# 6TH SEM./ ELECTRICAL/2022(S)
## TH-3 Control System Engineering

Full Marks: 80

Time- 3 Hrs

Answer any **FIVE**Questions including Q No.1& 2
Figures in the right hand margin indicates marks

2 x 10

1.      Answer **All** questions
   a.   What is signal flow graph?
   b.   Define phase margin. Is it positive or negative for stable feedback systems?
   c.   What do you mean by velocity error constant?
   d.   Define(i)Gain cross over frequency (ii) Resonant frequency, in frequency domain analysis.
   e.   What is the time response to unit ramp input in first order system?
   f.   What is corner frequency in Bode plot?
   g.   Define (i) Impulsesignal (ii) Transfer function.
   h.   What are the open loop poles of $G(s).H(s) = \frac{12(s+1)}{s(s+4)(s+5)}$ ?

   i.   What do you mean by all pass system?
   j.   What are the advantages of polar plot?

2.      Answer **Any Six** Questions                                                6 x 5
   a.   Explain the effects of feedback in a closed loop control system.
   b.   What are the basic properties of signal flow graph?
   c.   Derive the damped natural frequency from the time responseof second-order system to the unit step signal.
   d.   Describe about the PI controller using Block Diagram briefly.
   e.   Write a brief note on Constant-M circles with the help of polar plot.
   f.   An unity feedback control system has an open loop transfer function:
        $G(s)= \frac{K}{s(s^2+4s+13)}$.Find the (i) Centroid of asymptotes(ii) Breakaway point.
   g    Explain the effect of addition of poles and zeros to G(S).H(S) on the shape of Nyquist plot.

3       Explain all the rules for reduction of Block diagram, used in control systems in details.                                                              10
4       Explain about the Nicholas Chart used in frequency response analysis briefly.      10
5       Describe about the construction and working ofAC servomotors in details with the help of a neat diagram.                                              10
6       Describe the properties, advantages, disadvantages of transfer function in details.  10
7       Derive the expression for rise time, peak time, peak overshoot for second order systems                                                                  10

IV—Sem/ELECT/2019(S)(New)

## INSTRUMENTATION AND CONTROL
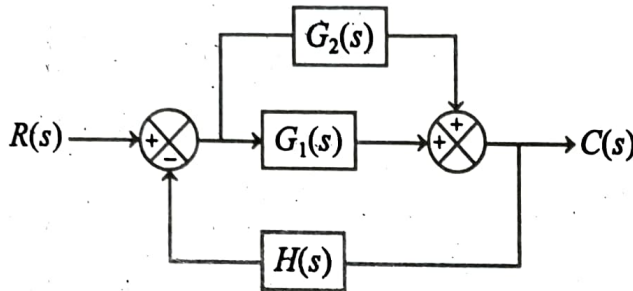### (Code : EET-404)

Full Marks : 80 — Time : 3 hours

Answer any **five** questions including **Q. Nos. 1 & 2**

*Figures in the right-hand margin indicate marks*

1. Answer *all* the questions in brief :  2 × 10

   (a) Name any two type of temperature transducer.

   (b) Find the transfer function of a given system.



   (c) What is piezoelectric effect ?

   (d) Compare between open loop and closed loop control system.

   (e) Write the $f$-$v$ analogy between mechanical and electrical system.

   (f) Define gauge factor.

   (g) Give two example of pressure measuring transducers.

   (h) Define stability and write the necessary conditions of stability.

   (i) What is servomechanism ?

   (j) Name the parameter that can be measured using CRO.

2. Answer the following :  5 × 6

   (a) Explain automatic tank level control system with neat diagram.

   (b) Write the short notes on optical pyrometer.

   (c) Derive the expression for the transfer function of a DC motor by using field control method.

   (d) What is the difference between primary and secondary transducer ? Give two example from each.

   (e) Draw the block diagram of a general purpose oscilloscope and derive its operating principle.

   (f) Explain the working principle of platinum resistance thermometer.

3. Draw the block diagram and determine the transfer function of a given electrical system by using block diagram reduction technique.    10
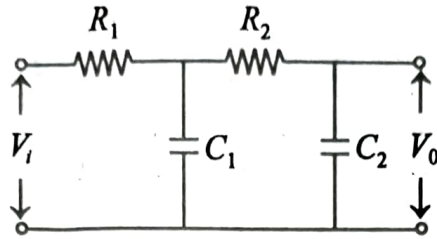


4. A system block diagram is shown as given below :
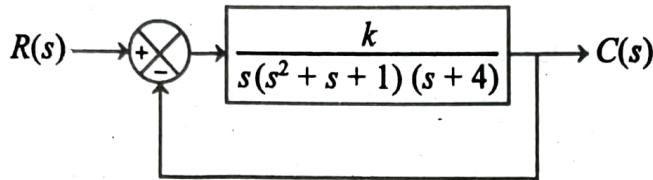


(a) Comment on system stability

(b) Find the range of K for the system to be stable.

