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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY EDUCATION

COURSE CODE: TEC 102

COURSE TITLE: TECHNICAL DRAWING I

DATE: 28TH APRIL 2022 **TIME:8.00-10.00 A.M.**

INSTRUCTIONS

- Attempt questions **1, 2** and any other **one** questions.
- All dimensions are in mm unless otherwise stated.

Time : 3 hours.

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE

Pictorial drawing of a machine part is shown in figure Q1. Study the part and draw, full size and in first angle orthographic projection the following views:-

i) Sectional Front on the cutting plane **A-A**
ii) End elevation viewed from the left hand side of i) above
iii) Plan

- Insert six leading dimensions. (40 marks)

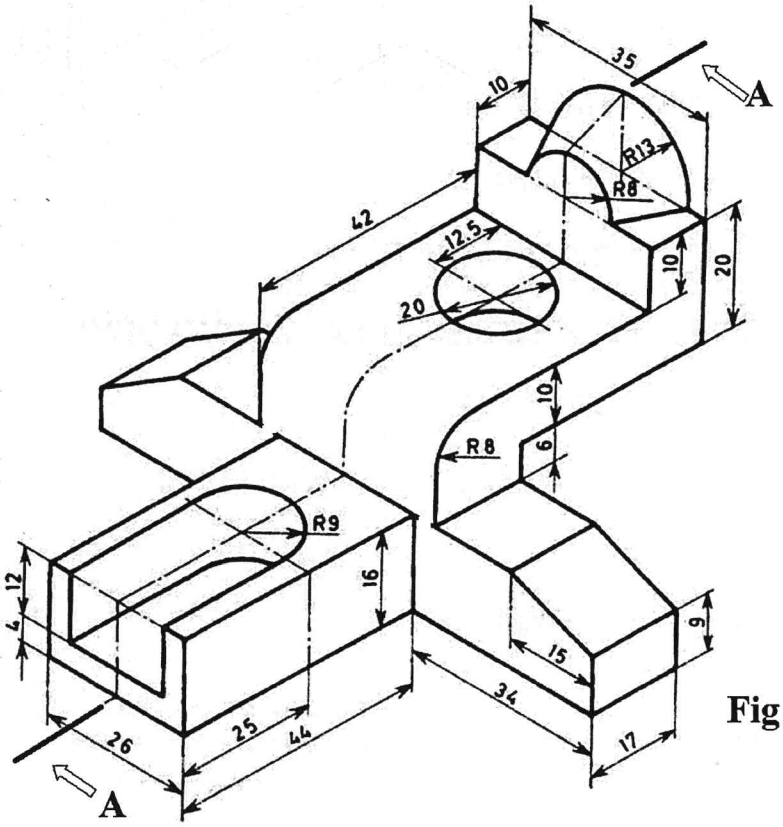


Fig Q1.

QUESTION TWO

a) Drawing of a machine spare part is given in fig. Q2. To a scale of 1:1 construct the part showing all the construction details. (14 marks)

