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, 60mm 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. (10 marks)

b) Sketch the milling machine and label FIVE main parts (10 marks)

Question TWO

a) By the method of continued fraction, determine the hole circle plate for indexing $10^{o}57'$, stating the amount of inevitable error. (10 marks)

b) A prism work piece 300 mm x 65 mm x 50 mm is to be milled on the milling machine. Describe the method of clamping, setting up and machining (10 marks)

Question THREE

a) If a milling machine is equipped with a 5 kW motor, estimate the deepest cut that may safely be taken on hard steel, when the work is 100mm wide and the feed is 150mm/min. (Take cutting power as 70% of motor rating). The specific cutting energy for hard steel is 5.5 J/mm^3. (10 marks)

b) A slab milling operation is being carried out on a 850 mm long, 150 mm wide high strength steel block at a feed of 0.25 mm/tooth. Depth of cut is 3.8 mm. The cutter has a diameter of 75mm, has 8 straight cutting teeth, and rotates at 150 r.p.m. Calculate:

   i) material removal rate
   ii) the cutting time
   iii) motor output horsepower if the specific cutting energy is 7 J/mm^3 and cutting efficiency is 75% (10 marks)

Question FOUR

Describe:

a) Sunderland Maag gear grinding
b) Honing
c) Bevel gear cutting
d) Hobbing (20 marks)

Question FIVE

With respect to CNC, discuss:

a) primary and secondary functions of a control system
b) open loop control system
c) Continuous path machining
d) Ball screw
e) Tool supply 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	Alumin-ium
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.