

END TERM EXAMINATION

SIXTH SEMESTER [B.TECH.] MAY-2010

Paper Code: ETME306

Subject: Metrology

Paper Id: 36306

Maximum Marks :75

Time : 3 Hours

Note: Q.1 is compulsory. Attempt one question from each unit. Assume missing data, if any.

- Q1 (a) Answer the following briefly and to the point only:- **(1.5x10=15)**
- Why parallel light must be used when projecting cylindrical objects in a projector?
 - Why monochromatic light is used for interferometry work and not the white light?
 - How is parallax error taken care of in sigma mechanical comparator?
 - What do you mean by 'cosine error'? Give examples.
 - Select the size of angle gauges required to build $32^{\circ}51'24''$.
 - Why is it not preferred to use sine bar for measuring angles more than 90° ?
 - Explain giving reason if a standard gauge can be used to check an interference fit?
 - Name only the various alignment tests that can be performed on lathes.
 - What are various types of fits and state how a fit is designated?
 - Explain how "progressive pitch error" arises in screw threads?
- (b) Differentiate between the following, giving sketches wherever necessary:- **(2x5=10)**
- Repeatability and Reproducibility of measurements.
 - Hole basis system and shaft basis system and state which system is usually preferred.
 - Accuracy, precision and sensitivity of an instrument.
 - 'GO' and 'NO GO' type plug gauges.
 - Electrical and Mechanical comparator.

UNIT-I

- Q2 (a) Distinguish between Primary, Secondary, Tertiary and working standards of length. **(4)**
- (b) What is the effect of temperature variation on the measurement? **(3)**
- (c) What are the possible sources of error in measurement? Which types of error can be avoided during precision measurements? **(5.5)**
- Q3 (a) Define and explain with an example the Taylor's principle of limit gauges. **(4)**
- (b) A hole and shaft system is designated as 75H8/g7. The standard tolerance is given by : $i = 0.45(\sqrt[3]{D}) + 0.001D$. The fundamental deviation for shaft 'g' is given by $2.5(D)^{0.34}$. The diameter steps are 50 to 80mm. **(8.5)**
- Sketch the fit and show the tolerance upon the actual dimensions of hole and shaft.
 - Design the limit gauges for the above hole.

P.T.O.

UNIT-II

- Q4 (a) What are essential requirements of a good comparator? How have these features been achieved in Sigma Mechanical Comparator (SMC)? (5)
- (b) How can the sensitivity of a pneumatic comparator be changed? (2.5)
- (c) Describe the working principle of optical comparator. (5)
- Q5 (a) A 100mm sine bar is to be set up to an angle of 32.5° . Determine the slip gauges needed. Also estimate the error in the angle if: (8)
- (i) the distance between rollers is not correct by $\pm 0.01\text{mm}$.
- (ii) if diameter of rollers is out by $\pm 0.005\text{mm}$.
- (iii) if error of parallelism between top surface and the line joining centre of rollers is $\pm 0.02\text{mm}$.
- (iv) if all the three errors exist simultaneously.
- (b) A 120mm diameter shaft has light parallel side splines. Describe how would you check the width of the splines, the angular spacing and their parallelism with the shaft axis. (4.5)

UNIT-III

- Q6 (a) Explain the Three Wire Method of measuring effective diameter of a screw thread. (5)
- (b) In measuring the thread angle of a standard metric thread the diameters measured over the wires of 0.750 and 1.500 are 19.50 and 21.75mm respectively. Find the angle of the thread and the possible error in the measurement if the diameters of the wires are certified to an accuracy of within one micron and each measurement over the wires is having a possible error of 0.01mm. (7.5)
- Q7 (a) What are the various elements of a spur gear which need to be inspected for accuracy? Name the instruments required in the inspection of these elements with their expected accuracies. (6)
- (b) Explain what is meant by constant chord calliper settings? Calculate the chord length and its distance below the tooth tip for a gear of module 3mm and 20° pressure angle. (6.5)

UNIT-IV

- Q8 (a) What are the advantages of laser as a light source in interferometric measurement? Explain the formation of interference fringes, when the light falls on an optical flat resting on a lapped surface? (10)
- (b) At what angle to the optical flat, the fringe pattern should be observed and why? (2.5)
- Q9 (a) What is the effect upon the work-piece, if a lathe tail-stock centre line is parallel to but slightly below the head stock spindle axis. (3.5)
- (b) If in a surface roughness measurement test, the height of 15 successive peaks and valleys measured from datum are: 43, 28, 38, 15, 25, 36, 18, 25, 20, 34, 42, 19, 37, 22, 36. If these measurement were made over a length of 25mm, determine the CLA and RMS values of the surface. (5)
- (c) Explain the principle of alignment as applied to measuring instruments and machine tools. (4)