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   05
modeling in control systems.

(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 05
measurement.

(C) Convert the following state-space system of a single input single output
system into a transfer function: 10

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

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

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-   05
amp). Enumerate limitations of the same.

(B) What are desired, interfering and modifying inputs w.r.t. measurement 05
of a system?

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

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

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

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

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

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

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

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

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

10

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

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