

T.E. Sem V CBSGS
Mechanical Engg.
Mechanical Measurement & Control

17/5/2016
3 pm to 6 pm

QP Code : 31079

[1]
03 Hrs

[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.

- Q.1(A) Explain generalized measurement system elements with block diagram. 05
- (B) What is mathematical modeling? Write significance of mathematical modeling in control systems. 05
- (C) Write short note on PID controller. 05
- (D) Write the working principle of piezoelectric accelerometer 05
- Q.2 Explain the following terms with respect to the measurement system: (i) 05
- (A) Span and Range (ii) Drift
- (B) Illustrate the working principle of "Nozzle flapper" for displacement measurement. 05
- (C) Convert the following state-space system of a single input single output system into a transfer function: 10

$$\begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} = \begin{bmatrix} -3 & 2 \\ 1 & 1 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} + \begin{Bmatrix} 0 \\ 2 \end{Bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix}$$

Here x_1 and x_2 are state-variables, $u(t)$ is a force vector and $y(t)$ being the system response.

- Q.3(A) With a neat sketch explain working of an Operational Amplifier (Op-amp). Enumerate limitations of the same. 05
- (B) What are desired, interfering and modifying inputs w.r.t. measurement of a system? 05

PTO

(C) For a unity feedback system having $G(s) = \frac{10(s+1)}{s^2 (s+2)(s+10)}$ determine

(i) error coefficients (ii) SteadyState error for input as $1 + 4t + \frac{t^2}{2}$

Q.4(A) What are the different elastic transducers used for the pressure measurement. Illustrate the working principle of any one in detail. 10

(B) A system is represented by the equation $S^8 + 5S^6 + 2S^4 + 3S^2 + 1 = 0$. Examine the stability of the system by using Routh's criterion. 10

Q.5(A) Sketch Bode plot and assess the stability for the control system having open loop transfer function 10

$$G(S)H(S) = \frac{120}{(S+2)(S+10)}$$

(B) With a neat sketch explain the constructional feature and working of (i) Ionization Gauge, (ii) Thermocouples 10

Q.6 Draw the root-locus of the control system whose open-loop transfer function is given by

$$G(S)H(S) = \frac{K}{S^2(S+1)} \quad 10$$

(B) With a neat sketch explain the constructional feature and working of (i) digital tachometer, (ii) Rotameter 10
