THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

MECHANICAL ENGINEERING – 3rd YEAR DEGREE

SECOND SEMESTER EXAMINATIONS – 2023

ME 314 – BASIC MANUFACTURING PROCESS AND DESIGN
TUESDAY, 30th MAY 2023 – 8.20AM

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper. You **must not** begin writing during this time.

2. Answer **All the** questions.

3. **Use only ink.** Do not use pencil for writing except for drawings and sketches.

4. Start each question on a new page and show all your calculations in the answer book provided. No other written material will be accepted.

5. Write your **NAME** and **NUMBER** clearly on the front page. **Do it now.**

6. Calculators are permitted in the examination room. Notes and textbooks are not allowed.

MARKING SCHEME:

Question Number 1	07
Question Number 2	07
Question Number 3	05
Question Number 4	05
Question Number 5	05
Question Number 6	05
Question Number 7	06

Question Number 1 (*07 marks*)(*Answer all questions Each Question carries 1 mark*)
Fill in the blanks

a   All metals shrink when cooling except perhaps _____

b   The ability of a metal to flow and fill a mold is known as _____

c   The rate of flow of air passing through a standard specimen under a standard pressure is termed as

_____

d   _____ is a complex phenomena that results from inhomogeneous deformation of the material during rolling.

e   When a piece of raw material is worked in such a way that its length is shortened and either or both its thickness and width increased, the operation is called_____

f   If DC is used and the work is positive (the anode of the circuit), the condition is known as_____

g   _____ constituents unite with any impurities in the molten metal and float them to the surface to be entrapped in the slag coating that forms over the weld.

Question Number 2 (*07 marks*)(*Answer all questions Each Question carries 1 mark*)
Choose the correct option

a   In arc welding of a butt joint, the welding speed is to be selected such that highest cooling rate is achieved. Melting efficiency and heat transfer efficiency are 0.5 and 0.7, respectively. The area of the weld cross section is 5 mm2 and the unit energy required to melt the metal is 10 J/mm3. If the welding power is 2 kW, the welding speed in mm/s is closest to

     (a)   4   (b)   14   (c)   24   (d)   34.

b   In arc welding, d.c. reverse polarity is used to bear greater advantage in
     (a)   Overhead welding   (b)   Flat welding of lap joints
     (c)   Edge welding   (d)   Flat welding of butt joints.

c   Which of the following are the most suitable materials for die casting?
     (a)   Zinc and its alloys   (b) Copper and its alloys
     (c)   Aluminium and its alloys   (d) Lead and its alloys

d   Poor machinability of centrifugally cast iron pipe is due to
     (a)   Chilling   (b)   Segregation
     (c)   Dense structure   (d)   High mould rotation speed

e   A strip is to be rolled from thickness of 30 mm to 15 mm using a two high mill having rolls of diameter 300 mm. The coefficient of friction for unaided bite should nearly be

     (a)   0.28   (b)   0.35   (c)   0.4   (d)   0.25

f   In a DC arc welding operation, the voltage-arc length characteristic was obtained as Varc = 20 + 5L where the arc length L was varied between 5 mm and 7 mm. Here Varc denotes the arc voltage in Volts. The arc current was varied from 400 A to 500 A. Assuming linear power source characteristic, the open circuit voltage and the short circuit current for the welding operation are

(a) 45 V, 450 A   (b) 75 V, 750 A

(c) 95 V, 950 A   (d) 150 V, 1500 A

g   Formability of the material depends on_____

(a) Temperature   (b) strain rate   (c) Stress   (d) all of these

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Question Number 3 (*5 marks*)

Gray cast iron blocks 200 x 100 x 10 mm are to be cast in sand moulds. Shrinkage allowance for pattern making is 1%. The ratio of the volume of pattern to that of the casting will be

Question Number 4 (*5 marks*)

Using open-die forging operation, a solid cylindrical piece of 304 stainless steel having 100 mm dia x 72 mm height is reduced in the height to 60 mm at room temperature. Assuming the coefficient of friction as 0.22 and the flow stress for this material at the required true strain as 1000 MPa., calculate the forging force at the end of stroke.

Question Number 5 (*5 marks*)

Discuss various types of extrusion process with diagrams. Also mention their relative advantages and disadvantages

Question Number 6 (5 marks)

Discuss various types flames obtained during oxy-acetylene gas welding with neat sketch

Question Number 7 (6 marks)

Calculate the melting efficiency in the case of arc-welding of steel with a potential of 20 V and a current of 200 A. The travel speed is 5 mm/s and the cross-sectional area of the joint is 20 mm^2. Heat required to melt steel may be taken as 10 J/mm^3 and the heat transfer efficiency as 0.85.