(c) For what value of K system become verge of instability and find the corresponding frequency of oscillation ?    10

5. Explain the measurement of stress and strain with the help of deflection type Wheatstone bridge.    10

6. Explain the operation of synchro system consisting of a synchro transmitter and a synchro receiver.    10

7. Explain the measurement of AC voltage, current, phase and frequency using CRO.    10

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## CONTROL SYSTEM ENGINEERING
### (Code : EET-604(E)(iii))

*Full Marks* : 70

*Time* : 3 hours

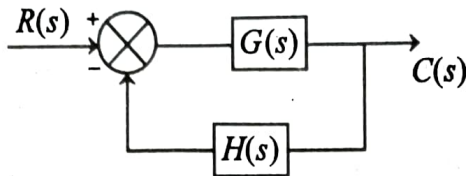Answer any **five** questions including **Q. Nos. 1 & 2**

*Figures in the right-hand margin indicate marks*

1. (*a*) What is transfer function ?    2

 (*b*) Derive the expression for the closed-loop control system given below :    5



 (*c*) Sketch the root locus plot of a unity feedback system with
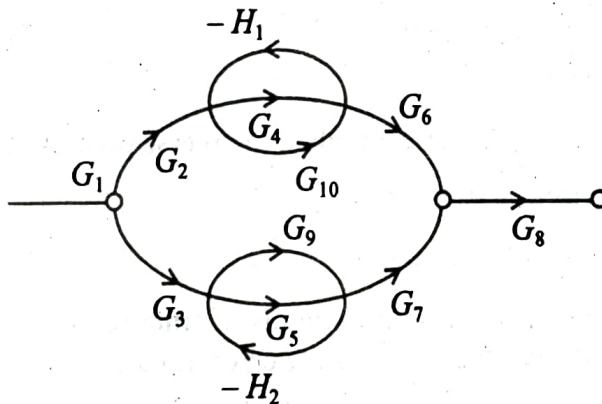
$$G(s) = \frac{k}{s(s+4)(s+3)}.$$

   7

2. (*a*) What is root locus ?    2

 (*b*) Using Mason's gain formula and find the transfer function for the following SFG :    5



 (*c*) Draw the polar plot of the T.F.

$$G(s) = \frac{1}{s(s-1)}.$$

   7

3. (*a*) What do you mean by angle of departure ?    2

 (*b*) Using Routh Hurwitz criterion, investigate the stability of the system whose characteristic equation is

$$s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0.$$

   5

*(Turn Over)*

(c) A unity feedback control system has

$$\frac{10}{s(s+10)(s+100)}$$

Draw the Bode plot graph.    7

4. (a) Define gain margin and phase margin.    2

(b) For a system having

$$G(s) = \frac{10}{(s+1)(s+3)}, \; H(s) = 1$$

(i) Determine characteristic equation
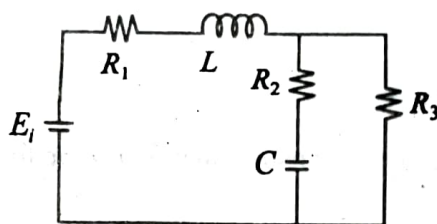(ii) Damping Ratio
(iii) Time at which 1st overshoot will occur
(iv) Time period of oscillation.    5

(c) Find the transfer function of the electrical network.    7



5. (a) What is a Nichol's chart ?    2

(b) Explain the Nyquist stability criterion applied to inverse polar plot.    5

(c) Explain constant 'M' circle and 'N' circle.    7

6. (a) What is closed loop frequency response ?    2

(b) Explain about the various types of test signals of time response analysis of control system. Also derive the steady state error equation of unit step, unit ramp and unit parabolic.    5

(c) Sketch the root locus plot of a unity feedback system with

$$G(s) = \frac{k}{s(s+4)(s+5)}.$$    7

7. Write short notes on (any *two*) :    7 × 2
(i) PID controllers
(ii) Routh-Hurwitz criterion
(iii) Polar plot.

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