03 Hrs   **[Total Marks 80]**

N.B.:
(1) **Question No.1 is compulsory**
(2) Attempt any **three** questionsout 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)	Derive an expression for steady state error when step and ramp input is given to the system.	8
(B)	Define the following terms with reference to the state space modelling of the system. (a) State space (b) State variables	06
(C)	What are thermistors? Explain their different forms of construction.	06
Q.2 (A)	What is mathematical modeling? Explain the importance of mathematical modelling in control systems.	06
(B)	Explain the construction, working and theory of thermal conductivity gauges for measurement of vacuum. Explain how radiation effects are minimized.	06
(C)	Obtain the state-space equation and output equation for the system defined by the equation,	08

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

Q.3(A)	Describe the construction and working of a Rotameter. Derive the expression or the volume flow rate. Explain its advantages and disadvantages.	10
(B)	For a system having $G(s) = \dfrac{15}{(s+1)(s+3)}$, H(s) =1, determine	10

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

TURN OVER

Q.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) Construct the block diagram that combines the following set of equations expressed in the "s" notations (Laplace notation). 10
(1) $W = X - Y$, (2) $V = W - Z$, (3) $Z(S + 6) = V(S + 2)$,
(4) $Y(S^2 + 6S + 8) = Z$, Given X is the input to the system and Y is the output from the block diagram. Find the transfer function.

Q.5(A) For a certain feedback system having , 10
$G(s) H(s) = \dfrac{3 (s+1)(s+6)}{s^2 (s^2+18s+400)}$, Sketch Bode plot and comment on G.M., P.M and stability.

(B) Explain the difference between vibrometers and accelerometers 10

Q.6(A) For a unity feedback system having $G(s) = \dfrac{100(s+1)}{s^2 (s+2)(s+10)}$, determine 10
(i) Type of system (ii) Error coefficients (iii) Steady state error for input as $1 + 4t + \dfrac{t^2}{2}$.

(B) What are desired, modifying and interfering inputs for an instrumentation system? Give examples for each of these. Draw a block diagram of for showing their influence on the output. 10

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