



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE IN MECHANICAL ENGINEERING
EMM 504: THEORY OF PRODUCTION PROCESSES

DATE: Thursday 12th April, 2012

TIME: 8.00 a.m. – 10.00 a.m.

Instructions

1. Attempt any THREE questions.
2. All questions carry equal marks.

QUESTION ONE

- a. Differentiate between elastic, anelastic and plastic behaviour of a material (3 marks)
- b. State and briefly describe the three idealised flow curves of plastic materials. (6marks)
- c. Differentiate between true and engineering strain. Show that
 $\epsilon = \ln(e + 1)$
Where; ϵ = true strain, and e = engineering strain (5 marks)
- d. The stress state in a steel part is given as shown below. If the yield strength of steel is 950 Mpa, determine whether yielding will have occurred on the basis of both the von Mises and Tresca criteria (6 marks)

$$\begin{vmatrix} 0 & 0 & 300 \\ 0 & -400 & 0 \\ 300 & 0 & -800 \end{vmatrix} \text{ Mpa}$$

QUESTION TWO

- a. Differentiate between hot and cold working of metals. What are the main two advantages and disadvantages of each? (6 marks)
- b. Name three general pre-form die design considerations for one achieve good closed die forgings. (3 marks)
- c. (i) Describe the main types of forging equipment giving the main advantages and disadvantages of each. (9 marks)
(ii) What would you consider in choosing a forging machine to do a job? (2 marks)

QUESTION THREE

- a. Define
 - Homogenous deformation
 - Semi-homogenous deformation
 - Inhomogeneous deformation(3 marks)
- b. Starting from a slab, billet and bloom, appropriately link these pieces with the production of rods, rails and coils during flat rolling. (3 marks)
- c. A plate of width 350 mm and 35 mm thick is reduced in a single pass in two high rolling mill to a thickness of 30 mm. the roll radius is 600 mm and its speed is 40m/min. The plastic stress-strain curve is given by $\sigma = 270\epsilon^{0.3}$ Mpa. Determine;
 - i. The roll force (6 marks)
 - ii. The roll torque (4 marks)
 - iii. The power required to accomplish the operation (4 marks)

QUESTION FOUR

- a. Name and briefly describe the three types of chips formed in metal cutting. (6 marks)
- b. Explain the following terms as used in production processes. Cite two factors which affect each. (4 marks)
- i. Workability
 - ii. Machineability
- c. A 60 minute tool life was obtained while cutting at $V = 30$ m/min, $f = 0.3$ mm/rev and $d = 2.5$ mm. Determine the change in tool life if the cutting speed, feed and depth of cut are increased by 20% individually and also taken together. The tool life equation for the tool is given by;

$$VT^{0.13}f^{0.77}d^{0.37} = C$$

Where symbols take their usual meaning

(10 marks)

QUESTION FIVE

- a. With or without simple diagrams, briefly explain the following sheet metal forming processes. (6 marks)
- i. Shearing
 - ii. Bending
 - iii. Stretch forming
- b. Name and explain four qualities of a good metal working/ cutting lubricant. (4 marks)
- c. In a copper wire drawing process the following data was collected:
- Reduction of area = 30%
 - Initial wire diameter = 12 mm
 - Yield stress = 240 N/mm²
 - Coefficient of friction, $\mu = 0.10$
 - The die angle, $\alpha = 6^\circ$
 - Drawing speed = 2.3 m/s
 - Motor efficiency = 98%
- Determine;
- i. The drawing load required.
 - ii. The power of the electric motor. (10 marks)