



TECHNICAL UNIVERSITY OF MOMBASA

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Faculty of Engineering and Technology  
Department of Mechanical & Automotive Engineering  
UNIVERSITY EXAMINATION FOR:  
BSc. Mechanical Engineering  
EMC 4312 : PRODUCTION TECHNOLOGY 1 (METROLOGY  
SPECIAL/SUPPLEMENTARY EXAMINATION  
SERIES: SEPTEMBER 2018  
TIME: 2 HOURS  
DATE: Sep 2018

**Instruction to Candidates:**

You should have the following for this examination

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

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

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

**Do not write on the question paper.**

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**Question ONE**

(a) (i) In taking measurements using the gear tooth vernier, derive the expression for gear tooth width and height setting (5 marks)

(ii) A spur gear of 25 teeth and module 4 is to have its teeth measured using the gear tooth vernier. Evaluate the vernier width and height setting (5 marks)

b) (i) Derive the expression for gauging radius  $R_G$  for gear measurement over rollers.

(ii) A spur gear has 15 teeth and module 5. Determine the **Gauging Dimension** over rollers placed in the first and seventh tooth spaces (5 marks)

**Question TWO**

a) With the aid of sketches, describe the principles of NPL Flatness Interferometer. (10 marks)

- b) With the aid of sketches, describe the Taylor Hobson's Talysurf surface roughness instrument (10 marks)

### QUESTION3

- a) Describe the main requirements of the sine bar. (5 marks)
- b) Figure Q3b shows a gauge made in the geometrical profile shown. Determine the dimension h to the nearest 0.002mm. On such a gauge the dimension h is found to be correct; but each of the  $123^\circ$  angles is found to be four minutes of arc undersize. Determine the error introduced into the dimension l to the nearest 0.002mm. (10 marks)
- c) Figure Q3c shows a method used to determine large radius of curvature by measuring dimension h. If the dimension  $h=42.67\text{mm}$ , determine the radius of curvature R. (5 marks)

### QUESTION4

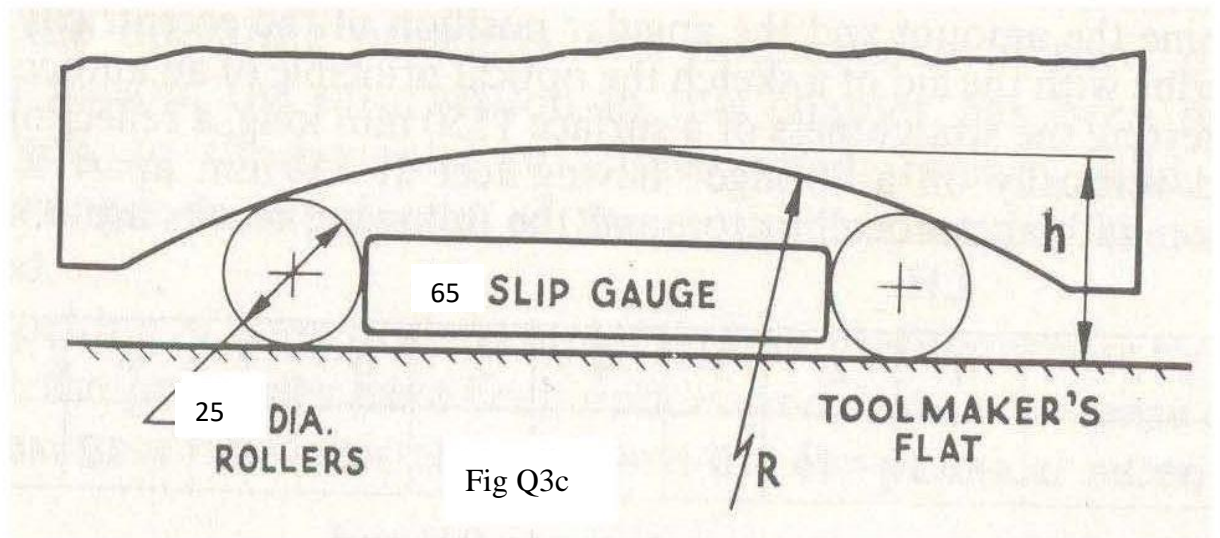
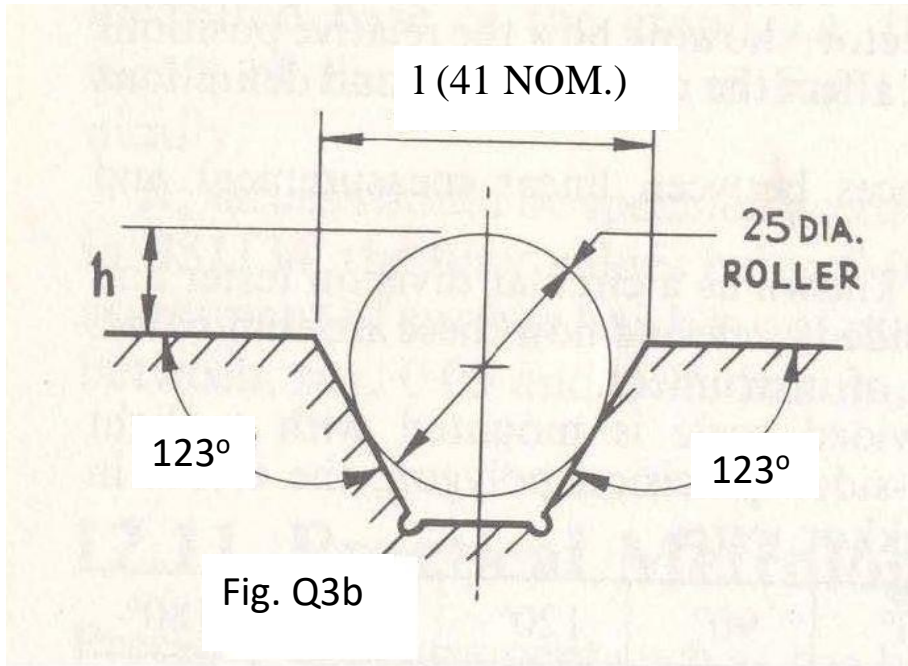
- a) With respect to testing of screw threads, derive the expression for:
- Best wire size
  - Simple effective diameter. (11 marks)
- b) On testing a given thread of flank angle  $30^\circ$  and pitch 4 mm, the wire available was of diameter 2.5 mm and resulted in the dimension T over the wires of 55.978 mm. Determine:
- Best wire size
  - Simple effective diameter. (4 marks)
- c) Determine the diameter of a large bore measured with a pin gauge of length 523mm that rocks for 26mm. (5 marks)

