



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMM 305: MATERIAL FORMING PROCESSES

DATE: 14/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

- i This paper contains five (5) questions.
- ii Question one carries 30 marks and the other questions carry 20 marks each
- iii Attempt question one (**COMPULSORY**) and any other two questions.
- iv All dimensions are in mm.
- v Neat sketches will earn you marks.

QUESTION ONE (COMPULSORY) 30 MARKS

- a) List four benefits of hot working as compared to cold working (5 marks)
- b) Briefly explain how strengthening by work hardening occur in metals (3 marks)
- c) Explain the principle of shearing in die cutting with neat sketch (4 marks)
- d) State three classifications of composites each according to; (3 marks)
 - i Matrix material
 - ii Reinforcement geometry
- e) Compare hydraulic drives with mechanical drives for presses. (6 marks)
- f) Briefly explain the reasons for annealing and tempering in the processing of glass (4 marks)
- g) Differentiate between hot chamber die casting and cold chamber die casting (3 marks)
- h) The component shown in Fig Q 1.8 is an aluminum machine part to be produced through sand casting. Using neat sketches, design; a split pattern locating parting line, a gating system, risers and show location of cores for producing internal features (11 marks)

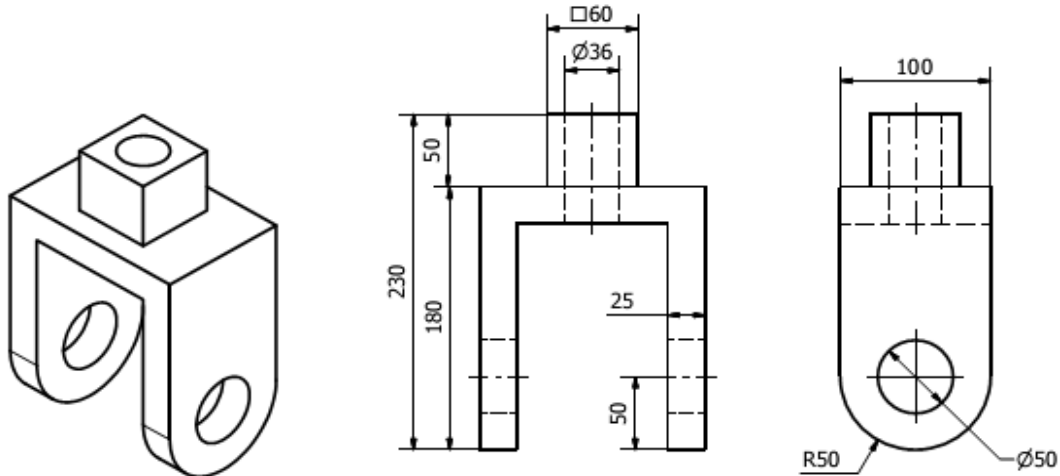


Fig Q 1.8

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, crosssectional 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 as 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 1.5 mm thick of 0.2% carbon steel. 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 three lubricants used in rolling processes
(3 marks)
- b) Sketch and explain four configurations of rolling
(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 sketches differentiate between the following types of blow molding
(4 marks)
 - i Extrusion Blow Molding
 - ii Injection Blow Molding
- c) Differentiate between vacuum molding and compression moulding of plastics and cite two applications for each method
(6 marks)
- d) Using neat sketches, differentiate the following methods of manufacturing flat glass
(4 marks)
 - i Rolling of Flat Plate
 - ii Float process