B.E.(with Credits)-Regular-Semester 2012-Mechanical Engineering Sem V

ME504 - Mechanical Measurement

P. Pages : 2 **GUG/W/16/3797**

Time : Three Hours * 3 9 8 7 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Answer Que. No. 1 or 2, 3 or 4, 5 or 6, 7 or 8 & 9 or 10.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of non-programmable calculator is allowed.

1. a) Draw the generalised block diagram of measurement system and explain various elements in it. **8**

b) A simple supported beam carries a concentrated Load P at its midpoint corresponding to various values of P. the maximum deflection Y is measured. **8**

P(kgf)	100	120	140	160	180	200
Y(cms)	0.45	0.55	0.60	0.70	0.8	0.85

For above set of observation obtain the equation of best fit line. Also find sensitivity & linearity.

OR

2. a) Explain the following. **8**

i) Threshold & Resolution

ii) Calibration of instruments

iii) Hysteresis & dead zone

iv) Desired & undesired input

b) Draw the generalized input – output configuration of a measurement system. Explain the terms desired, modifying and interfering input. Enlist Methods to correct spurious inputs. **8**

3. a) Derive and explain the response of the first order system when subjected to step input. Graphically explain the meaning of steady state & transient error obtained in it. **8**

b) A thermometer is initially at a temperature of 20ºC and is suddenly plunged into a liquid bath, which is maintained at 150ºC. The thermometer indicated 95ºC after time interval of 3 seconds. Estimate time constant for thermometer also calculate indicated temperature when time is five tunes time constant & comment on result. **8**

OR

4. a) What is noise? Enlist various methods of reducing effect of noise & interference. **6**

b) Show that spring mass damper system is a 2^{nd} order system. **6**

c) What is signal? Give its classification. **4**

5. a) Sketch and explain the working of linear variable differencial transducer. **8**

b) The diaphragms of a pressure measuring transducer are $2cm^2$ in area and 2.5 mm apart and the system has a capacitance of 250×10^{-12} farads. When a pressure of 10^4 N/m^2 is applied to the diaphragm there results a deflection of 0.25 mm in the diaphragm. Determine the change in the capacitance of system. **8**

OR

6. a) Explain the working of stroboscope for measurement of speed. **8**

b) Explain the working principle of drag cup tachometer with neat sketch. **8**

7. a) Describe the principle of operation of resistance strain guage. **8**

b) A 100Ω strain gauge is bonded to a Low carbon steel bar which has been subjected to tensile load. The bar has a preload uniform c/s area of 0.5×10^{-4} m^2 and youngs modulus for low carbon steel is 200 GN/m^2. If a load of 50 kN produces a change of 1Ω in guage resistance, determine the gauge factor for strain gauge. **8**

OR

8. a) Explain with neat sketch mcleod gauge used for measurement of vacuum. **8**

b) A shaft transmits a maximum power of 50 kw when running at a constant speed of 1500 rpm. Measurements of torque are made by a power of strain gauges which are bonded onto a specially machined portion of shaft. Each gauge has a nominal resistance of R = 120 Ω, gauge factor F = 2.0 and are connected electrically to the two arm of a half activated wheat stone bridge circuit which is energised with an excitation voltage of 6 Volts. If the gauges have a maximum strain of 0.0015, calculate shaft diameter. The modulus of elasticity of shaft material is 200 GN/m^2. **8**

Find out output voltage & sensitivity of measuring system.

9. a) Explain with sketch the working of Total Radiation Pyrometer. **8**

b) Explain the construction & working of Rotameter. **8**

OR

10. a) Explain the various forms of thermistors & Discuss the working of thermistor giving its advantages. **8**

b) Explain – **8**

i) Ultrasonic system of level measurement

ii) Hot wire Anemometer

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