



# MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN  
MECHANICAL ENGINEERING

SUPPLEMENTARY EXAMINATION

MED-PR 307: METROLOGY AND MEASURING INSTRUMENTS II

DATE: 1/9/2017

TIME: 2:00 – 4:00 PM

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## INSTRUCTIONS

*Answer all questions in Section A and choose any other TWO in Section B*

### SECTION A: (COMPULSORY-30 MARKS)

1. a) State any four factors to consider in the selection of a screw thread. (4 marks)
- b) Define the following terms as used in the measurement of screw threads;
  - i. Pitch
  - ii. Thread angle
  - iii. Crest
  - iv. Root
  - v. Flank (10 marks)
- c) Describe the following pitch errors in screw threads;
  - i. Thread drunkenness
  - ii. Periodic pitch error
  - iii. Progressive pitch error (9 marks)
- d) Show that the formula for calculation of simple effective diameter for ISO Screw thread is given by;  $E_d = T + P/2 \cot \theta - d(\operatorname{cosec} \theta - 1)$  Where;

Ed=Simple effective diameter

P= Nominal pitch

d=Wire diameter

$\Theta$  = semi-angle of the thread (7 marks)

**SECTION B (ANSWER ANY TWO QUESTIONS FROM THIS SECTION)**

2. a) Define the following terminologies with reference to gears;

i. Addendum.

ii. Dedendum.

iii. Diametral pitch. (6 marks)

b) i Show that the tooth thickness for a spur gear measured at the pitch line is given by

$$W = NM \sin\left(\frac{90^\circ}{N}\right)$$

Where W=Tooth Thickness

N= Number of Teeth

M= Module (5 marks)

ii Show that the depth from the top of the teeth for the above value of W is given by;

$$h = NM/2\left[1 + \frac{2}{N} - \cos\left(\frac{90^\circ}{N}\right)\right] \quad (5 \text{ marks})$$

c) Calculate the gear tooth vernier settings w and h to measure a gear of 133 teeth and module 3mm. (4 marks)

3. a) Define the following terms as applied to surface texture measurement.

i. Waviness

ii. Roughness

iii. Lay

iv. Flaws (8 marks)

b) With the aid of sketches explain the principle of operation of the following methods of measuring surface texture

i. Tomlison surface metre

ii. Talysurf (12marks)

4. a) Explain the effect of the following properties on surface texture;

- i. Wear resistance
  - ii. Fatigue life
  - iii. Bearing properties (9 marks)
- b) The Five highest peaks and Five deepest valleys were measured in mm from a line drawn on a surface roughness graphical traces as follows; 15,44,21,38,16,46, 17,42,18,49.if the vertical magnification was x 5000,Calculate  $R_z$  value of the surface. (6 marks)
- c) In an experiment to determine the texture of a surface the summation of all the areas of the trace was  $256\text{mm}^2$  over a length of 25mm.if the vertical magnification was x20000,Calculate the surface roughness in micrometres using the centre line average(C.L.A) technique. (5 marks)
5. a) Describe the following methods of inspection;
- i. Total inspection
  - ii. Sampling inspection (4 marks)
- b) Differentiate between inspection by variables and inspection by attributes. (4 marks)
- c) The table below indicates 100 observations of the length of a solid shaft.
- i. Draw a frequency distribution chart. (4 marks)
  - ii. A frequency polygon from the information given above. (8 marks)

Length in mm	Frequencies
9.0	2
9.1	4
9.2	6
9.3	10
9.4	14
9.5	30
9.6	14
9.7	8
9.8	6
9.9	4
10.0	2