

# TECHNICAL UNIVERSITY OF MOMBASA

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**Faculty of Engineering and Technology**

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN BACHELOR OF SCIENCE IN  
MECHANICAL ENGINEERING

(BSME) Y4-S1

**EMG 2402: MATERIALS FORMING PROCESSES I**

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: MAY 2016

TIME: 2 HOURS

## **INSTRUCTIONS:**

- ❖ You should have; Answer booklet,; Drawing instruments and Scientific calculator
- ❖ This paper consists of FIVE questions
- ❖ Attempt any THREE questions.

**This paper consists of THREE printed pages**

## **QUESTION 1**

a) (i) State TWO conditions that determine how well a material may be deep drawn.

(ii) Contrast hot working process with cold working process (4½ marks)

(b) A 55mm square aperture is to be produced on a steel strip of 3.2mm thick. The shear stress of the material is  $415\text{N/mm}^2$  and penetration occurs at one quarter of the thickness. If the maximum punch force is to be reduced by one third, and assuming single shear on the punch, calculate:

(i) Amount of shear required (mm)

(ii) Angle of shear (5½ marks)

(c) A cup of final diameter 95mm and height 216mm is to be deep drawn on a press tool. The blank is 1mm thick and the tensile stress is  $350\text{N/mm}^2$ . The reductions of 50%, 40%, 30% etc. Determine:

(i) Blank size

(ii) Number of drawing operations required and the height after each draw

(iii) Maximum drawing force (10 marks)

## QUESTION 2

- a) Describe:
- i) Swaging
  - ii) Extrusion of seamless tubes using spider mandrel/torpedo die (7 marks)
- b) A copper billet 125mm diameter and 255mm long is extruded at 820° C at a speed of 211mm/s. Using square dies and assuming poor lubrication, estimate the force required in this operation if the final diameter is 62.5mm. (Take  $C=131\text{MPa}$ ,  $m=0.06$ ) (6 marks)
- c) A 445mm wide 6061-T6 aluminium strip is rolled from a thickness of 30mm to 24mm. If the roll radius is 310mm and roll r.p.m is 103, estimate the total horsepower required for the operation. (Take  $K=410\text{MPa}$ ,  $n=0.05$ ) (7 marks)

## QUESTION3

Describe:

- i. Foam moulding
- ii. Rotational moulding
- iii. Laminated sheet, and
- iv. Extrusion of polymeric pipe (20 marks)

## QUESTION4

- a) Describe THREE types of ceramics. (3 marks)
- b) Describe three methods of forming ceramics. (6 marks)
- c) A solid cylindrical ceramic part is to be made whose final length is to be  $l_f=25\text{mm}$ . It has been established that for this material, linear shrinkage during drying and firing are 4% and 8% respectively based on the dried dimension  $L_d$ . Calculate:
- (i) Initial length  $L_o$  of the part.
  - (ii) The dried porosity  $P_d$  if the porosity of the fired part  $P_f$  is 5%. (6 marks)
- d) A steel workpiece has a given face with a desired length of 750mm . It is to be cast from a pattern of white iron. This pattern is itself derived from an original wooden pattern. Given that the shrinkage allowance for steel is 15mm/m, and the machining allowance for steel is 16mm/m; and that for white iron the shrinkage allowance is 11mm/m and machining allowance for white iron is 16mm/m, determine:
- i) Dimension of white iron pattern
  - ii) Dimension of wooden pattern (5 marks)

## QUESTION5

Describe:

- a) Lost wax process
- b) Shell moulding
- c) Centrifugal casting
- d) Sand casting (20 marks)