Time: 3 Hours **Marks: 80**

N.B. (1) Question No. **1** is Compulsory
(2) Answer any **THREE** questions from remaining five questions
(3) Assume suitable data wherever necessary

01 Answer any **four** : [20]

(A) Explain the advantages of digital control systems.

(B) What are steady state error constants and how they are related with steady state error and 'type' of systems?

(C) Check the stability of the system with characteristic equation

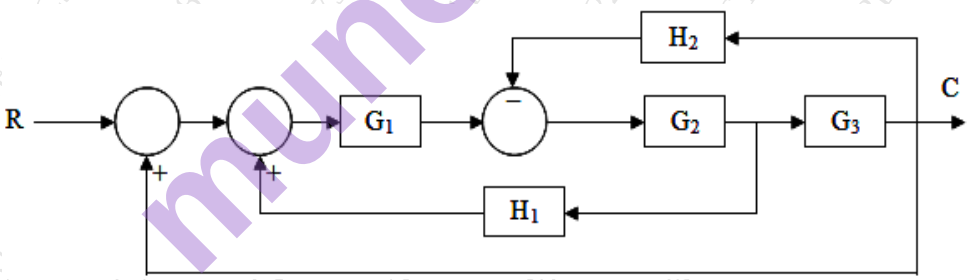
$s^5 + 2s^4 + 24s^3 + 48s^2 + 25s + 50 = 0$

(D) Explain the principle of Resistance Temperature Detectors

(E) Obtain the impulse response of the system with transfer function

$$\frac{10}{s(s+3)(s+5)}$$

02 **(A)** Find the transfer function (C/R) of the following system using block reduction technique [10]



(B) What are the time domain specifications of a standard second order system? How do they vary as functions of damping ratio and natural frequency of oscillation? Justify your answer. [10]

03 **(A)** A system is described by $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 8y = 8x$ [10]

If the tolerance is 2%, calculate all time domain specifications and maximum second peak.

(B) The open loop transfer function of a system is given by: [10]

$G(s)H(s) = \frac{K}{(s+3)(s+5)(s^2+2s+2)}$

Sketch root locus

04 **(A)** Sketch the Bode plot for the system shown below: [10]

$$G(s)H(s) = \frac{s}{(s+5)^2\,(s+20)}$$

(B) Sketch Nyquist plot for the system shown below, and comment on stability. [10]

$$G(s)H(s) = \frac{K}{(1+sT_1)\,(1+sT_2)}$$

05 **(A)** Explain in detail : landline telemetry and radio telemetry [10]

(B) Explain Data Acquisition System and its use in intelligent instrumentation system. [10]

06 Write short notes on any **four** : [20]

(A) Distributed Control System

(B) AC servomotor

(C) Potentiometer as a transducer

(D) HART communication protocol

(E) Fibre optic instrumentation.