U.S.N.										

B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

SEP – 2021 Semester End Main Examinations

Programme: B.E. **Semester : IV**
Branch : EE/EC/TCE/EI/ML **Duration: 3 hrs.**
Course Code: 19ES4ESCST **Max Marks: 100**
Course: CONTROL SYSTEMS **Date: 22.09.2021**

Instructions: 1. Answer any FIVE full questions.
2. Missing data, if any, may suitably assumed.

1. a) Enumerate the important features of feedback control systems. Explain with an example. **08**

b) Apply the fundamental laws to obtain the mathematical model of the translational mechanical system shown in fig 1b. Also obtain the F-V and F-I analogy **12**

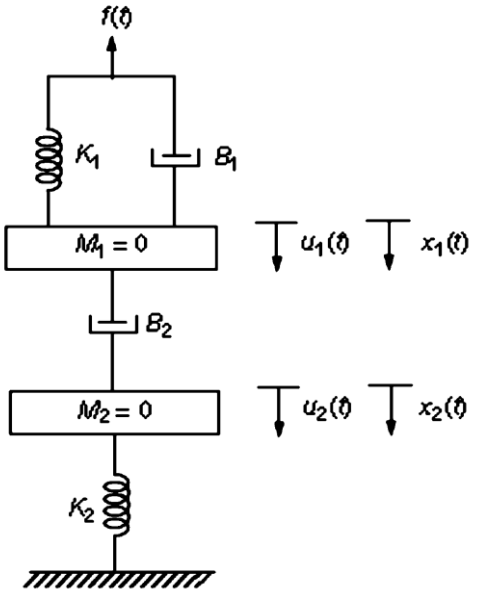

Fig.1(b)

2. a) Enumerate the differences between open and closed loop control system. **05**

b) **08**

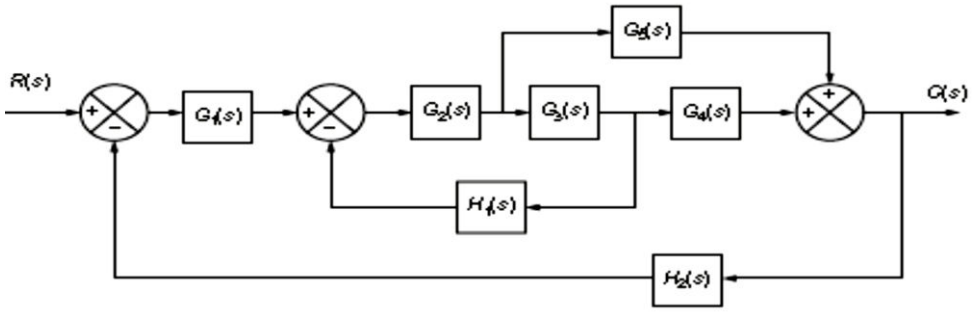

Fig. 2(b)

Apply the appropriate reduction rules and obtain the transfer function for the system shown in Figure 2(b).

c) **07**

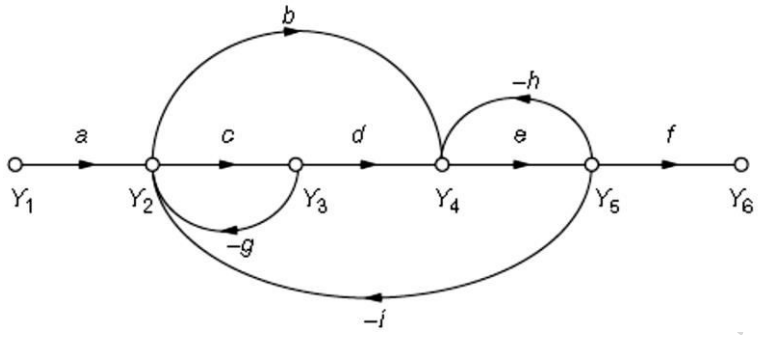

Fig. 2(c)

Apply MGF to obtain transfer function for the system shown in Figure 2(c).

3. **a)** Define the time domain specifications of a second order system injected with a unit step input with diagram. **06**

b) A feedback system has $G(s) = \frac{10}{s(s+2)}$, $H(s) = 1$ **08**

Determine the time-domain specifications such as rise time, percentage peak overshoot, peak time and settling time when the system is subjected to a step input of 12 units.

c) The open-loop transfer function of a unity feedback system is **06**
$G(s) = \frac{k}{s(1+0.025s)}$ and damping ratio = 0.4. Determine K and the steady-state error for the ramp input

4. **a)** The characteristic equation of a single loop feedback system is given as **10**

i) $F(s) = s^4 + 5s^3 + 5s^2 + 4s + k = 0$

ii) $F(s) = s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 13 = 0$

Find the stability of the system using R-H criterion and the range of value of k for stability if applicable.

b) Sketch the root locus of the system whose loop transfer function is given by **10**
$G(s)H(s) = \frac{K(s-4)}{s(s^2+2s+2)}$. Comment on the stability of the system

5. **a)** Explain the stability analysis using polar plot. **06**

b) Comment on stability using Nyquist criterion for the system having $G(s)H(s) = \frac{(50)}{s(1+s)(2+s)}$ **09**

c) Obtain the polar plot for $G(s)H(s) = \frac{1}{s^2(1+s)}$ **05**

6. **a)** Define the frequency domain specifications **06**

b) Sketch the Bode plot and determine the frequency domain specifications for $G(s)H(s) = \frac{80}{(s+2)(s+20)}$ Also, comment on the stability of the system **14**

7. **a)** Determine the state-space model for the electrical system shown in Fig. 7(a) **08**

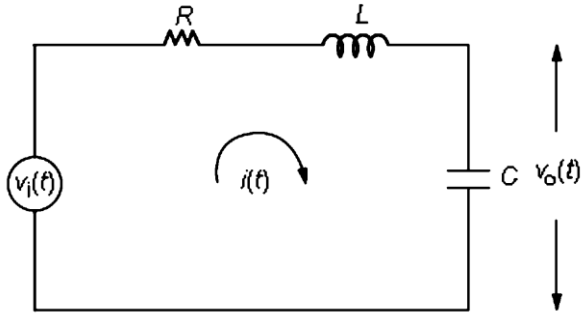

Fig. 7(a)

b) Obtain state-space representation for the system represented by **06**

$$\frac{d^3y(t)}{dt^3} + 8\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} + 6y(t) = u(t)$$

c) Obtain the transfer function for the state-space representation of a system given by **06**

A=[-1 -2 3;0 -1 1;-3 -1 -1]; B=[0; 0; 1]; C=[0 1 0];D=[0 0 0]

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