

**CHRISTIAN SOCIAL SERVICES COMMISSION (CSSC)  
NORTHERN ZONE JOINT EXAMINATION SYNDICATE (NZ-JES)**



**FORM SIX PRE – NATIONAL EXAMINATION 2026**

**131/1**

**PHYSICS 1**

**Time: 3:00 Hours**

**Wednesday 4<sup>th</sup> March, 2026 a.m.**

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**Instructions.**

1. This paper consists of section **A** and **B** with a total of **ten (10)** questions.
2. Answer **all** questions from section **A** and **two (2)** questions from section **B**.
3. Marks for each questions or part thereof are indicated.
4. Mathematical tables and **non-programmable** calculators may be used.
5. Cellular phones are **not allowed** in the examination room.
6. The following information may be useful.
  - (a) Acceleration due to gravity,  $g = 9.8 \text{ m/s}^2$ .
  - (b) Mass of the earth,  $M_e = 6.0 \times 10^{24} \text{ kg}$ .
  - (c) Universal gravitational constant,  $G = 6.67 \times 10^{-11} \text{ NM}^2 \text{ kg}^2$ .
  - (d) Stefan's constant  $\sigma = 5.7 \times 10^{-8} \text{ Wm}^{-2} \text{ K}^{-4}$ .
  - (e) Pie,  $\pi = 3.14$
  - (f) Density of water,  $P_w 1000 \text{ kg m}^{-3}$ .
  - (g) Latent heat of vaporization of water,  $l = 2256 \text{ Jg}^{-1}$
  - (h) Atmospheric pressure,  $P = 1.013 \times 10^5 \text{ Pa}$ .
  - (i) Radius of earth,  $R_e = 6370 \text{ km}$

## SECTION A (70 Marks)

Answer **all** questions in this section.

1. (a) (i) State the law of principle of homogeneity of dimension. **(1mark)**  
(ii) The force exerted between the fluid in motion and layers of a fluid 'F' is the function of the radius of a spherical body,  $r$ , coefficient of viscosity,  $\Omega$  and the velocity of a spherical body. From a knowledge of dimensions, derive the formula of viscous fore of a fluid. **(4 marks)**
- (b) (i) What do you understand by a term absolute error? **(1 mark)**  
(ii) In an experiment to determine the value of Young's modulus of elasticity of steel, a wire of length 325cm (measured by a metre scale of least count 0.1cm) is loaded by a mass of 2kg and it is found that it stretches by 0.227cm (measured by a micrometer having least count 0.001cm). The diameter of the wire as measured by a screw gauge (least count = 0.001cm) is found to be 0.043cm. Calculate the maximum permissible error. **(4 marks)**
2. (a) Rain falls vertically onto a plane roof, 1.5m square, which is inclined to the horizontal at an angle of  $30^\circ$ . The rain drops strike the roof with a vertical velocity of  $3\text{ m/s}$  and a volume of  $2.5 \times 10^{-2}\text{ m}^3$  of water is collected from the roof in one minute. Assuming that the conditions are steady and that the velocity of the raindrops after impact is zero, Calculate;  
(i) The vertical force exerted on the roof by the impact of the falling rain. **(3 marks)**  
(ii) The pressure normal to the roof due to the impact of the rain. **(2 marks)**
- (b) (i) Distinguish between periodic motion and oscillatory motion. **(2 marks)**  
(ii) Show that, the periodic time, (T) of simple pendulum is independent to mass of a pendulum but depend on length of string. **(3 marks)**
3. (a) (i) Why a pendulum cannot vibrate in an artificial satellite? **(2 marks)**  
(ii) Calculate the height of a satellite from the earth surface which goes around the earth in 90 minutes in a circuit or orbit. **(3 marks)**
- (b) Prove that the radius  $R_0$  of the orbit of the satellite is given by

$$R_0 = \sqrt[3]{\frac{GM_e T^2}{4\pi^2}}$$

Where  $T$  is the period of revolution,  $G$  and  $M_e$  are gravitational constant and mass of the earth respectively. **(5 marks)**

