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TEVETA
Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN PRODUCTION AND OPERATIONS MANAGEMENT

LEVEL 6 YEAR I EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATION

SITTING: NOVEMBER/DECEMBER 2025

SUBJECT: ENGINEERING SCIENCE

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE:

1. Write your examination number and national registration card number on the answer booklet provided. Ensure to append your signature in the space provided on the answer booklet.
2. Write your answer SCRIPT SERIAL NUMBER on the examination register provided and the entry slip.
3. There are Two (2) Sections in this paper. Sections A and B.
4. Section A has ten (10) multiple choice questions carrying two (2) marks each. Answer ALL questions in this section.
5. In Section B, answer Question Two (2) which is compulsory and any other Three (3) Questions from the remaining Five (5) questions.
6. Use pencils and graph papers (provided) for drawings and graphs.
7. Cell phones are not allowed in the examination room.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A (MULTIPLE CHOICE QUESTIONS)

QUESTION 1

Write the letter of the correct answer in the answer booklet provided.

1.1. Which of the following is not a base quantity? (2 marks)

a) Length
b) Mass
c) Density
d) Time

1.2. A Production and Operations Management student pushes a trolley using a Force of 50 N inclined at an angle of 30° with the horizontal line. (2 marks)

Calculate the Work Done in displacing this trolley by 20 m.

a) 875 J
b) 866 J
c) 754 J
d) 568 J

1.3. Identify the vector quantity from the list below. (2 marks)

a) Mass
b) Speed
c) Distance
d) Velocity

1.4. Convert 52 Mpa to N/mm^2. (2 marks)

a) 52 N/mm^2
b) 5200 N/mm^2
c) 52 X 10^{-9} N/mm^2
d) 26 N/mm^2

1.5. Which of the following is the good conductor of electricity: (2 marks)

a) Wood
b) Plastic
c) Copper
d) Rubber

1.6. An ideal gas at a temperature 27 °C is heated at constant pressure till the volume becomes three times. What will be the final temperature of the gas? (2 marks)

a) 81 °C
b) 627 °C
c) 900 °C
d) 927 °C

1.7. Recommend a method of liquefying gas from the list below: (2 marks)

a) High pressure, low temperature
b) Low pressure, high temperature
c) Low pressure, low temperature
d) None of the above.

1.8. Hydraulics machines can be classified as..... (2 marks)

a) Oil powered machines
b) Gas powered machines
c) Electrical powered machine
d) Solar powered machines

1.9. Pneumatic driven machines are..... (2 marks)

a) Oil powered machines
b) Gas powered machines
c) Electrical powered machine
d) Solar powered machines

1.10. The alloy of Copper and Zinc is..... (2 marks)

a) Brass
b) Nickel
c) Bronze
d) Duralumin

Total (20 marks)

SECTION B

ANSWER QUESTION 2 WHICH IS COMPULSORY AND ANY OTHER THREE (3) QUESTIONS IN THIS SECTION.

QUESTION 2 COMPULSORY

a) Contrast sound waves and light waves in terms of their medium requirements and wave types. (4 marks)

b) A bat emits ultrasonic sound waves at a frequency of 1000 kHz in air. If the sound meets a water surface, calculate the wavelength of the reflected and transmitted sound waves, given that the speed of sound in air is 340 m/s and in water is 1486 m/s. (10 marks)

c) If a light wave has a frequency of 5×10^{14} Hz, calculate its wavelength in a vacuum, where the speed of light is 3×10^{8} m/s. (6 marks)

Total (20 marks)

QUESTION 3

a) Distinguish heat from specific heat capacity. (4 marks)

b) A component made of lead having a specific heat capacity of 130 J/(kg °C) is heated from 27 °C to its melting point at 327 °C. If the quantity of heat required is 780 kJ. Determine the mass of the lead component. (8 marks)

c) The length of an iron steam pipe is 20.0m at a temperature of 18°C. Determine the length of the pipe under working conditions when the temperature is 300°C. Assume the coefficient of linear expansion of iron is $12 \times 10^{-6}/k$. (8 marks)

Total (20 marks)

QUESTION 4

a) Define the following terms:

i) Electric current. (2 marks)

ii) Conductance. (2 marks)

iii) Resistance. (2 marks)

b) Interpret Ohms Law. (2 marks)

c) If 5A, 10A and 13A fuses are available, state which is most appropriate for the following appliances which are both connected to a 240V supply:

i) Electric toaster having a power rating of 1 kW. (6 marks)

ii) Electric fire having a power rating of 3 kW. (6 marks)

Total (20 marks)

QUESTION 5

a) Define the following:

i) Work. (2 marks)

ii) Power. (2 marks)

iii) Energy. (2 marks)

b) A machine which is used for lifting a particular mass is supplied with 5 kJ of energy. If the machine has an efficiency of 65% and exerts a force of 812.5N to what height will it lift the mass? (5 marks)

c) A canister containing a meteorology balloon of mass 4 kg is fired vertically upwards from a gun with an initial velocity of 400m/s. Neglecting the air resistance, calculate

i) Its initial Kinetic Energy. (3 marks)

ii) Velocity at a height of 1 km. (3 marks)

iii) The maximum height reached. (3 marks)

Total (20 marks)

QUESTION 6

a) Define the following with respect to material properties:

i) Stress. (2 marks)

ii) Strain. (2 marks)

b) Explain the meaning of Modulus of Elasticity. (3 marks)

c) A hydraulic press exerts a total load of 3.5 MN. This load is carried by two steel rods, supporting the upper head of the press. If the safe stress is 85 MPa and E = 210 MN/m^2, find:

i) Diameter of the rods. (7 marks)

ii) Extension in each rod in a length of 2.5 m. (6 marks)

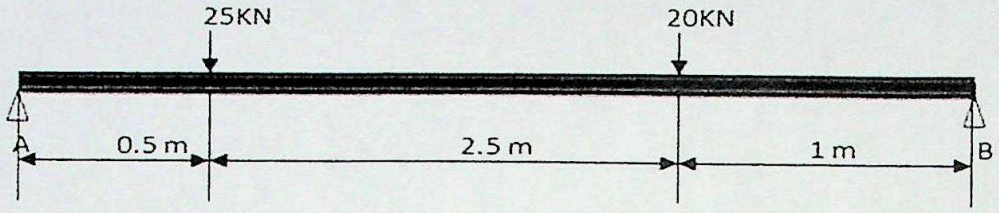
Total (20 marks)

QUESTION 7

a) State the Principle of Moments. (2 marks)

b) Distinguish a Torque from a Couple. (6 marks)

c) For the simply supported beam shown in **figure** the next page::



i) Determine the reactions at the two supports. (4 marks)

ii) Draw the Shear Force Diagram. (4 marks)

iii) Draw Bending Moment Diagram. (4 marks)

Total (20 marks)