MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING
THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

EMM 315: MATERIAL FORMING PROCESSES I

DATE: **TIME:**

INSTRUCTIONS:

    i.   This paper contains five questions.

    ii.   Question 1 is COMPULSORY

    iii.   Question 1 carries 30 Marks while the rest carry 20 Marks each

    iv.   Answer QUESTION 1 and any other TWO (2) questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a)   Difference between Hot and Cold Working:.   (10 marks)

b)   List the common defects found in casting. Also elaborate casting process.   (10 marks)

c)   A flat plate is to be cast in an open mold whose bottom has a square shape that is 200 mm by 200 mm. The mold is 40 mm deep. A total of 1,000,000 mm^3 of molten aluminum is poured into the mold. Solidification volumetric shrinkage is known to be 6.0%. If the linear shrinkage due to thermal contraction after solidification is 1.3% and if the availability of molten metal in the mold allows the square shape of the cast plate to maintain its 200 mm by 200 mm dimensions until solidification is completed, determine the final dimensions of the plate.

               (5 marks)

d)   Discuss 5 key design recommendations for ceramic parts.   (5 marks)

QUESTION TWO (20 MARKS)

Write a short notes on:-

        i) Sand Properties   (9 marks)

        ii) Pattern allowance   (6 marks)

        iii) Slush Casting   (5 marks)

QUESTION THREE (20 MARKS)

a)   From the perspective of shaping, describe the extrusion process.   (2 marks)

b)   For a certain metal, the strength coefficient = 700 MPa and strain-hardening exponent = 0.27. Determine the average flow stress that the metal experiences if it is subjected to a stress that is equal to its strength coefficient K.   (4 marks)

c)   If a metal were to cause the average flow stress to be 3/4 of the final flow stress after deformation, determine the value of the strain-hardening exponent.   (6 marks)

d)   A series of cold rolling operations are to be used to reduce the thickness of a plate from 50 mm down to 25 mm in a reversing two-high mill. Roll diameter = 700 mm and coefficient of friction between rolls and work = 0.15. The specification is that the draft is to be equal on each pass.   (8 marks)

     Determine;

        i)   minimum number of passes required, and

        ii)   draft for each pass?

QUESTION FOUR (20 MARKS)

a)   One way to classify forging operations is by the degree to which the work is constrained in the die.

     By this classification, name and briefly explain the basic types.   (3 marks)

b)   A cylindrical part is warm upset forged in an open die. The initial diameter is 45 mm and the initial height is 40 mm. The height after forging is 25 mm. The coefficient of friction at the die-work interface is 0.20. The yield strength of the work material is 285 MPa, and its flow curve is defined by a strength coefficient of 600 MPa and a strain-hardening exponent of 0.12. Determine the force in the operation;

        i) just as the yield point is reached (yield at strain = 0.002),

        ii) at a height of 35 mm,

        iii) at a height of 30 mm, and

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iv) at a height of 25 mm   (17 marks)

QUESTION FIVE (20 MARKS)

a)   What is glazing, as applied to ceramics?   (2 marks)

b)   What are some of the principal applications of cemented carbides, such as WC-Co?(2 marks)

c)   Discuss at least 5 functions of the ingredients that are added to glass in addition to silica.

                                                                      (5 marks)

d)   How do thermoplastic elastomers differ from conventional rubbers?   (2 marks)

e)   Using a clear illustration, describe the compression moulding process.   (9 marks)