RollNo. | | | | | | | | | | |

**ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)**

**B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024**

MECHANICAL ENGINEERING BRANCH
Semester
**ME 5552 METROLOGY AND MEAUREMENTS**
(Regulation 2015 / 2019)

Time:3hrs Max.Marks: 100

CO1 To introduce the basic terminology of measurements and the procedure for estimating measurement uncertainty.
CO2 To give an overview of the various linear and angular measuring instruments used in industries.
CO3 To provide the necessary skills needed to perform tolerance analysis in manufacturing situations and to design gauges for limit measurement during manufacturing.
CO4 To give an understanding of the importance of surface metrology and the role of GD&T in manufacturing.
CO5 To expose the science behind the advanced measurements and their applications in manufacturing industries in quality control

**BL – Bloom's Taxonomy Levels**
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

**PART- A(10x2=20Marks)**
(Answer all Questions)

| Q.No. | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 1 | Why random error is very difficult to control? | 2 | 1 | 2 |
| 2 | 'Metrological instruments need periodical calibration'. State whether the statement is true or false and justify your answer. | 2 | 1 | 2 |
| 3 | What do you mean by end standard? | 2 | 2 | 1 |
| 4 | Why sine bar is not used for measuring angles greater than 45 º? | 2 | 2 | 2 |
| 5 | Differentiate between the terms : Allowance ,Tolerance | 2 | 3 | 2 |
| 6 | What do you mean by the term - Fit? | 2 | 3 | 1 |
| 7 | State the importance of GD&T in manufacturing industries. | 2 | 4 | 1 |
| 8 | List down some instruments which can be use for 3 D metrology. | 2 | 4 | 1 |
| 9 | What do you mean by constructive interference? | 2 | 5 | 2 |
| 10 | Why it is necessary to carry out probe tip calibration while using touch trigger probe in a CMM? | 2 | 5 | 2 |

**PART- B(5x 13=65Marks)**
(Restrict to a maximum of 2 subdivisions)

| Q.No. | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 11 (a) | Describe the following types of errors and state how they can be taken care of<br>(i)Error due to temperature (ii) Error due to vibration<br>(iii)Error due to poor alignment (iv) Error due to dirt | 13 | 1 | 2 |
| | **OR** | | | |
| 11 (b) | A machinist used a micrometer to measure the dimension of a component that he manufactured as part of a Measurement System Analysis project. The measurements were repeated five times and the mean of the five readings was 16.06 mm with a standard deviation of 20 µm. Estimate the expanded uncertainty | 13 | 1 | 4 |

five times as above; all other values remaining the same)? Why is the uncertainty in the second study by the other user higher / lower than the first instance?

| | | | | |
|---|---|---|---|---|
| 12 (a) | What makes a comparator more accurate than other conventional measuring instruments? Describe the magnification system adopted in any one mechanical –optical comparator. | **13** | 2 | 2 |
| | **OR** | | | |
| 12 (b) | Cumulative error present in a gear has to be measured .Suggest a suitable instrument and explain how it can be used to measure the cumulative error. | **13** | 2 | 3 |
| 13 (a) | What is the need for tolerance stackup analysis? Write a brief note on worst case and RSS tolerance stack up analysis with a simple example. | **13** | 3 | 4 |
| | **OR** | | | |
| 13 (b) | Describe the general type of GO and NOGO gauges for the components having 30 $H_7 f_8$ fit. Assume gauge tolerance and wear allowance to be 10% of work tolerance. | **13** | 3 | 4 |
| 14 (a) | The straightness of a machine tool bed has to measured. Suggest a suitable measuring instrument to measure the straightness and explain the procedure you will be adopting to measure the straightness of the machine tool bed. | **13** | 4 | 3 |
| | **OR** | | | |
| 14 (b) | Is surface finish a macro geometrical error or micro geometrical error ? Suggest a suitable instrument to measure the surface roughness and explain its working. | **13** | 4 | 3 |
| 15 (a) | Explain how a laser source can be used for the alignment of components in a machine tool manufacturing company. | **13** | 5 | 3 |
| | **OR** | | | |
| 15 (b) | Discuss on the effects of implications of online inspection in manufacturing industries. | **13** | 5 | 4 |

## PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

| Q.No. | Questions | Marks | CO | BL |
|---|---|---|---|---|
| 16. | Discuss on the following<br>(i)Interchangeable system of manufacturing increases the productivity and reduces the cost of manufacturing | **7.5** | 2 | 5 |
| | (ii)'The process capability of the measuring instrument should be lesser than the tolerance of the measurand' | **7.5** | 2 | 5 |