



AFRICA NAZARENE UNIVERSITY

CENTRE: RONGAI
DEPARTMENT: COMPUTER SCIENCE
UNIT TITLE: PRINCIPLES OF PHYSICS
UNIT CODE: PHY 101
LECTURER: J. THAIRU
TRIMESTER: 2ND TRIMESTER 2014/2015
DATE: 16TH APRIL, 2015
TIME: 9.00 AM – 12.00 PM

Instructions:

1. Answer question **ONE (Compulsory)** and any other **TWO** questions.
2. Take; $g = 10\text{ms}^{-2}$, Specific heat capacity of steel and oil are $480\text{Jkg}^{-1}\text{K}^{-1}$ and $1600\text{Jkg}^{-1}\text{K}^{-1}$ respectively.
3. Write all your answers in the answer booklet provided.
4. Time: Three hours.

Question One: (36 Marks)

- a. Define the following terms
- (i) Momentum (2 Marks)
 - (ii) Inertia (2 Marks)
- b. An object is dropped from a height of 45m. Neglecting air resistance, calculate;
- (i) The time taken to reach the ground (3 Marks)
 - (ii) Its maximum velocity. (3 Marks)
- c. State the principle of conservation of energy. (2 Marks)
- d. With the aid of diagrams, distinguish between diffraction and interference of light. (6 Marks)
- e. Derive the formulae for resistivity of a conductor. (3 Marks)
- f. The following table shows the result of an experiment performed by a Physics student to investigate how steel wire behaves with increasing load:

Force (N)	0	2.0	4.0	4.5	5.0	5.5
Extension (mm)	0	0.10	0.20	0.24	0.30	0.40

Plot the force-extension graph and calculate the work done in stretching the specimen up to:

- (i) The proportionality limit
- (ii) Fracture (15 Marks)

Question Two: (12 Marks)

- a. An aircraft of mass 2.0×10^4 kg lands on an aircraft-carrier deck with a horizontal velocity of 90ms^{-1} . If it is brought to rest in a distance of 100m, calculate the average retarding force acting on the plane. (4 Marks)
- b. With the aid of diagrams, derive an expression for the resistance of three conductors connected in:
- (i) in series (4 Marks)
 - (ii) in parallel (4 Marks)

Question Three: (12 Marks)

- a. A steel component of mass 0.8kg is to be hardened by being heated to 1050⁰c and then plunged into an oil bath. The oil is contained in a steel tank of mass 2kg and its initial temperature is 20⁰c. Assuming that there are no heat losses, calculate the minimum mass of oil required in the tank if the final oil temperature must not exceed 50⁰c. (4 Marks)
- b. (i) Calculate the charge stored in a 3.0 μ F and a 6.0 μ F capacitor joined in series and then connected across the terminal of an 18 V battery. (4 Marks)
- (ii) What is the PD across each capacitor in b (i) above. (4 Marks)

Question Four: (12 Marks)

- a. Explain the circumstances under which total reflection occurs. (2 Marks)
- b. State four properties of electromagnetic waves. (2 Marks)
- c. A force of 15N is applied to a body of mass 3.0kg, initially at rest on a smooth horizontal surface, for a time of 3.0s. calculate;
- (i) the final velocity
- (ii) The distance travelled
- (iii) The work done
- (iv) The final kinetic energy of the body (8 Marks)

Question Five: (12 Marks)

- a. Show that for curved mirrors, the magnification M is given by $M = \frac{v}{f} - 1$ (2 Marks)
- b. (i) Define the term critical angle in relation to refraction of light. (2 Marks)
- (ii) Calculate the speed of light in diamond given that the refractive index of diamond is 2.42. (4 Marks)
- c. A battery of e.m.f. 1.5V has a terminal p.d. of 1.25V when a resistor of 25 Ω is joined to it. Calculate the current flowing, the internal resistance r and the terminal p.d. when a resistor of 10 Ω replaces the 25 Ω resistor. (4 Marks)

