



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

*(An Autonomous Institution affiliated to VTU, Belagavi)*

**Second Semester, M. Tech - Mechanical Engineering (MMDN)**

**Semester End Examination; June - 2017**

**Metrology and Computer Aided Inspection**

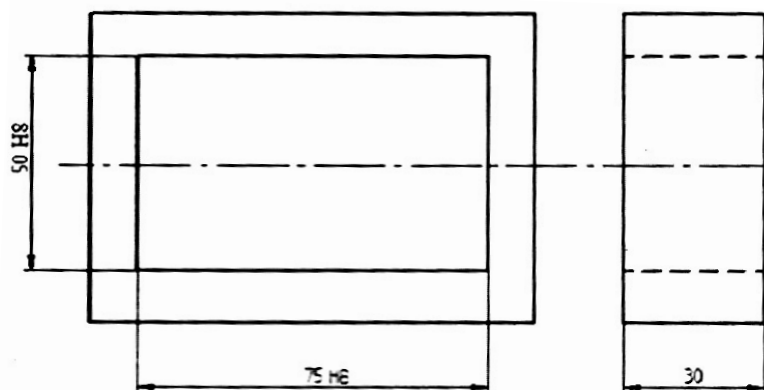
Time: 3 hrs

Max. Marks: 100

*Note: i) Answer FIVE full questions, selecting ONE full question from each unit.  
ii) Assume suitable data, if any.*

**UNIT - I**

- 1 a. Explain briefly the following : 8
  - i) Interchangeable manufacture ii) Selective assembly.
- b. Determine the actual dimensions to be provided for a shaft and hole of 90 mm size for H<sub>8</sub>e<sub>9</sub> type clearance fit. Size 90 mm falls in diameter steps of 80 and 100. Value of standard tolerance unit  $i = 0.45\sqrt[3]{D} + 0.001D$ . Value of tolerances for IT<sub>8</sub> and IT<sub>9</sub> grades are 25i and 40i. Value of fundamental deviation for 'e' type shaft is  $-11D^{0.41}$ . Also design the GO and NO GO gauges, considering wear allowance as 10% of gauge tolerance. 8
- c. Discuss the various geometric characteristics and symbols used in GD and T. 4
- 2 a. Calculate the limits of size for inspection gauges confirming to Taylor's principle to check the rectangular hole shown in Fig.2a. The limits of size for a 50 mm H8 hole are low limit 50.000 mm, high limit 50.039 mm. The limits of size for a 75 mm H8 hole are low limit 75.000 mm, high limit 75.046 mm. Use IS:919 or use the following information: fundamental deviation for H hole = 0,  $IT_8 = 25i$ ,  $i(\text{micron}) = 0.45\sqrt[3]{D} + 0.001D$ , 50 mm is in diameter step 30-50, 75 mm is in diameter step 50-80.



**Fig: 2a**

- b. Draw a neat sketch of 'progressive' type snap gauge and give any four advantages and disadvantages of this type of gauging. 10

**UNIT - II**

- 3 a. Discuss any four cases of parallelism of lines and planes. 8
- b. Explain the construction and working principle of Tomlinson surface meter with neat sketch and state its advantages. 12
- 4 a. Describe a method to find out the flatness of a surface plate. 6
- b. Describe four reference circles used in measurement of roundness. 8
- c. Explain the following surface roughness parameters : 6
- i) Ra                      ii) Rt                      iii) Rz.

**UNIT - III**

- 5 a. Name the various alignment tests to be performed on a lathe. Describe any three of them in detail. 12
- b. Discuss any two types of contact probes used in CMM. Also discuss the calibration of probes. 8
- 6 a. Describe the following tests that are carried out on milling machines with sketches : 12
- i) Axial slip of a spindle                      ii) True running of inner taper of spindle
- iii) Parallelism of work table surface to spindle axis.
- b. Explain the working principle of co-ordinate measuring machine and discuss its advantages over manual inspection methods. 8

**UNIT - IV**

- 7 a. Explain shape identification and edge detection techniques of machine vision system. 10
- b. Explain the following with sketches : 10
- i) Laser scanning gauge
- ii) Gauging wire diameter from the diffraction pattern formed in a laser.
- 8 a. Give a brief description of components involved in laser interferometer. 10
- b. Discuss the various stages involved in the operation of a machine vision system. 10

**UNIT - V**

- 9 a. Explain the measurement of following limit gauges with suitable sketches : 12
- i) Taper plug gauges                      ii) Taper ring gauges.
- b. List out the sources of uncertainty in measurements. 8
- 10a. Discuss the important considerations for the design of automatic gauging systems with suitable sketches. 12
- b. Discuss the possible factors which could contribute significantly to the uncertainty of measurement in CMM. 8