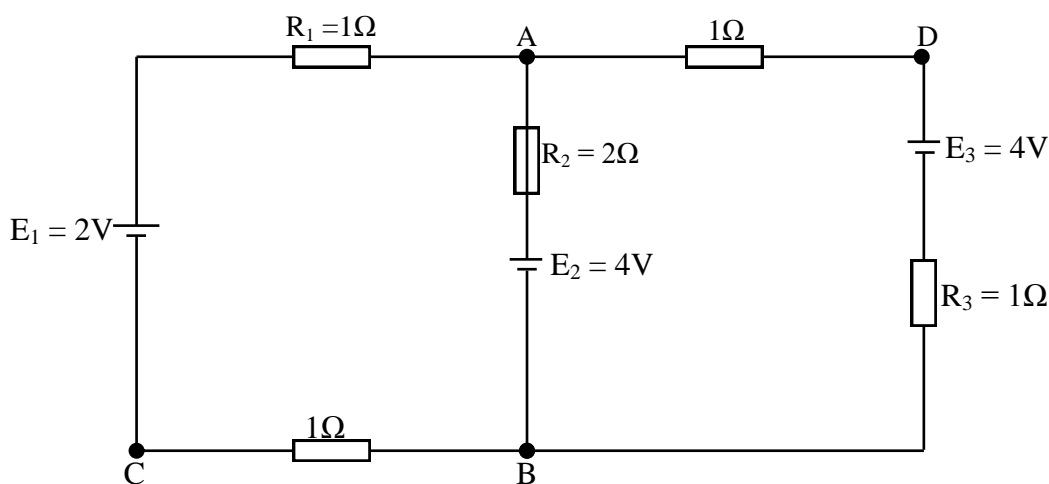
4. (a) (i) How a swimmer jumping from a height is able to increase the number of loops made in the air?  
(ii) Prove that, the velocity  $V$  of a solid cylinder of mass  $M$  and radius  $R$  which is made to roll down an inclined plane without slipping at the moment when reaches the bottom of an inclined plane is given by
- $$V = \sqrt{\frac{4}{3}gh}$$
- (b) Calculate the kinetic energy of the flywheel of mass 30,000g and diameter 1m which is rotating at 300 revolutions per minute about an axis through its centre. **(5marks)**
5. (a) (i) Give **two (2)** practical examples of second law of thermodynamics. **(2 marks)**  
(ii) Calculate the quantity of heat transferred to nitrogen in an isobaric heating such that the gas may perform 2 joules of work. **(3 marks)**
- (b) In a certain thermocouple the thermo e.m.f is given by  $E = a\theta + \frac{b\theta^2}{2}$  where  $\theta$  is the temperature of the hot junction. If the cold junction is at  $0^\circ\text{C}$ ,  
 $a = 10\mu\text{V}^\circ\text{C}^{-1}$  and  $b = -0.05\mu\text{V}^\circ\text{C}^{-1}$ , Calculate;  
(i) The neutral temperature  $\theta_r$   
(ii) Inversion temperature,  $\theta_i$   
(iii) The maximum electromotive force,  $E_{\text{max}}$ . **(5 marks)**

6. (a) (i) Why the tile floor feels cooler than the wooden floor, even though both floor materials are at the same temperature? **(02marks)**
- (ii) How does a fish survive in a pond during an extreme winter season even if the pond is deep frozen on the surface. **(02 marks)**
- (b) Two perfect lagged bars X and Y are arranged in series and parallel. When the bars are in series, the hot end of X is maintained at  $90^{\circ}\text{C}$  and the cold end of Y is maintained at  $30^{\circ}\text{C}$ . When the bars are in parallel the hot end of each is maintained at  $90^{\circ}\text{C}$  and the cold end of each is maintained at  $30^{\circ}\text{C}$ . Calculate the ratio of the total rate of the flow of heat in parallel arrangement to that in series arrangement. The length of each bar is  $L$  and cross section area of each bar is  $A$ . (Thermal conductivity of X is  $400\text{Wm}^{-1}\text{K}^{-1}$  and that of Y is  $200\text{Wm}^{-1}\text{K}^{-1}$ ) **(06 marks)**
7. (a) For each of the following cases, elaborate:
- (i) **Two (2)** techniques for improving plant environment **(02 marks)**
- (ii) **Three (3)** disadvantages of geothermal energy. **(03 marks)**
- (b) Explain the influence of aerial environment on plant growth. **(05 marks)**

### SECTION B (30 Marks).

Answer **two (2)** questions from this section.

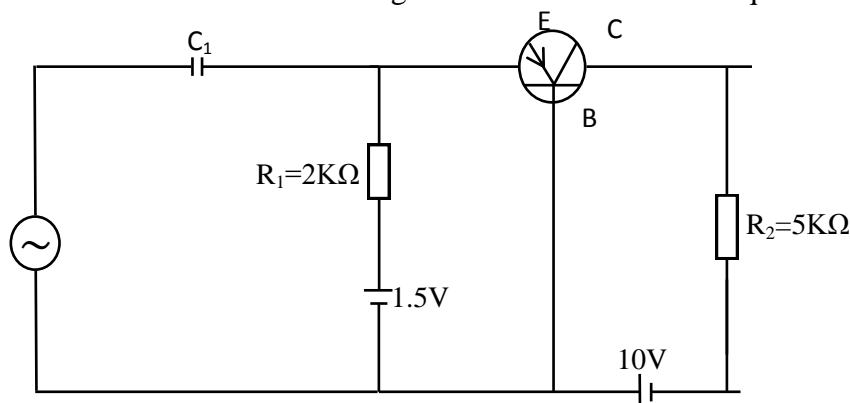
8. (a) (i) Why the transmission of electricity is always done at the highest possible voltage? **(02 marks)**
- (ii) An LCR circuit has inductance  $L=10\text{mH}$ , resistance  $=3\Omega$  and capacitance,  $C=1\mu\text{F}$  are connected in series to a source of  $205\text{V}$  rms. Calculate the amount amplitude at frequency 20% lower the resonance frequency of this circuit. **(03 marks)**
- (b) (i) A cell of e.m.f,  $E$  and internal resistance  $r$  is used to drive a current  $I$  through a load resistance  $R$ , show that, for maximum electric power to be transferred to the load, a load resistance,  $R$  must be equal to the internal resistance,  $r$  of a cell. **(05 marks)**
- (ii) Distinguish between electromotive force (e.m.f) and potential difference **(05 marks)**
- (c) (i) Consider the diagram below and answer the questions that follow:



