

**MASTER OF TECHNOLOGY (MECHANICAL CAD/CAM) (CBCS - 2015 COURSE)**

**M. Tech. (Mechanical CAD/CAM) Sem-II :SUMMER- 2022**

**SUBJECT : CONTROL SYSTEMS**

Day : Thursday  
Date : 28-07-2022

**S-14203-2022**

Time : 10:00 AM-01:00 PM  
Max. Marks : 60

**N.B.**

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

**SECTION – I**

**Q.1** Explain in brief concept of mathematical modelling. Also, obtain the transfer function of simple mechanical system. **(10)**

**OR**

**Q.1** Differentiate between the PI and PD control actions with their applications, advantages and limitations. **(10)**

**Q.2** A system has following transfer function  $\frac{C(S)}{R(S)} = \frac{20}{S+10}$ . Determine its unit step response with zero initial conditions. Sketch the response trend. **(10)**

**OR**

**Q.2** Find the time for 1<sup>st</sup> undershoot, 2<sup>nd</sup> overshoot for **(10)**  
$$G(s) = \frac{15}{(s+1)(s+3)}, H(s) = 1.$$

**Q.3** The open loop transfer function of a unity feedback control system is given by **(10)**  
$$G(s) = \frac{K}{s(1+sT_1)(1+sT_2)}$$

Applying Routh-Hurwitz criterion, determine the value of 'K' in terms of T<sub>1</sub> and T<sub>2</sub> for the system to be stable.

**OR**

**Q.3** Determine the stability of the system with following characteristic equation **(10)**  
using Routh-Hurwitz criterion  $5S^6 + 3S^5 + 10S^4 + 9S^3 + 25S^2 + 12S + 100 = 0$ .

P.T.O.

**SECTION – II**

**Q.4** Write a short note on: co-relation between time response and frequency response. **(10)**

**OR**

**Q.4** Find the frequency response specifications for the following control system **(10)** with characteristic equation as,  
 $S^2 + 8S + 200 = 0$  .

**Q.5** Obtain the state model for the system with transfer function **(10)**  
 $\frac{Y(S)}{U(S)} = \frac{3S + 4}{S^2 + 5S + 6}$  .

**OR**

**Q.5** A linear time invariant system is characterized by the state variable model. **(10)**  
Examine the observability of the system.

$$A = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & -3 \\ 0 & 1 & -4 \end{bmatrix}, B = \begin{bmatrix} 40 \\ 10 \\ 0 \end{bmatrix} C = [0 \quad 0 \quad 1] .$$

**Q.6** What are the major applications of a stepper motor? Describe the construction and working of any one type of stepper motor. **(10)**

**OR**

**Q.6** Derive transfer function for lead compensator. **(10)**

\* \* \*