



# MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING

MED-PR 307 METROLOGY AND INDUSTRIAL MEASUREMENTS II

DATE: 26/7/2019

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;  
 $E_d$ =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;
- Addendum.
  - Dedendum.
  - Diametral pitch. (6 marks)
- b) i) Show that the tooth thickness for a spur gear measured at the pitch line is given by
- $$W = NM \sin\left(\frac{90}{N}\right)^\circ$$
- 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;
- $$h = NM/2\left[1 + \frac{2}{N} - \cos\left(\frac{90}{N}\right)^\circ\right] \quad (5 \text{ marks})$$
- 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.
- Waviness
  - Roughness
  - Lay
  - Flaws (8 marks)
- b) With the aid of sketches explain the principle of operation of the following methods of measuring surface texture
- Tomlison surface metre
  - Talysurf (12 marks)
4. a) Explain the effect of the following properties on surface texture;
- Wear resistance
  - 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  $\times 5000$ , 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  $25\text{mm}$ . if the vertical magnification was  $\times 20000$ , 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 below. (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