CBCS SCHEME

USN | | | | | | | | | | |

17ME73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is closed loop control system? **(02 Marks)**

b. Explain the closed loop control system with an example. **(08 Marks)**

c. Describe proportional + Integral + Derivative control system with its characteristics. **(10 Marks)**

OR

2 a. What are the requirements of an ideal control system? Explain any three in detail. **(10 Marks)**

b. Explain :
i) Proportional control system
ii) Proportional and integral control system. **(10 Marks)**

Module-2

3 a. Find the transfer function of mechanical system shown in Fig.Q3(a).

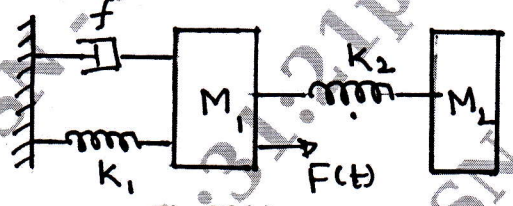

Fig.Q3(a) **(10 Marks)**

b. Draw the signal flow graph for the following set of equations and obtain the transfer function:

$x_2 = a_{12}\,x_1 + a_{32}\,x_3 + a_{42}\,x_4 + a_{52}\,x_5$

$x_3 = a_{23}\,x_2$

$x_4 = a_{34}\,x_3 + a_{44}\,x_4$

$x_5 = a_{35}\,x_3 + a_{45}\,x_4$ **(10 Marks)**

OR

4 a. Derive the differential equation of first order electrical system. **(05 Marks)**

b. A gas filled thermometer has a thermal resistance of R and is filled with a gas whose thermal capacitance is C. Obtain the transfer function relating the temperature of the gas inside the thermometer to the temperature of the medium in which the thermometer is inserted. Neglect capilarity of the thermometer. **(05 Marks)**

c. Determine the transfer function of the system shown in Fig.Q4(c), by block diagram reduction method.

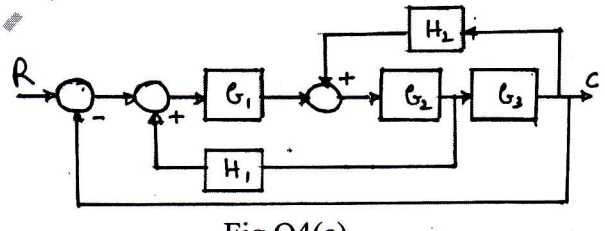

Fig.Q4(c) **(10 Marks)**

Module-3

5 a. A unity feedback control system has $G(s)=\frac{25}{s(s+5)}$. Determine the following quantities if it is subjected to unit step input
i) Rise time
ii) Peak time
iii) Maximum over shoot
iv) Settling time for 2% tolerance. **(08 Marks)**

b. Define : i) Absolute stability ii) Relative stability. **(04 Marks)**

c. Investigate the stability of the control system using R–H criteria. The characteristic equation is $s^4+2s^3+11s^2+18s+18=0$. **(08 Marks)**

OR

6 Sketch the root locus plot for a system whose open loop transfer function :

$$G(s)H(s)=\frac{K[s^2+6s+25]}{s[s+1][s+2]}$$

Show that the system is absolutely stable. **(20 Marks)**

Module-4

7 Draw the BODE plots for the system having the open loop transfer function :

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

Determine the value of K to obtain
i) A phase margin of 50° ii) A gain margin of 10db. **(20 Marks)**

OR

8 Determine the stability of the open loop control system

$$G(s)H(s)=\frac{10[s+1]}{s[s-1][s+5]} \text{ using Nyquist method.}$$ **(20 Marks)**

Module-5

9 a. Explain phase lead compensation. **(08 Marks)**

b. Define : i) State variables ii) State vector. **(04 Marks)**

c. Evaluate the observability of the system with $A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix}$, $B=\begin{bmatrix}0\\0\\1\end{bmatrix}$ and $C=[3\ 4\ 1]$

Using Gilbertz test. **(08 Marks)**

OR

10 a. Explain phase lag compensation. **(08 Marks)**

b. What are the advantages of state variable analysis? **(04 Marks)**

c. Obtain the state equation for the mechanical system shown in Fig.Q10(c).

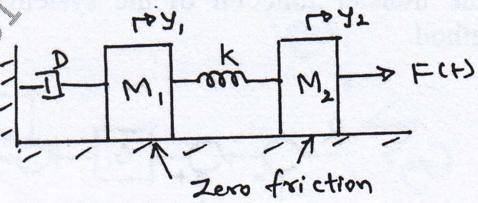

Fig.Q10(c) **(08 Marks)**

* * * * *