### QUESTION5

- a) (i) Derive from first principles the  $D_{\max}$  and  $D_{\min}$  expressions for the taper plug gauge shown (Fig Q5)
- (ii) On such a taper plug gauge the roller diameter is 9mm,  $h=51.3\text{mm}$ ,  $H=66.8\text{mm}$ ,  $M_2=51.82\text{mm}$ ,  $M_1=43.65\text{mm}$  and  $S=5\text{mm}$ . Determine:
- Taper angle
  - $D_s$
  - $D_{\min}$
  - $D_{\max}$  (14 marks)
- b) The M87 set of slip gauges has the following pieces (Table Q5)

Range (mm)	Steps (mm)	No. of pieces
Wear blocks 2.5	-	2
1.001 to 1.009	0.001	9
1.01 to 1.49	0.01	49
0.5 to 9.5	0.5	19
10 to 90	10	9
1.0005	-	1
	Total	87

Select the slips to build a length of 92.1765mm (6 marks)



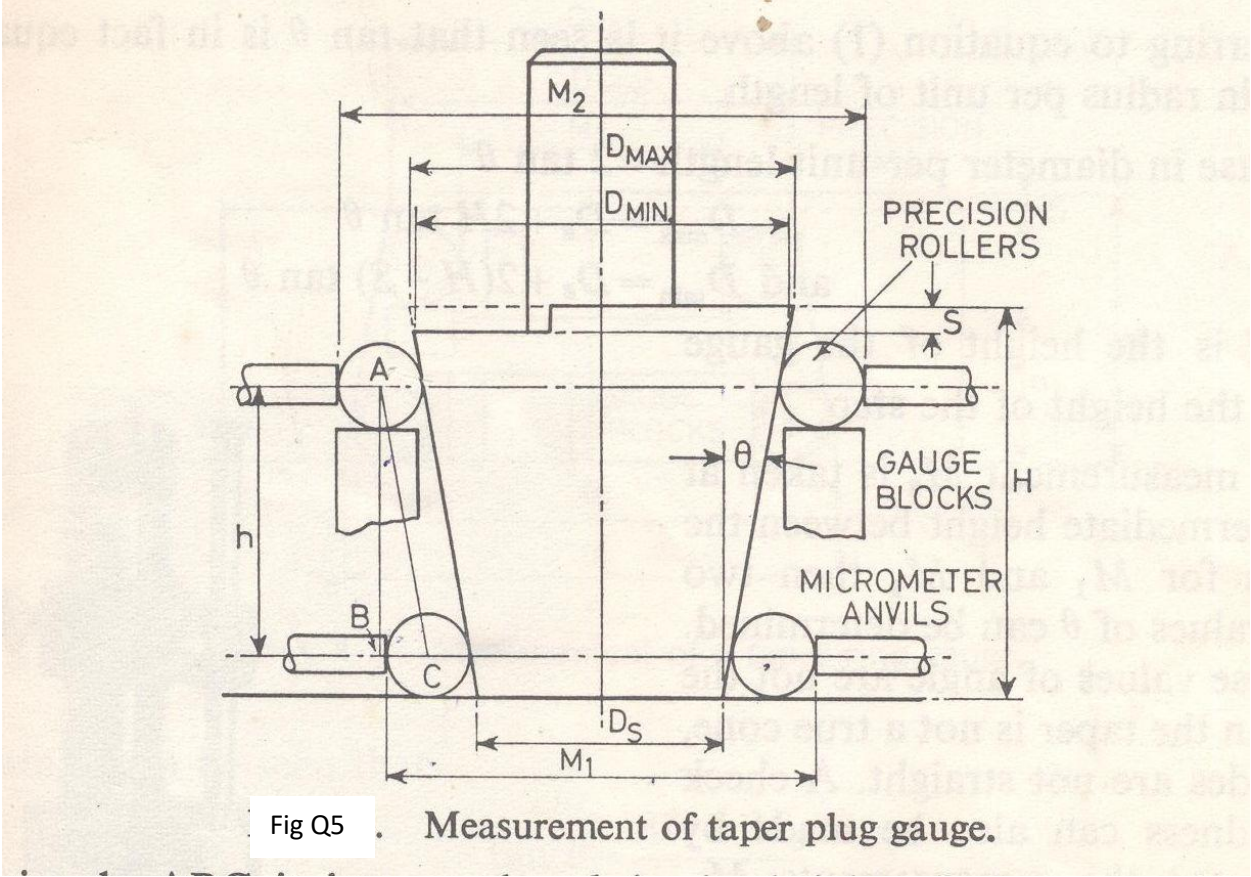


Fig Q5

Measurement of taper plug gauge.