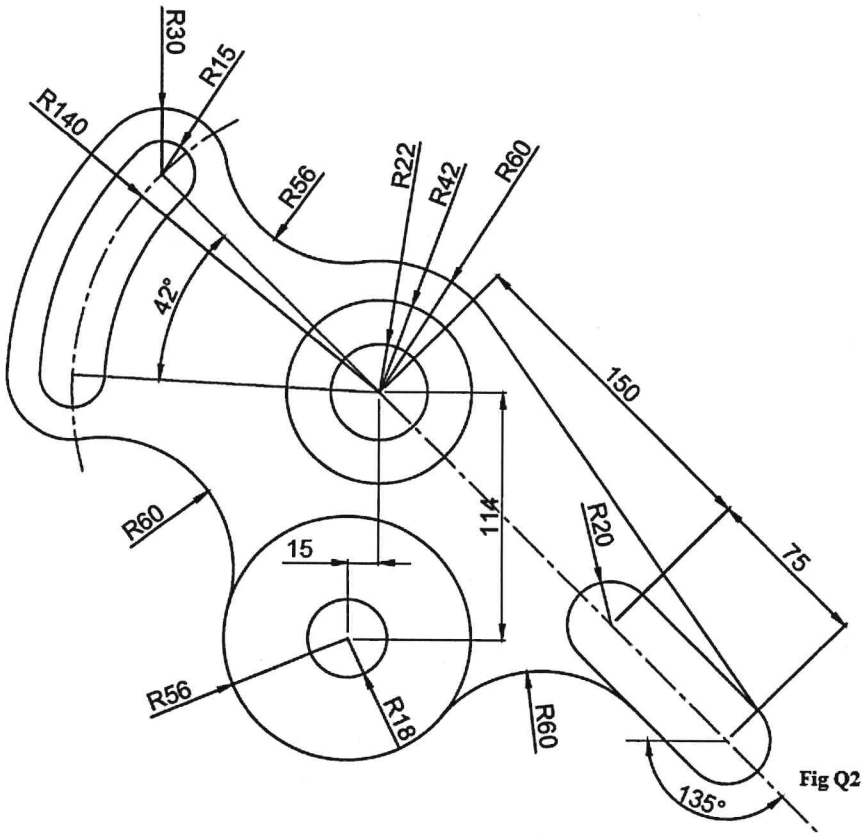


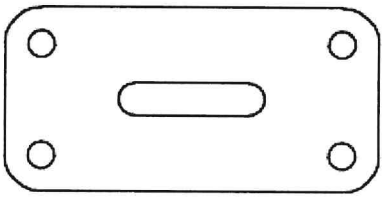
Fig Q2

b) A triangle has a base angle of 37.5^0, base 35mm and perimeter of 120mm. Construct the triangle and hence similar triangle whose perimeter is 150mm. (6 marks)

QUESTION THREE

a) Construct a diagonal scale to show kilometers, hectometers and decameters when 2.5 centimeters are equal to 1 kilometer and long enough to measure 6 kilometers. On the scale show a distance of 4.54kilometers and 5.86 kilometers. (10 marks)

b) Figure Q3(b) shows template to be produced in the workshop. To a scale of 2:1 redraw the template and dimension it fully. (7marks)



LENGTH	: 80
WIDTH	: 40
BOREHOLES	: 4 x Ø6
ROUNDINGS	: R5
OBLONG HOLE WIDTH	: 7 , 40 LENGTH

Fig Q3(b)

c) With aid of sketches show what is meant by
(i) half section
(ii) 30 CRS
(iii) Scrap section (3 marks)

QUESTION FOUR

(a) Figure Q4shows shaped block in pictorial projection. Study the blocks, using freehand and in good proportions sketch the block in their respective orthographic projection angles the following views:-

(i) Front elevation in direction F

(ii) End elevation in direction E

(iii) Plan

- include all the hidden details (18 marks)

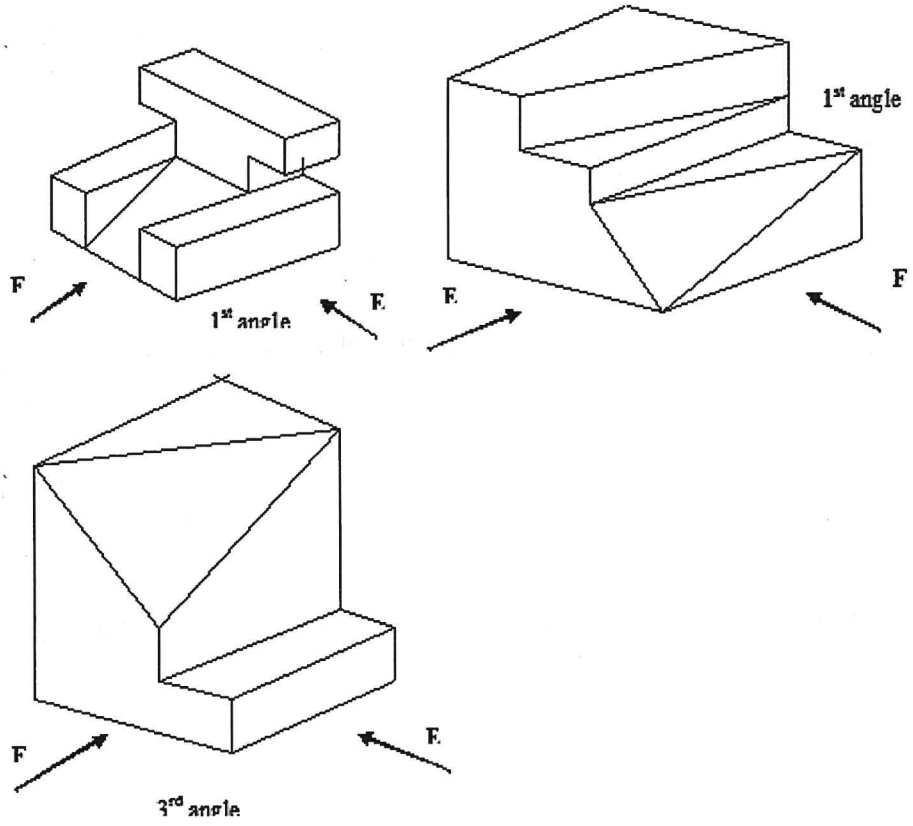


Fig Q 4.

