TECHNICAL UNIVERSITY OF MOMBASA

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 415N/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 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=131MPa, 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 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=25mm. 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)*