

N.B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data, if necessary.
- 4) Use of non-programmable calculator is allowed.

Q.1 Find range of 'K' so that system with the following equation will be stable. **(10)**

$$F(S) = S(S^2 + S + 1)(S + 4) + K = 0$$

OR

Q.1 For a system with characteristic equation: **(10)**

$$F(S) = S^6 + 3S^5 + 4S^4 + 6S^3 + 5S^2 + 3S + 2 = 0. \text{ Examine}$$

stability.

Q.2 Explain following rules for block diagram reduction: **(10)**

- i) Blocks in parallel
- ii) Eliminate feedback loop
- iii) Shift summing point before the block

OR

Q.2 Develop closed loop transfer function for the control system shown in figure -1. **(10)**

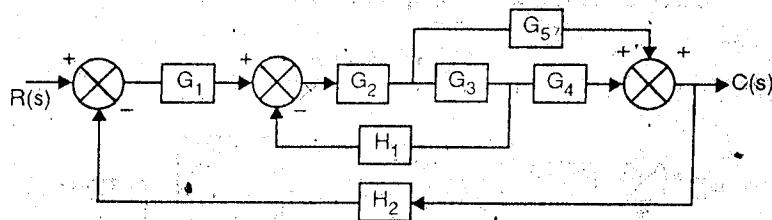


Figure - 1

Q.3 Explain the following terms: **(10)**

- i) Delay time
- ii) Peak time
- iii) Peak overshoot
- iv) Settling time
- v) Steady state error

OR

Q.3 Explain the concept of state, state variable, state vector, state space and state model. **(10)**

Q.4 Write short notes on the following: **(10)**

- i) Inverting amplifier
- ii) Non-inverting amplifier

OR

Q.4 Draw the neat circuit diagram of SAR type ADC & explain how it works. **(10)**

Q.5 Explain in detail working of PID control action. **(10)**

OR

Q.5 Differentiate between feedback and feed-forward control system. **(10)**

Q.6 Draw and explain architecture of PLC. State the selection criteria of PLC. **(10)**

OR

Q.6 Write a short note on 'Timers' used in PLC. **(10)**