

# 22472

**22223**

**3 Hours / 70 Marks**

Seat No. 

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

- 1. Attempt any FIVE of the following: **10****
- a) List practical applications of control system.
  - b) State the necessity of standard test signal.
  - c) Define relative stability.
  - d) Give disadvantages of derivative controller.
  - e) Define the following terms:
    - i) Delay time and Rise time
  - f) A system has poles at  $S = -3$ ,  $S = -2$  and zero at  $s = -1$ . Represent the system in S plane.
  - g) State advantages of PID controller.

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- 2. Attempt any THREE of the following:** **12**
- a) List any four rules of block diagram reduction technique.
  - b) Define the following terms related to second order system.
    - i) Damping
    - ii) Damping Ratio
    - iii) Undamped Natural Frequency.
    - iv) Damped Frequency
  - c) Discuss the special cases of Routh's Criterion.
  - d) Define synchro error detector. Give its applications.
- 3. Attempt any THREE of the following:** **12**
- a) Compare AC and DC servo motor.
  - b) Draw electronic PID controller using Op-amp.
  - c) Compare open loop and closed loop control system on the basis of block diagram transfer function, examples, stability and applications.
  - d) Illustrate Proportional-Integral (PI) control action with output equation and nature of output response.
  - e) Explain working of DC position control system.
- 4. Attempt any THREE of the following:** **12**
- a) Compare linear time variant and linear time invariant control system.
  - b) Write the Laplace transform for the following input signal.
    - i) Step
    - ii) Ramp
    - iii) Parabolic
    - iv) Impulse
  - c) Find stability of system whose characteristics equation is  $S^5 + S^4 + 3S^3 + 9S^2 + 16S + 10 = 0$  use Routh's Criterion.

- d) Draw the block diagram of process control system. State function of each blocks.
- e) Explain the working of variable reluctance type stepper motor with neat diagram

**5. Attempt any TWO of the following: 12**

- a) Define transfer function of a system. Find the transfer function of RLC circuit.
- b) A second order system had  $\frac{C(s)}{R(s)} = \frac{25}{S^2 + 6S + 25}$  for unity step input, determine
  - i) Natural and damped frequency
  - ii) Rise time
  - iii) Peak time
  - iv) Peak overshoot
  - v) Settling time
- c) Compare stepper motor and DC servo motor.

**6. Attempt any TWO of the following: 12**

- a) The unity feedback system is characterised by open loop transfer function  $G(S) = \frac{K(S+13)}{S(S+3)(S+7)}$  using Routh's criteria calculate range of K for system to be stable.
  - b) Compare PI, PD and PID controller.
  - c) Explain working of Potentiometer as an error detector. Give any two applications.
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