



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMM 315: MATERIAL FORMING PROCESSES

DATE: 21/5/2019

TIME: 8.30-10.30 AM

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)

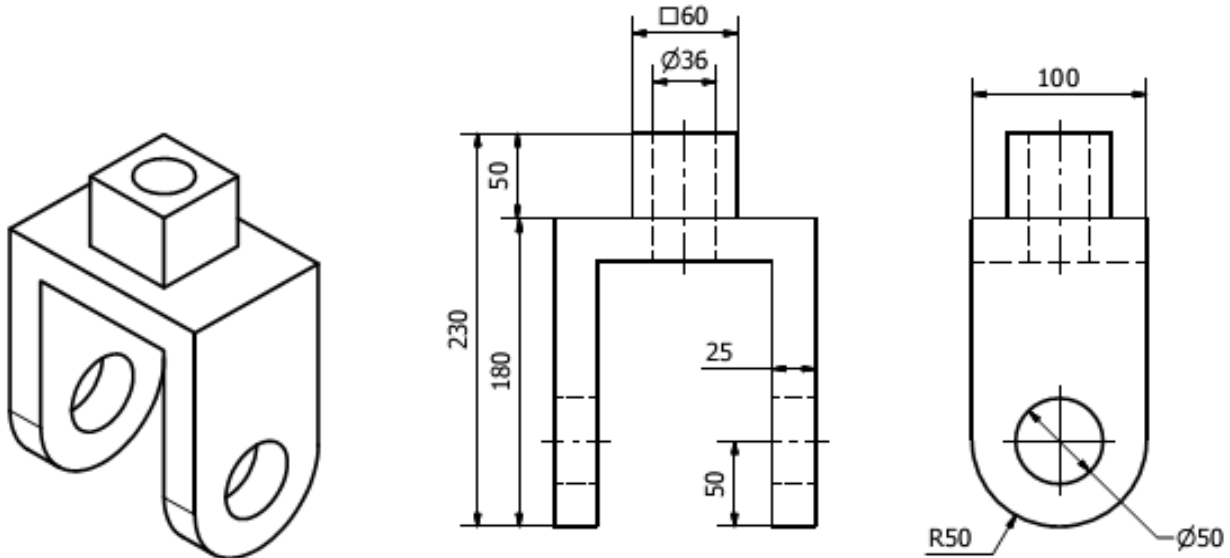


Figure: QuestionONE

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 cm^2 , Volume of cavity = 1850 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)