

B.Tech. Degree VI Semester (Supplementary) Examination, October 2009

ME 603 INSTRUMENTATION THEORY AND CONTROL ENGINEERING (2002 Scheme)

Time: 3 Hours

Maximum Marks: 100

- I a) Explain the following static characteristics.
- | | | |
|-----------------------|------------------|------|
| (i) Accuracy | (ii) sensitivity | |
| (iii) Reproducibility | (iv) Dead zone | |
| (v) Resolution | (vi) Hysteresis | (12) |
- b) A voltage has a true value of 1.50 V. An instrument with a scale range of 0 – 2.5 V, shows a voltage of 1.46 V. What are the values of
- | | | |
|---|-----------------|-----|
| (i) Absolute error | (ii) Correction | |
| (iii) % Relative error with respect to true value | | |
| (iv) % Relative error with reference to F.S.D. | | (8) |

OR

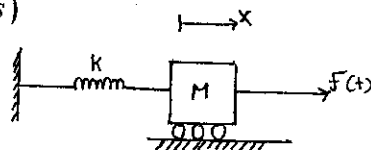
- II a) A thermometer is calibrated for 100° C to 200° C. The accuracy is specified within $\pm 0.2\%$. What is the maximum static error? (4)
- b) Develop the mathematical model of a first order instrument. (8)
- c) Differentiate between
- | | |
|--|-----|
| i) Accuracy and precision | |
| ii) Systematic error and random error. | (8) |

- III a) Explain the working of (i) load cells (ii) RTDS. (12)
- b) Explain any one torque measuring technique. (8)

OR

- IV a) Differentiate between bonded and unbonded strain gauges. (8)
- b) Suggest a suitable technique to measure a temperature of about 1000° C of a glowing matter. Explain the technique. (12)

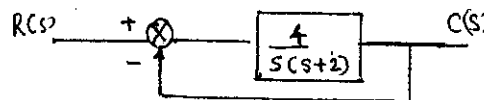
- V a) Find $\frac{X(s)}{F(s)}$ for the given mechanical system.



- b) Compare the different actuators used in Robot Arm System. (8)

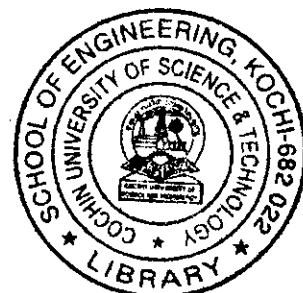
OR

- VI a) Find the closed loop transfer function of the given system and find
- | | |
|----------------------|--|
| i) Natural frequency | |
| ii) Damping ratio | |



- b) For a closed loop system $G(S)H(S) = \frac{10}{S(S+1)(S+2)}$; find the steady state error when it is subjected to a step input $r(t) = 2t$ (8)

(Turn over)



- VII a) Find the number of roots in right half of S-plane for the given characteristic equation. State whether the system is stable.

$$F(S) = 2S^6 + 4S^5 + S^4 - 32S^3 + 51S^2 + 3S + 1S$$
 (12)
 b) Define gain margin and phase margin. (8)
- OR**
- VIII a) Sketch the Bode plot for the transfer function $G(S) = \frac{1000}{(1 + 0.1S)(1 + 0.001S)}$
 Determine:
 i) Phase margin
 ii) Gain margin
 iii) Whether the system is stable. (16)
 b) State Lyapunov's Stability theorem. (4)
- IX a) Compare the performance of proportional, derivative and integral controllers. (12)
 b) Explain the working of stepper motor. Why is it popular in control systems? (8)
- OR**
- X a) Write short notes on
 i) Servo motors
 ii) Synchros (12)
 b) Explain any one pneumatic controller. (8)
