



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M.Tech. - Mechanical Engineering (MCIM)

Semester End Examination; May/June - 2018

Metrology and Computer Aided Inspection

Time: 3 hrs

Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.

ii) Assume suitable missing data if any.

UNIT - I

- 1a. Draw a neat sketch of 'Progressive' type snap gauge and give any four advantages and disadvantages of this type of gauging. 8
- b. Determine the tolerances on the hole and the shaft for a precision running fit designated by 50H7/g6. You may use the following aid for solving the problem or use IS: 919 for convenience. 50 mm lies between the range 30 - 50 mm, $i = 0.46 (D)^{1/3} + 0.001 (D)$ (microns), Fundamental deviation for H hole = 0, Fundamental deviation of g shaft = $-2.5 D^{0.34}$. State the actual maximum and minimum sizes of the both hole and shaft and maximum and minimum clearances. 8
- c. Write a brief note on the 'selective assembly' of machined parts. 4
- 2a. Discuss the following types of fits and how they can be achieved : 8
- i) Selective fit ii) Push fit iii) Driving fit iv) Shrinkage fit
- b. Calculate the dimensions of plug and ring gauges to control the production of 50 mm shaft and hole pair of H₇d₈ as per IS specification. The following assumptions may be made :
50 mm lies in diameter step of 30 and 50 mm and the upper deviation for 'd' shaft is given by $-16D^{0.44}$ and lower deviation for the hole H is zero. 8
- Tolerance unit i (microns) = $0.45\sqrt[3]{D} + 0.001D$ and IT6 = 10 i and above IT6 grade the tolerance magnitude is multiplied by 10 at each fifth step.
- c. Describe the various types of errors on screw threads and explain the reasons for the same. 4

UNIT - II

- 3 a. With a neat sketch, explain straightness test by using spirit level and autocollimator. 8
- b. Describe the four reference circles used in measurement of roundness. 8
- c. Explain the following surface roughness parameters : 4
- i) R_a
- ii) R_t
- 4 a. With a neat sketch, discuss the squareness testing by indicator method. 8
- b. With a neat sketch, explain the construction and working principle of Tomlinson surface meter and state its advantages. 12

UNIT - III

- 5 a. Explain the following alignment tests performed on pillar type drilling machine with a simple sketch :
- i) Flatness of clamping surface of base 12
 - ii) Perpendicularity of drill head guide with table
 - iii) Squareness of clamping surface of table to its axis
- b. Discuss any two types of contact and non-contact probes used in CMM. 8
- 6 a. Name the various alignment tests to be performed on a lathe. Describe any three of them in detail. 12
- b. Distinguish between the following :
- i) Alignment test and performance test of a machine tool 8
 - ii) Geometric and practical tests on a machine tool

UNIT - IV

- 7 a. Give a brief description of components involved in laser interferometer. 10
- b. Explain the following with respect machine vision :
- i) Normalization 10
 - ii) Gray scale color relation
 - iii) Template techniques
- 8 a. Explain the following with sketches :
- i) Laser triangulation sensors 12
 - ii) Gauging wide diameter from the diffraction pattern formed in a laser
 - iii) Two-frequency laser interferometer
- b. Discuss the various stages involved in the operation of a machine vision system. 8

UNIT - V

- 9 a. Discuss the Zeiss slip gauge interferometer in checking of slip gauges. 10
- b. List out the sources of uncertainty in measurements. 10
- 10 a. Explain the measurement of following limit gauges with suitable sketches :
- i) Parallel screw plug gauges 10
 - ii) Parallel screw ring gauges
- b. Briefly explain the length measurement uncertainty of CMM. 10

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