EX/INSC/PG/CORE/TH/MI104A/2025

**M. Sc. INSTRUMENTATION EXAMINATION, 2025**

**(1st Year, 1st Semester)**

**PAPER : PG/CORE/TH/MI104A**

**( Linear Control System )**

*Time* : *Two Hours* *Full Marks* : 40

Answer *any* **four** questions (all questions carry equal marks 10, part questions *(a)* and *(b)* carry equal 5 marks).

**1.** *(a)* Draw a block diagram of a closed loop control system with its elements and explain. **(CO1)**

*(b)* Find the expression of the transfer function of a closed loop control system where R(s) is the input, C(s) is the output, G(s) is the forward transfer function and H(s) is the feedback transfer function of the system.

**2.** *(a)* Determine the rise time, peak time, settling time and peak overshoot of a second order control system, which is subjected to a unit step input, where $\xi = 0{\cdot}5$ and $w_n = 6$ rad/sec. **(CO2)**

*(b)* Find the stability of the system having closed loop transfer function as $T(s) = k / (s^3 + 5s^2 + 5s - 2)$.





**3.** *(a)* Explain stability of a system in terms of gain cross over frequency and phase crossover frequency. **(CO2)**

*(b)* Find the stability of the system using Routh-Hurwitz criterion having the characteristic equation given by $2s^4 + 2s^3 + s^2 + 3s + 2 = 0$.

**4.** Explain the mechanism of *(a)* Proportional Controller and *(b)* Integral Controller. **(CO3)**

**5.** Write short notes on *(a)* Stepper motor and *(b)* Servo motor. **(CO3)**

**6.** For the transfer function $G(s)\,H(s) = 2 / s\,(1 + 0{\cdot}5s)\,(1 + 0{\cdot}05s)$, Determine : phase crossover frequency, gain margin, gain crossover frequency and phase margin. **(CO4)**

**7.** *(a)* Find the frequency response of a first order system with $G(s) = 1 / (s\tau + 1)$. **(CO4)**

*(b)* Obtain the transfer function of a typical thermal water heating system.

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