Code No: R1622024 **R16** SET - 1

II B. Tech II Semester Supplementary Examinations, November - 2019
CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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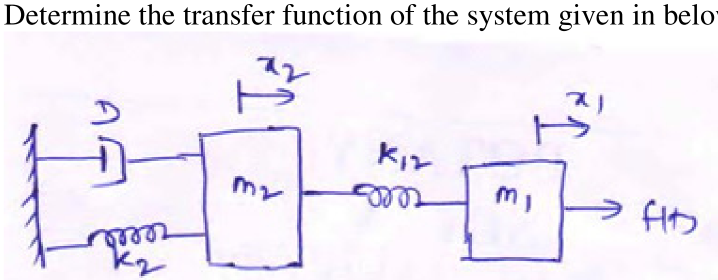
PART –A

1. a) What are the merits and demerits of closed loop control systems.
   b) Differentiate between transient response and steady state response with diagram.
   c) States the Routh's stability criterion?
   d) What is the procedure for investing stability using Nyquist criterion.
   e) What are the most commonly used compensators in the design of control system.
   f) Write the general procedure to determine the state space models of a control system.

PART -B

2. a) Compare block diagram with signal flow graph methods.
   b) Determine the transfer function of the system given in below figure.



3. a) What is meant by step input, ramp input and impulse input. How do you represent them graphically?
   b) A unity feedback control system has an open loop transfer function $G(s) = \dfrac{10}{s(s+2)}$
   Determine the time domain specifications for a step input of 12 units.

4. a) What do you mean by root locus? What are the merits, applications and limitations of root locus?
   b) Determine the stability of a closed loop control system whose characteristic equation is
   $s^5 + 3s^4 + 2s^3 + 6s^2 + 6s + 9 = 0$
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5. a) Derive the expression for frequency domain specifications.

   b) Draw the polar plot for the transfer function G(s)= $\dfrac{1}{s(2+s)(1+s)}$. Determine the frequency at which the plot crosses the real axis and the corresponding $|G(j\omega)|$.

6. A unit feedback system has an open loop transfer function G(s) = $\dfrac{k}{s(s+4)(s+2)}$.

   Design a phase lag compensator to meet the specifications, velocity error constant = 7 and phase margin ≥ 35°

7. a) Define the following terms with respect to phase variable approach
   i) State, ii) State variable, iii) state model and iv) State equations

   b) The state equation of the LTIV system are given by
   $$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-2 & 0\\ 0 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u;\ y=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$
   i. Find the State Transition Matrix
   ii. Find the solution for y(t) and
   iii. If a unit step is given to input, what will be the behavior of the output?