



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
BSc. Mechanical Engineering
TMC 4215 : WORKSHOP TECH II
END OF SEMESTER EXAMINATION
SERIES: AUGUST 2017
TIME: 2 HOURS
DATE: Pick Date Aug 2017

Instruction to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

Maximum marks for each part of a question are as shown.

Do not write on the question paper.

Question ONE

- a) A shaft, 50mm diameter, is to have a groove milled along it. The sides of the groove are radial, it is 11.25mm wide at the top and 6mm wide at the bottom. The centre is to be cut with a cutter 6mm wide, after which the shaft is to be indexed round and set over for milling the slot sides with the same cutter setting. Calculate the indexing and set over. (8 marks)
- b) Sketch the knee type milling machine and label FIVE main parts (7 marks)
- c) Describe the procedure of straddle milling (5 marks)

Question TWO

- a) By the method of continued fraction, determine the hole circle plate for indexing $51^{\circ}37'$, stating the amount of inevitable error. (8 marks)
- b) calculate the time taken to complete a 450 mm long cut using a slab mill of diameter = 125 mm; 6 teeth; feed/tooth = 0.05 mm and cutting speed = 25m/min (6 marks)

c) Sketch and name FIVE typical milling cutters(6 marks)

Question THREE

- a) Using sketches, describe the process of loading a cutter onto the horizontal arbor (5 marks)
- b) Using sketches, describe how a 90° vee-block groove can be cut on the milling machine (5 marks)
- c) A face milling operation on a medium carbon steel work piece 100mm wide has 5 kW optimum power available. A H.S.S cutter, diameter 120 mm, has 15 teeth, runs at 20 m/min at depth of cut 5 mm. For a specific cutting constant **K=20,000 mm³/min kW**, determine:
 - i) Feed rate
 - ii) Spindle speed (RPM)
 - iii) Feed per tooth (10 marks)

Question FOUR

Describe:

- a) Honing
- b) Gear shaping
- c) Broaching
- d) Hobbing (20 marks)

Question FIVE

With respect to CNC, discuss:

- a) Open loop control system
- b) Primary and secondary functions of a control system
- c) Continuous path machining
- d) Tool supply system
- e) Importance of binary system (20 marks)

ENERGY REQUIRED FOR MILLING*
Values given are Joules per cubic millimetre removed

Material being Cut	Cast Iron	Mild Steel	Hard Steel	Brass	Aluminium
J/mm ³	1.9	2.7	4.0 to 7.0	1.60	0.90

*For face milling the power may be taken as $\frac{2}{3}$ to $\frac{3}{4}$ of that given in table.

Plate No. 1: 15, 16, 17, 18, 19, 20 holes.

Plate No. 2: 21, 23, 27, 29, 31, 33 holes.

Plate No. 3: 37, 39, 41, 43, 47, 49 holes.

For the Brown and Sharpe dividing head, the gears supplied are as follows:

24(2), 28, 32, 40, 44, 48, 56, 64, 72, 86 and 100 teeth.

REFEER