



# **MACHAKOS UNIVERSITY**

**University Examinations 2018/2019**

**THIRD YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE  
OF BACHELOR OF SCIENCE MECHANICAL ENGINEERING**

**EMM 315: MATERIAL FORMING PROCESSES**

**DATE: MAY 2018**

**TIME: 2 HOURS**

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## **INSTRUCTIONS**

- i) This examination contains **FIVE** questions.
- ii) You are required to answer **THREE** questions only
- iii) Question **ONE** is compulsory
- iv) Attempt any other **TWO** questions.
- v) Questions **ONE** carries **30 marks** and the **others** carry **20 marks** each.

## QUESTION ONE (30 marks)

- a) List **FOUR** benefits of hot working as compared to cold working. [2 marks]
- b) Using a neat sketch, explain the principle and mechanism of metal rolling processes. [3 marks]
- c) Enumerate **FOUR** comparisons between forward and backward extrusion. [4 marks]
- d) List and explain **SIX** sheet metal forming operations. [6 marks]
- e) Briefly explain the reasons for annealing and tempering in the processing of glass. [4 marks]
- f) The component shown in Figure Question **ONE** is an aluminum machine part to be produced through sand casting. Using neat sketches, design; a split pattern locating parting line, a gating system and risers, and show location of cores for producing internal features. [11 marks]

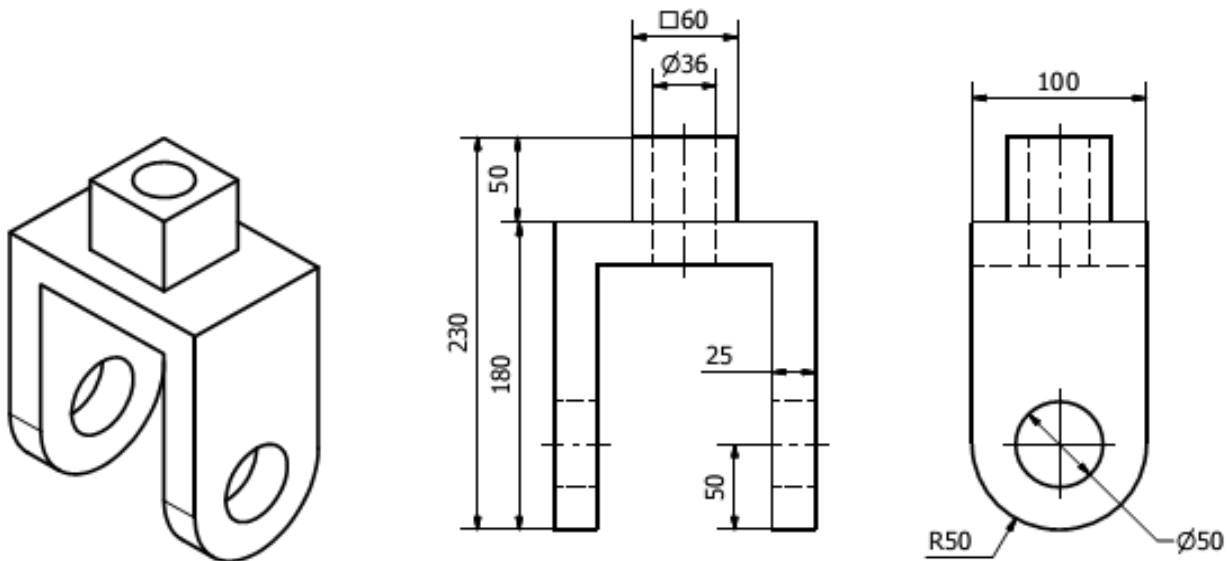


Figure: QuestionONE

## QUESTION TWO (20 marks)

- a) Differentiate between expendable mold processes and permanent mold processes [2 marks]
- b) Using neat sketches differentiate between shell moulding and investment casting [4 marks]
- c) Explain the causes and methods of mitigating the following defects in casting [8 marks]
- i) Sand wash
  - ii) Shrinkage cavity
  - iii) Misrun
  - iv) Hot tearing
- d) In a sand casting process, the following parameters are proposed; Height of sprue ( $h$ ) = 25mm, cross-sectional area at sprue base =  $4 \text{ cm}^2$ , Volume of cavity =  $1850 \text{ cm}^3$ . Calculate the following pouring parameters: [6 marks]
- i) Velocity of molten metal,
  - ii) Volumetric flow rate
  - iii) Time required to fill mould cavity

## QUESTION THREE (20 marks)

- a) Using neat sketches compare grain flow for a spur gear produced through casting, machining or forging. What advantage is to be obtained through forging process? [4 marks]
- b) Define spring back and explain how allowances may be made to compensate its harmful effects. [6 marks]
- c) Using neat sketches explain the operation of progressive and combination dies used in press work applications. [6 marks]
- d) A washer with 12.7 mm internal hole and an outside diameter of 25.4 mm is to be made from 0.2% carbon steel 1.5 mm thick. Considering the elastic recovery of the material, find (a) clearance (b) blank die opening size (c) the piercing punch size, (e) the piercing die-opening size. Assume a clearance of 5% of blank thickness for soft steel and 0.005mm allowance for blank expansion and elastic recovery. [4 marks]

#### QUESTION FOUR (20 marks)

- a) List **SIX** advantages of ceramic materials. [3 marks]
- b) Sketch and explain **FOUR** configurations of rolling process. [4 marks]
- c) Briefly explain **THREE** defects in metal forging. [3 marks]
- d) Using a sketch, explain the pultrusion method of producing composite materials and cite **TWO** applications. [5 marks]
- e) Using a neat sketch explain the press-and-blow technique for producing a glass bottle. [5 marks]

#### QUESTION FIVE (20 marks)

- a) Briefly explain and show the basic components of injection moulding machine for plastics [6 marks]
- b) Using neat sketches differentiate between the following types of blow molding [7 marks]
  - i) Extrusion Blow Molding
  - ii) Injection Blow Molding
- c) Using neat sketches, differentiate the following methods of manufacturing flat glass
  - i) Rolling of Flat Plate
  - ii) Float process [7 marks]