BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00982

Term-End Examination

December, 2011

BME-014 : METROLOGY AND INSTRUMENTATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **Five** questions. All questions carry **equal** marks. Use of scientific calculator is permitted.*

1. (a) Differentiate between primary and secondary standards of measurement. **3**

(b) Give units of **5**

(i) Force (ii) Work (iii) Power

How do you derive unit of force by using second law of motion. Will there be different units for above mechanical quantities in SI and FPS system ? Name units in both systems.

(c) A winch crab requires a work of 2Nm/min for causing it to move without lifting any load. For lifting an unknown load w newtons through a height of 2m in 2 min. an effort F = 25 N works over a distance of 10 m. Find the work done by machine in Joules (J) and upon the load w in J. Also find power in kW. 6

2. (a) Define following standard units of 5

(i) luminous intensity,

(ii) current and

(iii) voltage

What are resistance, current and voltage standards ?

(b) The economy of a car is described as 23km/ litre. What will be the economy in miles/gallon ? One gallon = 231 in^3. 4

(c) Resistance (Ω) of a wire at temperature T ($^\circ$C) is given as $R = R_0 [1 + \alpha (T - 18)]$ 5

where R_0 (Ω) is the resistance of wire at 18°C and α is in 1/°C convert the equation to have temperatures T and 18 in $^\circ$F.

3. (a) Define 5

(i) arithmetic mean

(ii) median

(iii) mode

(iv) geometric mean

(v) harmonic mean

(b) For the following observations of length find arithmetic mean, geometric mean, median and mode. 5

x (mm) – 5.12, 5.15, 5.16, 5.18, 5.20, 5.21, 5.24, 5.25,

(c) How are errors normally distributed ? Show on sketch the most common distribution of error and describe characteristics in terms of 50%, 68%, 95% and 99% data. 4

4. (a) Define fit and its classes. 3

(b) What are two systems of fit ? Illustrate with the help of diagrams. 5

(c) Define tolerance. What are unilateral and bilateral tolerances. Find the type of fit and amount of maximum and minimum clearance/ interference for a pair of shaft and hole defined as follows : 6

Shaft dia : $45^{+0.055}_{+0.050}$

hole dia : $45^{+0.050}_{-0.025}$

5. (a) Make a list of gauges that are used in production. Describe two of them which are applied on internal surface. 5

(b) Name the gauges to be used for following : 5

(i) Pulley (ii) Wire

(iii) Thread (iv) Shaft.

Sketch two of these gauges and mention the material in which they are made.

(c) Would you include an outside caliper in the group of gauges ? Can it be used as a "go no go" gauge ? 4

6. (a) Sketch and describe 6

(i) Inside spring caliper

(ii) Inside firm joint caliper and

(iii) Transfer caliper

(b) Explain with the help of diagram how an internal hole diameter is measured with inside micrometer. 6

(c) Mention names of micrometers used on external side and the uses. 2

7. (a) What is a sine bar ? How is it used to measure an angle between two surfaces ? Could you measure all angles with this arrangement ? 5

(b) What is the purpose of a spirit level ? How does it differ from clinometer ? 5

(c) How does a comparator differ from a measuring device ? Describe principle of an optical comparator. 4

8. (a) What instruments are used for measuring flatness or small differences in length ? Describe one such instrument with the help of sketch. 8

(b) Two light waves represented by 6

$E_1 = E_0 \sin (wt - \phi_1)$ and

$E_2 = E_0 \sin (wt - \phi_2)$

travel in the same planes. Find the condition of extinction of light.