**Figure 1**

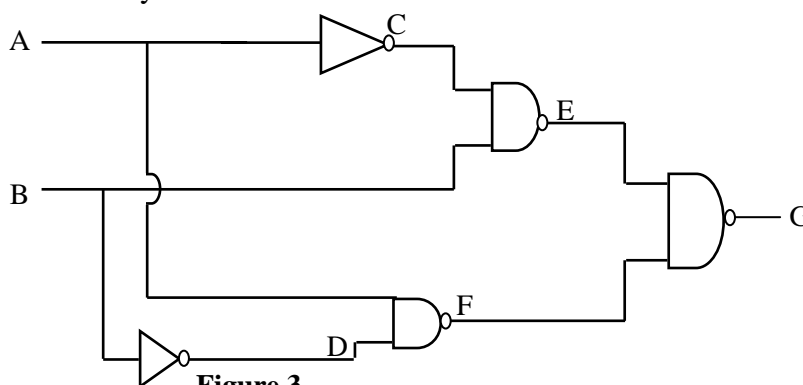
- (i) Calculate the current through  $R_2$ .
- (ii) Determine the potential difference between points C and D. **(05 marks)**
9. (a) (i) Briefly explain how the temperature affects the electrical conductivity of semiconductor material. **(01 marks)**
- (ii) With three reasons why stabilization transistor operating point is necessary. **(1 1/2 marks)**

- (b) (i) What are the **three (3)** important properties of semiconductor **(3 marks)**  
(ii) Study the common emitter circuit in figure below and answer the questions which follow;



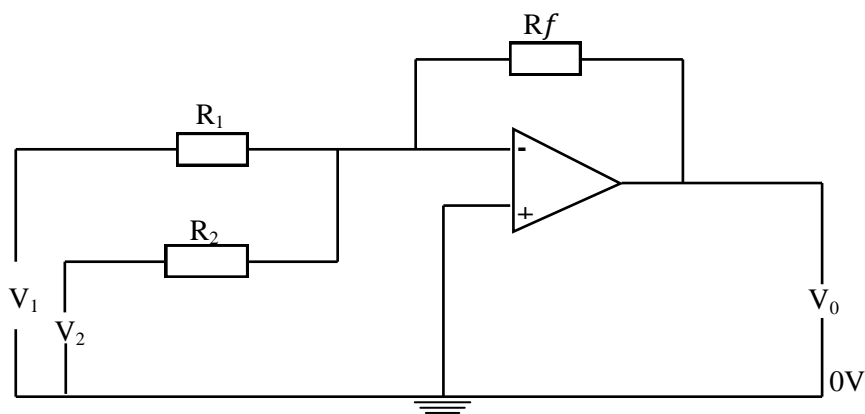
**Figure 2**

- (i) What is the function of  $R_1$ , 1.5v and 10v supply? **(01½ marks)**  
(ii) Explain the role played by capacitor  $C_1$ . **(01½ marks)**  
(iii) Given that,  $I_E = 1.0\text{mA}$  and  $I_B = 0.02\text{mA}$ , calculate the voltage amplification of the circuit if  $V_i = 10\text{mV}$  and input resistance is  $50\Omega$ . **(2 marks)**
- (c) (i) Identify **three (3)** basic logic gates that make up all digital circuits. **(01 ½ marks)**  
(ii) Construct the truth table from the logic gates shown in **figure 2** below and state single gate would produce exactly the same function.



**Figure 3**

10. (a) (i) Distinguish between inverting amplifier and non –inverting amplifier. **(2 marks)**  
(ii) What are the distinguishable features of operational amplifier (op-amps). **(3 marks)**  
(b) **Figure 4** is an operational amplifier circuit where  $R_1 = R_2 = 12\text{k}\Omega$  and  $R_f = 48\text{k}\Omega$ .



**Figure 4**

- (i) Calculate the input voltage  $V_2$  if the input  $V_1 = 0.50\text{V}$  and output voltage  $V_0 = 0.9\text{V}$ . **(5 marks)**  
(ii) What is the practical use of such a circuit. **(2 marks)**
- (c) (i) What is meant by amplitude modulation **(2 marks)**  
(ii) The speech of signal in the frequency range  $300\text{Hz}$  to  $3400\text{Hz}$  are used to amplitude modulate the carriers of frequency  $200\text{KHz}$ . Calculate the bandwidth of resultant modulated signal. **(3marks)**