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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

SUMMER TERM END TERM EXAMINATION – AUGUST 2024

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| **Semester : B.TECH. - Summer** | **Date : 06-08-2024** |
| **Course Code : MEC2015** | **Time : 09.30am to 12.30am** |
| **Course Name : Metrology and Mechanical Measurements** | **Max Marks : 100** |
| **Program : B.TECH.** | **Weightage : 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific, non-programmable calculator and MMM Data sheet are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | What are the key differences between Line and End standards? | (CO 1) | [Knowledge] |
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| 2 | How do accuracy and precision differ in terms of measuring the proximity of a measurement to a true or accepted value, and the consistency of multiple measurements? | (CO 2) | [Knowledge] |
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| 3 | What role does a Coordinate Measuring Machine (CMM) play in metrology? | (CO 4) | [Knowledge] |
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| 4 | Why is the "best wire size" important when measuring the effective diameter using the three-wire method? | (CO 5) | [Knowledge] |
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| 5 | What are the definitions of 'addendum' and 'dedendum' in relation to screw threads? | (CO 3) | [Knowledge] |
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| 6 | How are plain gauges classified when used to check the dimensions of a hole or shaft? | (CO 2) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | Discuss the advantages and limitations of using non-contact measurement techniques, such as laser scanning and optical systems, in modern metrology. How do these techniques compare with traditional contact-based measurement methods? | (CO 4) | [Comprehension] |
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| 8 | The National Physical Laboratory (NPL) is the UK's metrology institute. Can you identify and describe a tool endorsed by the NPL for inspecting the flatness between gauge surfaces? | (CO 3) | [Comprehension] |
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| 9 | Given a 75 mm shaft rotating in a bearing, with tolerances of 0.075 mm for both the shaft and the bearing, and a required allowance of 0.10 mm, determine the dimensions of the shaft and the bore of the bearing using the basis hole system. | (CO 4) | [Comprehension] |
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| 10 | Describe the different types of pitch errors that can occur in screw threads. What are the causes of these errors, how do they manifest in the thread profile, and what impact do they have on the functionality and mating of threaded components? | (CO 5) | [Comprehension] |
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| 11 | What is the significance of Datum in Geometric Dimensioning and Tolerancing (GD&T), and how does it establish a reference framework for dimensional measurements? Also, describe the different types of Datum. | (CO 2) | [Comprehension] |
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| 12 | Explain with a neat diagram the concepts of Maximum Material Condition (MMC) and Least Material Condition (LMC) for both holes and shafts. | (CO 2) | [Comprehension] |
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| 13 | For a medium force fit on a 75 mm shaft, where both the hole tolerance and shaft tolerance are 0.225 mm, and the maximum interference is 0.0375 mm, calculate the appropriate dimensions for the hole and shaft using the basis hole system. | (CO 3) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | For a hole and shaft pair with a nominal size of 25 mm, targeting a clearance fit with a maximum clearance of 0.02 mm and a minimum clearance of 0.01 mm, calculate the following:  (a) The permissible limits for both the hole and the shaft using the hole basis system.  (b) The permissible limits for both the hole and the shaft using the shaft basis system. | (CO 5) | [Application] |
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| 15 | An engineer needs to verify the fit of a shaft using a gauge. Identify the appropriate type of gauge, and provide a detailed diagram with labels. | (CO 2) | [Application] |
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| 16 | A mechanical engineering company is designing a precision assembly that involves a fitting between a hole and a shaft. The hole, with a nominal size of 85 mm, will be finished using broaching and honing, while the shaft, requiring an F-type fit, will be produced on a capstan lathe. | (CO 4) | [Application] |
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