



**B.E DEGREE EXAMINATIONS: APRIL / MAY 2023**

(Regulation 2017)

Fifth Semester

**MECHANICAL ENGINEERING**

U17MEI5202: Engineering Metrology and Quality Control

**COURSE OUTCOMES**

- CO1:** Apply knowledge of linear and angular measurements and effective communication for engineering practice
- CO2:** Apply knowledge of form measurements with effective communication for engineering application.
- CO3:** Explain the working principles of advanced instruments / equipment's used in metrology.
- CO4:** Construct various control charts for the variables and attributes.
- CO5:** Apply knowledge of various sampling methods, concepts, and reliability

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**  
**PART A (10 x 2 = 20 Marks)**  
**(Answer not more than 40 words)**

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|---|-----|------|
| 1. Define metrology and state the objectives of metrology.            | CO1 | [K2] |
| 2. List down different instruments used for angular measurement.      | CO1 | [K2] |
| 3. Sketch the defect of backlash in case of gear.                     | CO2 | [K2] |
| 4. Define the effective diameter of the thread.                       | CO2 | [K2] |
| 5. Mention the types of CMM.  | CO3 | [K2] |
| 6. Define Machine Vision.   | CO3 | [K2] |
| 7. State the meaning of Process capability, and how it is determined. | CO4 | [K2] |
| 8. State different types of control charts used in SQC.               | CO4 | [K2] |
| 9. What are the 3 approaches to lot sentencing?                       | CO5 | [K2] |
| 10. State merits and demerits of acceptance sampling.                 | CO5 | [K2] |

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

11. a) Explain with a neat sketch how a Vernier Caliper is used for linear measurements. 8 CO1 [K<sub>2</sub>]  
 b) Describe the various components of the Bevel protractor. 8 CO1 [K<sub>2</sub>]
12. a) Draw a neat, labeled sketch of a screw thread micrometer and state its principle of working. 8 CO2 [K<sub>2</sub>]  
 b) Explain the principle of operation of rolling gear tester. 8 CO2 [K<sub>2</sub>]
13. a) With a neat sketch, explain the working of AC LASER interferometer. 8 CO3 [K<sub>2</sub>]  
 b) Explain the procedure to be used in the measurement of various dimensions of a typical component using a cantilever type CMM. 8 CO3 [K<sub>3</sub>]
14. a) The following data show the values of the sample mean ( $\bar{X}$ ) and its range (R) for the samples of size 5 each. Calculate the values for control limits for the mean, range chart and determine whether the process is in control. 12 CO4 [K<sub>3</sub>]  
 (conversion factors for  $n = 5$ ,  $A_2 = 0.58$ ,  $D_3 = 0$  and  $D_4 = 2.115$ )
- | Sample No.         | 1    | 2    | 3    | 4    | 5    | 6   | 7    | 8   | 9    | 10   |
|--------------------|------|------|------|------|------|-----|------|-----|------|------|
| Mean ( $\bar{X}$ ) | 11.2 | 11.8 | 10.8 | 11.6 | 11.0 | 9.6 | 10.4 | 9.6 | 10.6 | 10.0 |
| Range (R)          | 7    | 4    | 8    | 5    | 7    | 4   | 8    | 4   | 7    | 9    |
- b) Describe the Computer Aided Inspection. 4 CO3 [K<sub>2</sub>]
15. a) Draw and explain the measurement of the effective diameter of a screw thread using three wires. 8 CO2 [K<sub>3</sub>]  
 b) Describe the benefits and limitations of SQC. 8 CO4 [K<sub>2</sub>]
16. a) List down different types of sampling plans and explain any of them in brief. 8 CO5 [K<sub>2</sub>]  
 b) What is an OC curve explain its significance in acceptance sampling. 8 CO5 [K<sub>3</sub>]

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