MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

**FIRST SEMESTER EXAMINATION FOR DIPLOMA IN MECHANICAL
ENGINEERING**

MED-PR 305: ENGINEERING DESIGN 1

DATE: 5/8/2016   **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

- **Answer question 1 (compulsory) and any other *TWO* questions**
- **You need drawing instruments to write this examination**

1. (a) State the fundamental difference between dimension tolerance and geometric tolerance.
                                                                              (4 marks)
   (b) Explain the meaning of the following terminologies as used in geometric tolerancing
        with aid of sketches

      (i)   Cylindricity
      (ii)   Angularity
      (iii)   True position
      (iv)   Symmetry   (16 marks)

   (c) Figure 2 shows a machine part casting with designer's instructions. Draw the machine
       part and add the information indicated according to BS 308. Only features having
       geometric tolerances need to be shown.

      (i)   The periphery at the considered cross section perpendicular to the axis of the
              machine part must be between two concentric cylinders one having a radius
              0.25mm larger than the other.
      (ii)   The axis of the four diameter 10mm holes must be contained in cylinders
              0.02mm diameter at the true position of the axis from the axis of hole A and
              projected from surface B at a height equal to the mating part.

(iii)   The axis of hole D is datum D. It must lie in a cylinder 0.05mm diameter inclined at 30^0 to the axis A.

(iv)   Surface B is datum. It must lie between two planes 0.03mm apart parallel to the datum E.

(v)   The run out on diameter 30mm must not exceed 0.1mm measured parallel to the axis of the hole.   (10 marks)

2. (a) Explain the principle of operation of each of the following mechanisms

      (i)   Screw thread
      (ii)   Cam
      (iii)   Linkages   (9 marks)

    (b) Explain the following concepts of machine guarding

      (i)   Interlock
      (ii)   Automatic
      (iii)   Fail- safe- design   (9 marks)

    (c) State any TWO potential dangers that an operator of a machinery may face during his normal working periods.

                      (2 marks)

3. (a) Define the term ergonomics   (2 marks)

    (b) Explain any *FOUR* additional scientific disciplines incorporated in the study of ergonomics

                      (8 marks)

    (c) Explain what you understand by the ergonomics control loop. Use a sketch for your answer.

                      (10 marks)

4. (a) With aid of a flow chart, illustrate the engineering design process stages.

                      (6 marks)

    (b) Design a simple mechanism for a motor car windscreen wiper.   (9 marks)

    (c) Explain FIVE reasons which may necessitate re-designing an engineering product

                      (5 marks)

5. (a) Sketch and explain four types of screw thread forms and state where they are applied in engineering.

                      (12 marks)

    (b) Figure 3 shows a plunger (B) and pointer (A), the pin on which the pointer pivots slides in the slot that is cut on the central part of the plunger.

      Design a mechanism that will enable pointer (A) to oscillate as the plunger (B) reciprocates along the length as shown by arrow C.   (8 marks)