(b) Give the symbol for the following:-

(i) Third angle projection

(ii) Threaded shaft. (2 marks)

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MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER MAIN EXAMINATIONS

FOR THE DEGREE OF B.SC MECHANICAL AND INDUSTRIAL ENGINEERING

COURSE CODE: MIE 372

COURSE TITLE: THERMODYNAMICS III

DURATION: 2 HOURS

DATE: 28-4-2022 **TIME: 15.00 -17.00 HRS**

INSTRUCTIONS TO CANDIDATES

(i) Answer **Question 1 (Compulsory)** and any other **TWO** questions
(ii) All symbols have their usual meaning
(iii) Use steam tables provided

This paper consists of **3** printed pages. Please Turn Over

QUESTION ONE (Compulsory) – 30 MARKS

a) What is the implication of the Grashof number with regard to fluid flow?

(4 Marks)

b) Differentiate between the following bodies.

(i) Black body

(2 Marks)

(ii) Grey body

(2 Marks)

c) Use a sketch to show the progression in the velocity boundary layer as the fluid flows

(5 Marks)

(d) Explain briefly the differences between the following types of heat exchangers

(i) Recuperative

(2 Marks)

(ii) Regenerative

(2 Marks)

(e) Draw a well labeled diagram to show the temperature distribution in a parallel-flow heat exchanger

(5 Marks)

(f) Define the following.

i) Heat exchanger effectiveness

(2 Marks)

ii) Thermal capacity

(2 Marks)

(g) Define the Stefan-Boltzmann law

(4 Marks)

QUESTION TWO – 20 MARKS

A single pass shell and tube counter-flow heat exchanger uses waste gas on the shell side to heat a liquid in the tubes. The waste gas enters at a temperature of 400°C with a mass flow rate of 40kg/s. The water enters at a temperature of 100°C with a mass flow rate of 3kg/s.
Assuming that the velocity is not to exceed 1m/s, use the data provided below to calculate:

a) The required number of tubes

(6 Marks)

b) The effectiveness of the heat exchanger

(14 Marks)

DATA

- Tube inside diameter = 10mm
- Tube outside diameter = 12.5mm
- Tube length = 4m
- Specific heat capacity of waste gas = 1.04kJ/kgK
- Specific heat capacity of liquid = 1.5kJ/kgK
- Density of liquid = 500kg/m^3
- Coefficient of heat transfer of the shell side = 0.26kW/m^2K
- Coefficient of heat transfer of the tube side = 0.58kW/m^2K

QUESTION THREE – 20 MARKS

Calculate the rate of heat loss in air by natural convection per unit length from a horizontal pipe of 250mm diameter, the surface of which is at 239°C, and the room temperature is 15°C.
For the horizontal pipe take:

$$Nu = 0.53[(Pr), (Gr)]^{0.25}$$

and evaluate the properties at mean film temperature. Also take the coefficient of cubical expansion β to be T^{-1}; where T is the absolute temperature in Kelvin.

(20 Marks)

QUESTION FOUR – 20 MARKS

An exhaust pipe of 75mm outside diameter is cooled by surrounding it by an annular space containing water. The exhaust gas enters the exhaust pipe at 350°C, and the water enters from the mains at 10°C. The heat transfer coefficients of the gases and water may be taken to be 0.3 and 1.5 kW/m^2K, respectively, and the pipe thickness is negligible. The gases are required to be cooled to 100°C and the mean specific heat at constant pressure is 1.13 kJ/kgK. The gas flow is 200 kg/h and the water flow is 1400 kg/h. The specific heat capacity of water is 4.19 kJ/kgK.

Calculate the required length of pipe for:

a) a parallel-flow heat exchanger

(16 Marks)

b) a counter- flow heat exchanger

(4 Marks)