

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) 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. 06
- (a) State space (b) State variables
- (C) Explain the following terms with reference to static characteristics of the measuring instruments. 06
- (a) Hysteresis (b) Drift
- 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) Explain the construction and working of a d.c. tachogenerator. Explain its advantages and disadvantages. 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

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
 $G(s)H(s) = \frac{3(s+1)(s+6)}{s^2(s^2+18s+400)}$, Sketch Bode plot and comment on G.M., P.M and stability.
- (B) With a neat sketch explain the constructional feature and working of 10
 (i) Piezo- electric accelerometer and (ii) Pyrometers.
- Q.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 followings aspects of signal conditionings for any one of the sensor: amplification, conversion filtering, modulation/demodulation, and grounding. 10