



**EAST AFRICAN SCHOOL OF AVIATION EXAMINATION**  
**END TERM II EXAMS**

**DIPLOMA IN AERONAUTICAL ENGINEERING TELECOMMUNICATION**

**PHYSICAL SCIENCE, MECHANICAL SCIENCE & ELECTRICAL PRINCIPLES**

**STREAM: Y1 (Telecommunication)**

**Duration: 3 HRS**

**DATE: 11.4.2017**

**TIME: 0900 – 1200 HRS**

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**INSTRUCTION TO CANDIDATES**

1. *This paper consists of **FOUR (4)** pages*
2. *You should have the following for this examination:*  
*Mathematical tables/ Electronic calculator.*
3. *Answer **ALL** questions in **section 1**, **ANY 2** questions in **section 2** and **ALL** in **section 3**.*

**SECTION1: PHYSICAL SCIENCE**

Answer **ALL** questions from this section

1. a) State Newton's law of cooling. **(2 marks)**
- b) Explain three modes of heat transfer. **(3 marks)**
- c) Distinguish between the following terms.
- i) Adiabatic process and isothermal process
  - ii) Closed system and open system
  - iii) Isochoric process and isobaric process
  - iv) Boundary and surrounding of a system. **(8 marks)**
- d) A quantity of air is compressed in a cylinder to one-fifth of its original volume. The pressure is initially 13 bar and the temperature during compression rises from 18°C to 130°C.
- i) Calculate the pressure of the compressed air.
  - ii) If this air is allowed to expand at constant temperature to its original volume, calculate the new pressure. **(5 marks)**
- e) State **TWO** conditions for simple harmonic motion. **(2 marks)**

**SECTION 2: MECHANICAL SCIENCE**

Answer any **TWO** questions from this section

2. a) Explain any **FOUR** non-destructive testing methods used in materials. **(4 marks)**
- b) Explain the following terms as used in materials
- i. Malleability
  - ii. Hardness
  - iii. Corrosion
  - iv. Elasticity **(8 marks)**
- c) An object of mass 2 kg slides from rest down a smooth plane inclined at 30° to the horizontal. What will be its velocity when it has slid 2 m down the plane. **(4 marks)**
- d) The resistance to motion of a car is proportional to the square of its speed. The car has a mass of 1000 kg and can maintain a steady speed of 30 m/s when travelling up a hill inclined at  $\arcsin\frac{1}{20}$  to the horizontal with the engine working at 60 kW. Find the acceleration of the car when it is travelling down the same hill with the engine working at 4 kW at the instant when the speed is 20 m/s. **(4 marks)**

3. a) Define the following terms as used in fluid flow.
- i) Laminar flow
  - ii) Turbulent flow
  - iii) Pressure head
  - iv) Discharge
- (4 marks)**
- b) Name THREE instruments used to measure fluid pressure. **(3 marks)**
- c) Water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through the pipe is 35 litres/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm<sup>2</sup>, find the intensity of pressure at section 2. **(13 marks)**
4. a) State the first law of thermodynamics. **(2 marks)**
- b) An unmarked thermometer is put in ice-water mixture (at 0<sup>0</sup> C) and boiling water. The length of liquid column is 2.6 cm and 8.4 cm respectively. If the length of the liquid column becomes 12 cm when put into hot oil, determine the temperature of the hot oil. **(4 marks)**
- c) Define the following terms as applied in heat.
- i) Heat capacity
  - ii) Specific latent heat of fusion
  - iii) Isolated system.
- (6 marks)**
- d) Show that  $c_p - c_v = R$  where  $c_p$  - specific heat capacity at constant pressure,  $c_v$  - specific heat capacity at constant volume, R- specific gas constant **(8 marks)**

### **SECTION 3: ELECTRICAL PRINCIPLES**

Answer **ALL** questions from this section

5. a) Define the following terms.
- (i) Static electricity
  - (ii) Electric intensity
  - (iii) Electric displacement
  - (iv) Potential difference
- (4 marks)**
- b) State the three laws of electrostatics **(3 marks)**
- c) Three point charges of +16 X 10<sup>-9</sup>C, +64 X 10<sup>-9</sup>C and -48 X 10<sup>-9</sup>C, are placed at the corners of a square of 4 cm sides. Calculate the electric field at the fourth corner. **(7 marks)**

d) Three concentric spheres of radii 4, 6 and 8 cm have charges of +8, -6 and +4 $\mu\text{C}$  respectively. What are the potentials and field strengths at points 2, 5, 7 and 10 cm from the center?  
**(6 marks)**

6. a) Define the following as used in S.I units

- i) Mole. **(1 mark)**
- ii) Ampere. **(1 mark)**
- iii) Meter. **(1 mark)**
- iv) Candela. **(1 mark)**
- v) Unit. **(1 mark)**

b) Using MKSA system of unit derives the dimensional equations of:-

- i) e.m.f; **(2 marks)**
- ii) Magnetic flux density; **(2 marks)**
- iii) Capacitance. **(2 marks)**

c) A gas bubbles from an explosion under water oscillates with a period and proportional to  $P^a d^b E^c$  where P is the hydrostatic pressure, d is the density of water and E is the energy of explosion. Find the values of a, b and c. **(9 marks)**