



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2422: JIG & TOOL DESIGN

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Answer any other **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **TWO** printed pages

Question One

- a) Justify the use of jigs and fixtures. **(2 marks)**
- b) A drill bushing costs ksh. 1350 per unit to drill without a jig and ksh. 620 per unit when a drill jig is used. Assuming that the jig costs ksh. 7,500 how much will the jig save over the production run of 2150 parts? **(6 marks)**
- c) It is required to mill 550 cast iron blocks. There are three alternatives:
- (i) A skilled block maker, who earns ksh. 720/hr, can mill the blocks at a rate of 25 blocks/hr.
 - (ii) Use a limited fooling which costs ksh. 2,100 in the production department. The machine operator earns ksh. 420/hr with a cycle time of 80 seconds.
 - (iii) Use a more expensive tool costing ksh. 6700, with cycle time 24 seconds and operator wages of ksh. 420/hr.

Which alternative should the tool designer prefer? (12 marks)

Question Two

- a) State **FOUR** good clamping principles for the design of jigs and fixtures. (4 marks)
- b) Give **TWO** reasons why chip clearance is important in the design of jigs and fixtures. (3 marks)
- c) Design a suitable jig for drilling the three $\phi 12$ holes indicated in figure Q2. (13 marks)

Question Three

- a) Give **THREE** reasons for using a system of limits and fits in modern industry compared with 'making to suit' or selective assembly. Under what conditions would selective assembly be used? (10 marks)

- b) A hole is specified as $\phi 27.5H11$. Sketch a limit gauge suitable for gauging units given that:
 $Z = 19 \mu m$
 $Y = 0 \mu m$
Gauge tolerance = $10 \mu m$
(BS 4500A Chart is provided) (10 marks)

Question Four

- a) It has come to your notice that your shop press is consuming too much power. Suggest some remedial measures. (4 marks)
- b) A drawn steel cup, of diameter 86.5mm and height 53mm is to be drawn from 1.6mm thick steel sheet of $\sigma_t = 415 N / mm^2$ on a 25t press.
(i) Determine the blank diameter.
(ii) Suggest reasonable punch and die diameter for the blanking process
(iii) Estimate the press capacity required
(iv) Is the press provided adequate? (8 marks)

- c) Design a press tool set for blanking and piercing the component shown in figure Q4. (8 marks)

Question Five

- a) With the aid of sketches, explain how the following form tools are mounted for precise height adjustment and rigidity:
(i) Radial form tool
(ii) Tangential form tool (8 marks)

- b) Draw and dimension both tangential form tool and radial form tool to machine the groove shown in figure Q5. Both tool are to have 5° front clearance and 10° front rake angle. The radial form tool has 'outside diameter' 125mm. **(12 marks)**