



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

MED-PR 307: METROLOGY AND MEASURING INSTRUMENTS II

DATE: 27/7/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

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

SECTION A: (COMPULSORY-30 MARKS)

1. a) Define the following terminologies with reference to gears;
 - i Addendum.
 - ii Dedendum.
 - iii Diametral pitch.
 - iv Clearance (8 marks)
- b) With the aid of a sketch explain the working principle of a gear tooth vernier. (6 marks)
- c) 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 (6 marks)

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

$$h = M \left[1 + \frac{N}{2} \left(1 - \cos \left(\frac{90}{N} \right) \right) \right] \quad (6 \text{ marks})$$

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

SECTION B (ANSWER ANY TWO QUESTIONS FROM THIS SECTION)

2. a) Describe the following pitch errors in screw threads;
- i Thread drunkenness
 - ii Periodic pitch error
 - iii Progressive pitch error (6 marks)
- b) List three classes of fits for isometric threads and state where they are used. (3 marks)
- c) A Screw thread is designated as M8x2-6H/6g. State the meaning of each symbol. (5 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 (6 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 (12 marks)
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 256mm^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) Diffentiate 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