your answer to a typical 60W lightbulb. Is your professor rather bright, or pretty dim? (Stefan's constant = $5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$).