

**SUBJECT CODE NO: E-256**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E.(EEP/EE/EEE) Examination Nov/Dec 2017**  
**Control System Engineering**  
**(REVISED)**

[Time: 3 Hours]

[Max.Marks:80]

- N.B
- Please check whether you have got the right question paper.
- Attempt any three questions from each section.
  - Question No.1 and Q.No.6 are compulsory.
  - Solve any two questions from remaining from each section.
  - Figures to the right indicates full marks.

**SECTION A**

Q.1 Solve any five.

10

- Define transfer function.
- What is time variant and time invariant?
- Define Non-Touching Loop and Loop gain.
- What do you mean by signal flow graph?
- State mason's Gain formula.
- Write Torque balance equation for as  
 Ideal- Inertia  
 Ideal- spring.
- What are the two types of Mechanical system?
- Define settling time and peak overshoot.

Q.2 a) Obtain the overall transfer function  $C(s)/R(s)$  for the system, shown in fig.1.

08

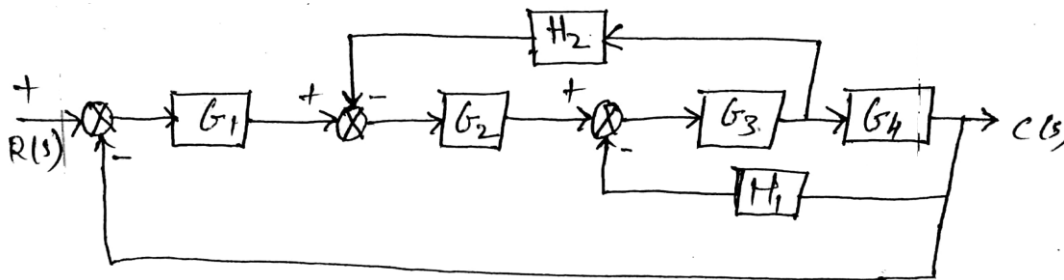


Fig-1

b) For the Mechanical system show in fig. 2. Draw the force – voltage and force current analogous circuits.

07

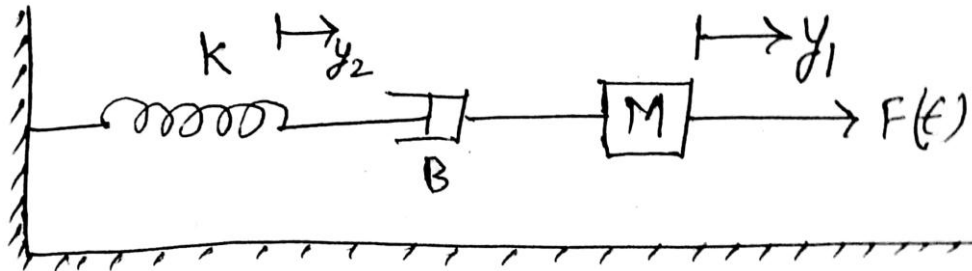
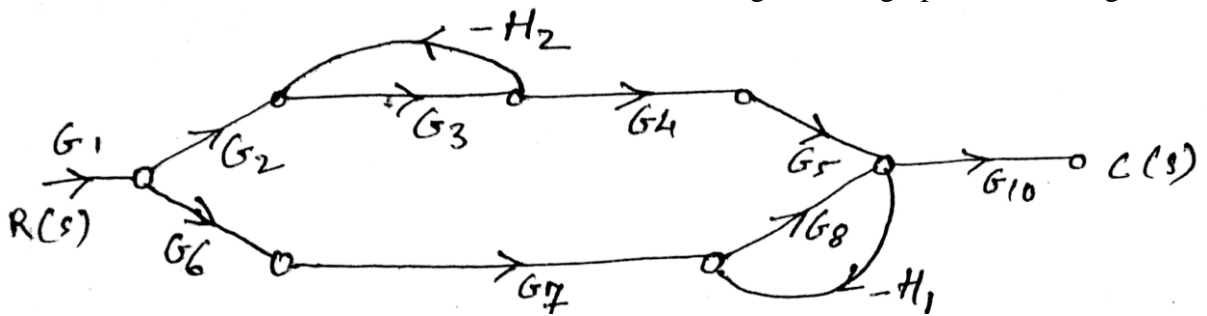


Fig 2

Q.3 a) Determine the overall Transfer function  $C/R$ , from the signal flow graph shown in fig.3. 08



b) Explain the synchro and its types. 07

Q.4 a) Explain steady state error constant. 07

b) Find the stability of system by Routh's criterion. 08

i)  $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 1s = 0$

ii)  $s^4 + 2s^2 + 1 = 0$

Q.5 a) A unity feedback control system has an open Loop transfer function. 08

$G(s) = \frac{s}{s(s+1)}$  Find the rise time, percentage overshoot, peak-time, and setting time for a step input of 10 units. Also determine the peak overshoot.

b) Draw the polar plot of 07

$$G(s) = \frac{10}{s(s+1)(s+2)}$$

## SECTION B

- Q.6 Solve any five. 10
- What do you mean by angle of Departure?
  - What is polar plot.
  - Define observability and controllability.
  - Define gain Margin in bode plot.
  - What are compensators?
  - What is sensitivity?
  - Define BIBO stability?
  - What is meant by frequency response of system?

- Q.7 Sketch the root Locus of the system has an open Loop transfer function. 15
- $$G(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$

- Q.8 Sketch the bode plot and hence find Gain crossover frequency, phase crossover frequency, Gain Margin & phase margin. 15

$$G(s) = \frac{10(1+0.1s)}{s(1+0.01s)(1+s)}$$

- Q.9 a) Sketch the polar plot for the transfer function. 08

$$G(s)H(s) = \frac{10}{s(s+1)(s+2)}$$

- b) Determine the state transition matrix for the system. 07

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where  $u > 0$

- Q.10 a) Test for controllability & observability for given system. 08

$$\dot{x}(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u$$

$$y = [1 \ 0 \ 2]x(t)$$

- b) Explain the effect of addition of poles and zeros on root Locus. 07