Code No: RT31043 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, October/November- 2020
CONTROL SYSTEMS
(Common to Electronics and Communication Engineering, Electronics and Instrumentation Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
(Normal, semi and polar graph sheets are to be supplied)

~~~~~~

PART –A **(22 Marks)**

1. a) Define a system and a control system with one example. [3M]
   b) Write the differences between Block diagram and signal flow graph. [4M]
   c) Write the equation for the steady state error when the input is unit step signal for type 0 Systems. [4M]
   d) How the roots of characteristic equation are related to stability? [4M]
   e) Define gain margin and phase margin of a polar plot. [3M]
   f) Define state, state variable, and state model. [4M]

PART –B **(48 Marks)**

2. a) Explain the different types of control systems with neat diagrams. [8M]
   b) What is a mechanical rotational system? Explain the torque balance equations of idealized elements. [8M]

3. a) Derive the expression for transfer function of Armature controlled DC servomotor. [8M]
   b) Define Signal flow graph, explain the reduction rules of SFG with one example. [8M]

4. a) Define the 2^{nd} order system; explain the response of undamped second order system for unit step input. [8M]
   b) The open loop transfer function of a unity feedback system is given by: [8M]
   $G(s)=K/s(sT+1)$, where K and T are positive constants. By what factor should the amplifier gain K be reduced, so that the peak overshoot of unit step response of the system is reduced from 75% to 25%?

5. a) Construct the Routh array and determine the stability of the system whose characteristic equation is: $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$. Also determine the number of roots lying on right half of s-plane, left half of s-plane and on imaginary axis. [8M]
   b) Sketch the root locus of the system whose open loop transfer function is: $G(s)=K/s(s+2)(s+4)$. Find the value of K, so that the damping ratio of the closed loop system is 0.5. [8M]

6. a) What is frequency response of a system; derive the frequency domain specifications of second order system. [8M]
   b) For the function, $G(s)=5(1+2s)/(1+4s)(1+0.25s)$, draw the bode plot. [8M]

7. a) Explain about Controllability and observability with one example. [8M]
   b) Explain the procedure of derivation of state models from block diagrams with one example. [8M]

*****
~~~~~~