Dr Akhilesh Kumar 9/12/2022

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National Institute of Technology Hamirpur

Department of Mechanical Engineering

End Semester Examination (Nov/Dec. 2022)

Sub.: Metrology and Measurement (ME-214) **Time: 03 hrs.**

Instruction: *All **questions** are compulsory and carry **equal** marks.*
Assume suitable data and clearly mention it, if needed.

1. Define limits, fits and tolerances. Define different types of fits and show these types through a schematic sketch.
2. Define hole and shaft. Also, indicate hole basis system and shaft basis system schematically. Which system is widely preferred and why?
3. What is the significance of feature inspection? Define straightness, flatness, parallelism and roundness. How is straightness measurement correlated with flatness measurement?
4. Explain why it is preferred not to use a Sine bar for generating/measuring angles larger than 45^0, if high accuracy is demanded. Explain by supporting the answer mathematically.
5. Define pressure. Explain in brief a pressure measurement technique with a clear schematic labeled diagram.
6. Where thermocouples and pyrometers are used? Explain their working principles and the associated limitations of these instruments separately.
7. Explain in short about load cell, tachometer, stroboscope and accelerometer separately. How is power developed by an engine measured?
8. A hole and shaft system has the dimensions: 40 H6/c6. Sketch and state the type of fit and show these upon the actual dimension of hole and shaft. Also, calculate the corresponding maximum and minimum fit values. Use the following data:

   Diameter 60 lies in the diameter step of 30 to 50 mm.

   Fundamental tolerance unit, i (μm) = $0.45\ D^{1/3} + 0.001\ D$

   where D is the representative size in mm;

   Tolerance value for IT6 = $10i$

   Fundamental deviation for c shaft = - (95+0.8D) μm

9. What is the significance of surface finish in industrial applications? Define Ra, Rt and Rz with neat schematic diagrams.
10. Determine the dimension of GO and No-GO plug gauges using unilateral and bilateral systems separately to check the hole of dimension $40 \pm^{0.05}_{0.05}\ mm$ considering wear allowance as 10% of work tolerance.

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ALL THE BEST