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

II B. Tech II Semester Supplementary Examinations, April - 2021
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**

~~~~~~

PART –A

1. a) What is mathematical model? What are the different types of systems for modeling?
   b) What are the demerits of static error coefficient method?
   c) What are the conditions to be satisfied for the root locus at any point in the s-plane?
   d) What are the frequency domain specifications?
   e) Derive the transfer function of phase lead compensator.
   f) What are the properties of state transition matrix?

PART -B

2. a) What do you mean by a block diagram? What is meant by summing point and takeoff point? List the merits of block diagram representation.
   b) Explain AC servo motor operation with necessary diagrams and derive its transfer function.

3. a) Define the time domain specifications. Derive expressions for them in case of 2^{nd} order system.
   b) Derive the ramp response of a first order system and plot the response.

4. a) The open loop transfer function of a unity feedback system is
   $G(s) = \frac{k(s+a)}{s(s+b)}$
      i) Prove that breakaway and break in points will exist only when $|a| > |b|$
      ii) Prove that the complex points on the root locus with centre(-a,0) and radius $\sqrt{a^2 - ab}$
   b) State and explain the special condition of R-H criterion.

5. a) Describe the procedure for constructing the polar plots.
   b) A unity feedback control system has an open loop transfer function given by
   G(s) H(s) = $\frac{8}{s(s+4)(5s+1)}$. Draw Nyquist diagram and test the stability.

||''|''|''|''|''||
~~~~~~

6. The open loop transfer function of the uncompensated system is

$$G(s)\,H(s) = \frac{5}{s(s+2)}$$

Design a suitable compensator for the system so that the static velocity error constant is 20 sec^{-1} , the phase margin is atleast 55^0 and the gain margin is atleast 12dB.

7. a) State the advantages of state space approach for analysis and design of control systems.

b) Obtain the state model of the system described by the transfer function.

$$\frac{Y(s)}{U(s)} = \frac{1}{s^3 + 5s + 6}$$