Code No: EE1503   **GEC-R14**

II B. Tech II Semester Regular Examinations, May 2016
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 Hours   **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B**. All Questions carry equal Marks.

PART-A
6 × 2 = 12M

1) A certain control system is described by a differential equation $\dfrac{d^2 y}{dt^2} + 4\dfrac{dy}{dt} + 9y = 5x$, where 'y' is output and 'x' is input. Obtain the transfer function of the system.

2) What are the advantages of signal flow graph technique over block diagram technique?

3) What are the time domain specifications of the second order under damped system?

4) What are the difficulties in RH stability criterion?

5) Define gain crossover and phase crossover frequencies?

6) What is meant by controllability and observability?
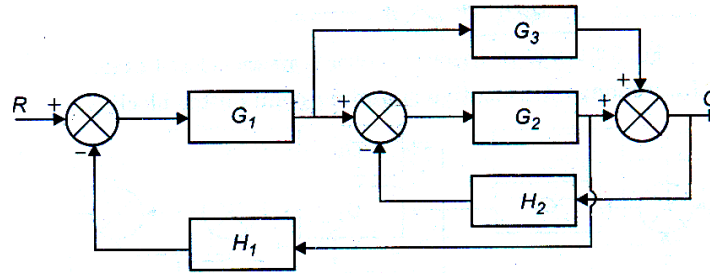
PART-B
4 × 12 = 48M

1. a) Find the transfer function of the following system?   (8M)
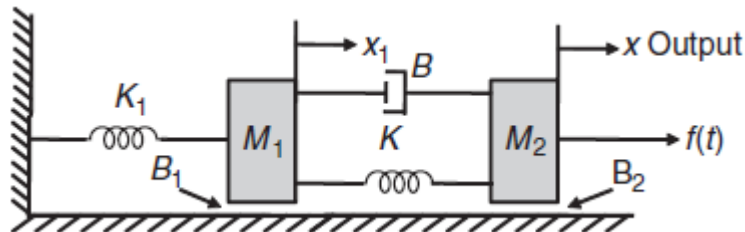
   b) Write the differences between open loop and closed loop control systems.   (4M)

2. a) Derive the transfer function of Field controlled DC servo motor.   (4M)

   b) Determine the overall transfer function relating C and R for the system whose block diagram is given below.   (8M)

3. a) A system is given by differential equation $\dfrac{d^2 y}{dt^2} + 4\dfrac{dy}{dt} + 8y = 8x$, where y=output and x= input. Determine all time domain specifications.   (6M)

   b) The forward path T.F. of a unity feedback control system is given by $G(s) = \dfrac{2}{s(s+3)}$. Obtain the expression for unit step response of the system.

   (6M)

4. Open loop T.F. of a unity feedback system is $G(s) = \dfrac{K(s+a)}{s(s+b)}$.

   i) Prove that break-away and break-in points will exist only when $|a| > |b|$

   ii) Prove that the complex points on the root locus form a circle with center (-a, 0) and radius $\sqrt{a^2 - ab}$ (12M)

5. A unity feed-back control system has $G(s) = \dfrac{10}{s(s+1)(s+2)}$. Draw the Nyquist plot and comment on closed loop stability?   (12M)

6. The state space representation of a linear time-invariant system is given below

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

   Determine the following   (12M)

   i) State transition matrix

   ii) Controllability and observability

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