

T.E. Mech. V - EBSGS

23.5.17

(3 Hours)

[Total Marks : 80

- N. B. : (1) Question No.1 is compulsory.
 (2) Attempt any **three** questions out of remaining **five** questions.
 (3) Figures to right indicate full marks.
 (4) Assume suitable data if **necessary**.
 (5) Notations carry usual meaning.

1. (A) What are "Desired", "Modifying" and "Interfering" inputs for an instrumentation system? Draw block diagram for showing their influence on the output. 8
 (B) Define the following terms with reference to the state space modelling of the system. 6
 (a) State space (b) State variables
 (C) Explain the following terms with reference to static characteristics of the measuring instruments. 6
 (a) Hysteresis (b) Drift
2. (A) What is mathematical modeling? Explain the importance of mathematical modelling in control systems. 6
 (B) With a neat sketch explain the working of strain gauge based accelerometer. 6
 (C) Obtain the state-space equation and output equation for the system defined by the equation, 8

$$\frac{Y(s)}{U(s)} = \frac{2s^3 + s^2 + s + 2}{s^3 + 4s^2 + 5s + 2}$$

3. (A) With a neat sketch explain the constructional feature and working of (i) Thermistors. (ii) Ultrasonic Flow meter. 10

- (B) For a system having $G(s) = \frac{15}{(s+1)(s+3)}$, $H(s) = 1$, determine 10

- (i) Characteristic equation
 (ii) ω_n and damping ratio (ξ)
 (iii) Time at which 1st overshoot will occur
 (iv) Time period of oscillations
 (v) No. of cycles output will perform before settling down

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4. (A) What are different temperature compensation techniques used in the measurement of strain using strain gauges? Explain any two methods in detail. 10
- (B) For a system having $G(s) H(s) = \frac{K(1+s)^2}{s^3}$, find range of values of "K" for system to be stable, using Routh's array. 10
5. (A) For a certain feedback system having, 10
- $$G(s) H(s) = \frac{3(s+1)(s+6)}{s^2(s^2+18s+400)}$$
- Sketch Bode plot and comment on G.M., P.M and stability.
- (B) With a neat sketch explain the constructional feature and working of (i) McLeod gauge and (ii) Pyrometers. 10
6. (A) For a unity feedback system having $G(s) = \frac{100(s+1)}{s^2(s+2)(s+10)}$, determine 10
- (i) Type of system (ii) Error coefficients (iii) Steady state error for input as $1+4t+\frac{t^2}{2}$.
- (B) With neat sketches discuss significance of following aspects of signal conditionings for any one of the sensor: amplification, conversion filtering, modulation/demodulation, and grounding. 10