Total No. of Questions : 8]   [Total No. of Printed Pages : 4

**Roll No** ....

EC-4005 (CBGS)

B.E. IV Semester

Examination, May 2018

Choice Based Grading System (CBGS)

Control Systems

Time : Three Hours

Maximum Marks: 70

Note: i)   Attempt any five questions.

ii) All questions carry equal marks.

1. a) What is a control system? What are open and closed loop control systems? Enlist some applications of control systems. rgpvonline.com

   b) Define transfer function. Determine the overall transfer function of the following closed loop control system.
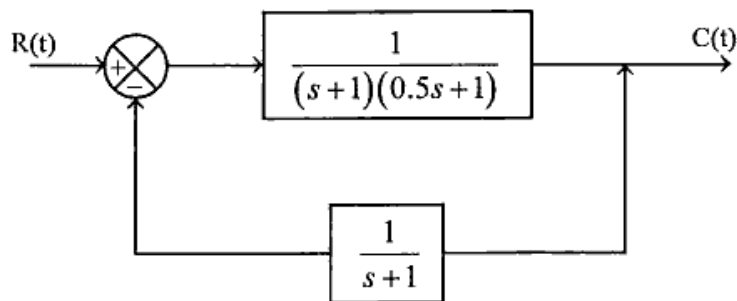
2. a) Draw the signal flow graph for the following feedback control system.
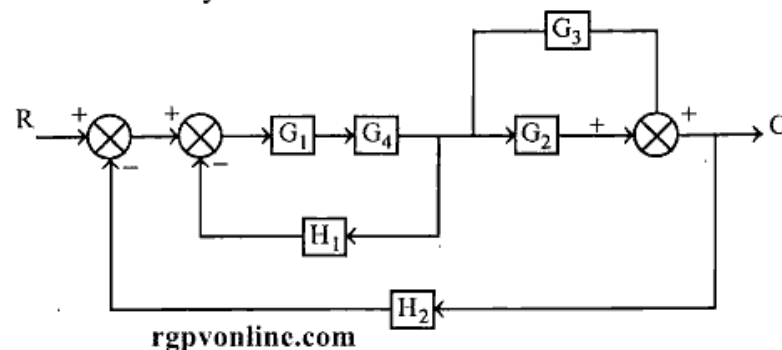
   b) Explain the various standard test signals.

3. a) The closed loop transfer function of a negative unity feedback control system is given by

   $$\frac{C(s)}{R(s)} = \frac{10}{s^2 + 4s + 5}$$

   Determine the damping ratio, undamped natural frequency and maximum overshoot for an unity step input.

   b) Draw the time response of second order system specify and define delay time, rise time, peak time, peak overshoot and settling time.

4. Sketch the root locus for the open loop transfer function of a unity feedback control system given as

   $$G(s) = \frac{k}{s(s+1)(s+3)}$$

   Determine the value of k for damping ratio of 0.5 and for marginal stability.

5. a) Use Routh Hurwitz criterion to test the stability of a control system whose characteristic equation is given as

$$3s^4 + 10s^3 + 5s^2 + 5s + 2 = 0$$

   b) Briefly explain the correlation between time and frequency response of a second order system.

6. a) What are polar and inverse polar plots? How do they differ from Bode plot? rgpvonline.com

   b) The loop transfer function of control system is given by

$$G(s)H(s) = \frac{s}{1 - 0.2s}$$

   Determine the stability of the closed loop system using Nyquist stability criterion.

7. a) What is the need of compensators? Draw the diagram of lead compensator and find the expression for its transfer function.

   b) Explain the working of PID controller and its advantages.

8. a) A feedback system has a closed loop transfer function as

$$\frac{10(s+4)}{s(s+1)(s+3)}$$

   construct state model and its representation.

   b) Determine the state controllability and observability of the system, describe by

$$\dot{x} = \begin{bmatrix} -3 & 1 & 1 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} x + \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 2 & 1 \end{bmatrix} u, \; y = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} x$$

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