

**CORK INSTITUTE OF TECHNOLOGY  
INSTITIUID TEICNEOLAIOCHTA CHORCAI**

**Autumn Examinations 2008/09**

<b>Module Title:</b> Introduction to Physics (CA)
---

**Module Code:**          **PHYS 6011**

**School:**                  Science

**Programme Title:**

Bachelor of Science Applied Physics and Instrumentation – Stage 1  
Higher Certificate in Science Industrial Measurement and Control – Stage 1  
Bachelor of Science Applied Biosciences – Stage 1  
Bachelor of Science Biomedical Science – Stage 1

**Programme Code:**    **SPHYS\_7\_Y1**  
                              **SIMCT\_6\_Y1**  
                              **SBIOS\_7\_Y1**  
                              **SBMSC\_7\_Y1**

**External Examiner(s):**      Mr. J. McComb, Dr. V. Casey

**Internal Examiner(s):**      Ms C. Devaney  
  Dr A. O'Connor  
  Dr M. Woods

**Instructions:** Answer any **FOUR** questions. All questions carry equal marks.

**Duration:**          2 Hours

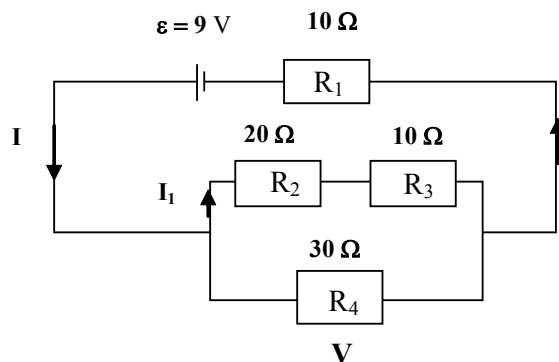
**Sitting:**                Autumn 2009

**Requirements for this examination:**      Log tables.

<p><b>Note to Candidates:</b> Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper. If in doubt please contact an Invigilator.</p>
--

Continued Over

1. (a) An object of height 5.0 cm is placed 12.0 cm in front of a biconvex converging lens of focal length 4.0 cm.
  - (i) State the *Lens Equation* and the equations for the *image magnification*.
  - (ii) Determine the *position* of the image, the *height* of the image, the *orientation* of the image [erect/inverted] and its *nature* [real/virtual]. (15 marks)
  
- (b) Describe how the *human eye* produces an image of an object. What is the role of the *pupil* and the *retina*? How is the operation of the eye affected by the ciliary muscle in viewing near and distant objects? How does this differ to the operation of a glass lens? (10 marks)
  
- 2 (a) State *Ohm's Law*. (2 marks)
  
- (b) For the following circuit, calculate the:
  - (i) *resistance* ( $R_p$ ) of the parallel combination of  $R_1$ ,  $R_2$  and  $R_3$ . (4 marks)
  - (ii) *total resistance*  $R_{eq}$  for the circuit. (2 marks)
  - (iii) *total current* ( $I$ ) drawn from the battery. (3 marks)
  - (iv) *voltage* ( $V$ ) across resistor  $R_4$  ( $30\ \Omega$ ) (4 marks)
  - (v) *current* ( $I_1$ ) in resistor  $R_2$  ( $20\ \Omega$ ) (5 marks)
  - (vi) *power* ( $P$ ) dissipated in resistor  $R_2$ . (5 marks)



- 3 (a) (i) Define *Specific Heat Capacity*.  
 (ii) How much heat energy (Q) does a fridge have to remove from a mass of 500 g of water at 22 °C to make ice at –5 °C? The specific heat capacity of water is 4186 J kg<sup>-1</sup> K<sup>-1</sup>; the specific heat capacity of ice is 2100 J kg<sup>-1</sup> K<sup>-1</sup>; and the specific latent heat of fusion for water is 3.33 x 10<sup>5</sup> Jkg<sup>-1</sup> (13 marks)
- (b) A sleeping bag has an area of 2.5 m<sup>2</sup> and is insulated by 6.0 cm thickness of goose down. The outside temperature is -44 °C and the inside temperature is 36 °C.
- (c) (i) State the *thermal conductivity equation*.  
 (ii) If the person is releasing heat at a rate of 39 Joules per second (39W), calculate the *thermal conductivity constant, k* for goose down. (12 marks)
- 4 (a) What is meant by (i) *Longitudinal Waves*; (ii) *Transverse Waves*.  
 Give ONE example of a *physical property* for each of these types of waves. (6 marks)
- (b) State the *wave equation*. Hence determine the *frequency* of the red Cadmium emission line of wavelength  $\lambda_R = 644$  nm. The velocity of light in a vacuum,  $c = 3.0 \times 10^8$  ms<sup>-1</sup>. (7 marks)
- (c) Explain what is meant by the *intensity* of a wave and state its *units*. (3 marks)
- (d) Determine the *intensity* of a spherical sound wave emitted from a speaker at a distance of 25 m from the speaker when the power of the speaker is 40 W. (5 marks)
- (e) Plot a graph of the displacement versus distance for a water wave and indicate the *amplitude (a)* and *wavelength ( $\lambda$ )* on the plot. (4 marks)

5. Answer section (a) and any THREE of sections (b) to (e).

- (a) An object is embedded an apparent depth of 0.8 cm in a block of ice of refractive index 1.31. The light enters the block with an angle of incidence of  $30^\circ$ .

Calculate:

- (i) the *angle of refraction* in the ice [v];  
(ii) the *real depth* of the embedded object in the ice. (7 marks)

- (b) Write brief notes on **either** *thermal radiation* **or** *thermal convection*. (6 marks)

- (c) Calculate the *resistance* ( $R$ ) of a copper wire of length 2.5m and diameter 0.74 mm. [The resistivity  $\rho$  of copper is  $1.7 \times 10^{-8} \Omega\text{m}$ ]. (6 marks)

- (d) An aluminium rod measures 2.0 m at  $10^\circ\text{C}$ . Find its length when the temperature rises to  $135^\circ\text{C}$ . The linear *expansion coefficient* (*expansivity*) of aluminium,  $\alpha = 2.4 \times 10^{-5} \text{ K}^{-1}$  (6 marks)

- (e) Explain the optical terms *critical angle* and *total internal reflection*. Hence briefly explain how these relate to the operation of an *optical fibre*. (6 marks)

--- END---