SPECIAL SUPPLE B.TECH/CHE/IT/8TH SEM/AEIE 4282/2018

CONTROL SYSTEM AND APPLICATION
(AEIE 4282)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The damping ratio is defined as
(a) ratio of actual damping to the critical damping
(b) ratio of critical damping to the actual damping
(c) ratio of natural frequency to the damping frequency
(d) ratio of damping frequency to the natural frequency.

(ii) A second order control system has a damping ratio 0.8 and natural frequency of oscillation 12 rad/sec. Determine the damped frequency of oscillation
(a) 7.2 rad/sec (b) 8.2 rad/sec
(c) 6.2 rad/sec (d) 10.2 rad/sec.

(iii) If the damping ratio is increased , the value of the settling time will
(a) decrease (b) increase
(c) not be effected (d) none of these.

(iv) If the damping ratio is increased , the PD controller will reduce
(a) peak overshoot (b) rise time
(c) peak time (d) none of these.

(v) If $G(jw) = 0.5 \angle 180^0$, the gain margin will be
(a) 7.02 db (b) 8.02db
(c) 6.02db (d) 2.02 db.

(vi) The characteristics equation of a system is given by $s^3+4s^2+3s+k=0$, the value of k for which system is unstable is
(a) k >12 (b) k=12
(c) k>39 (d) k<3.

(vii) The location of the closed loop conjugate pair of poles on the jw axis indicates that the system is
(a) stable (b) unstable
(c) marginally stable (d) critically stable.

(viii) The intersection point of a root locus with the imaginary axis is determined using
(a) bode plot (b) routh hurwitz array
(c) gain phase plot (d) dk/ds=0.

(ix) If a root locus separates at a point between two open loop poles , the point is called
(a) critical point (b) crossover point
(c) shift point (d) breakaway point.

(x) The open loop transfer function of a system is given by $G(S)H(S)=K/S(S^2+4S+5)$. The number of breakaway points is /are
(a) 0 (b) 2
(c) 1 (d) 3.

Group - B

2.

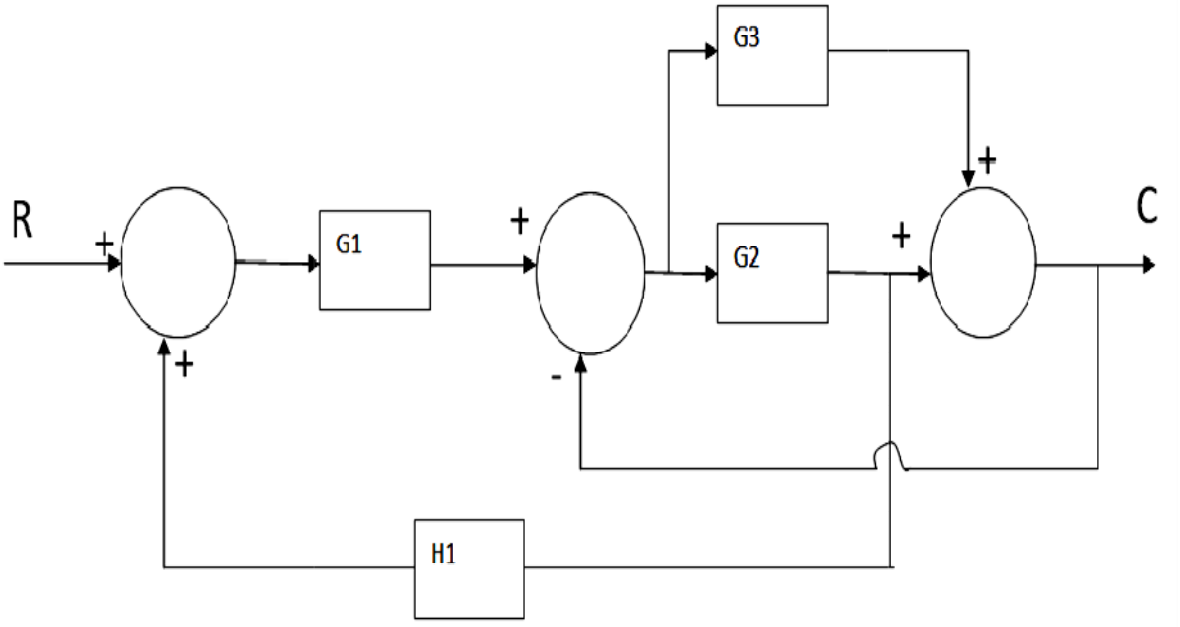

Figure: 1

Determine the overall transfer function of the system represented by the given block diagram (Figure 1) using block diagram reduction techniques. **12**

3.

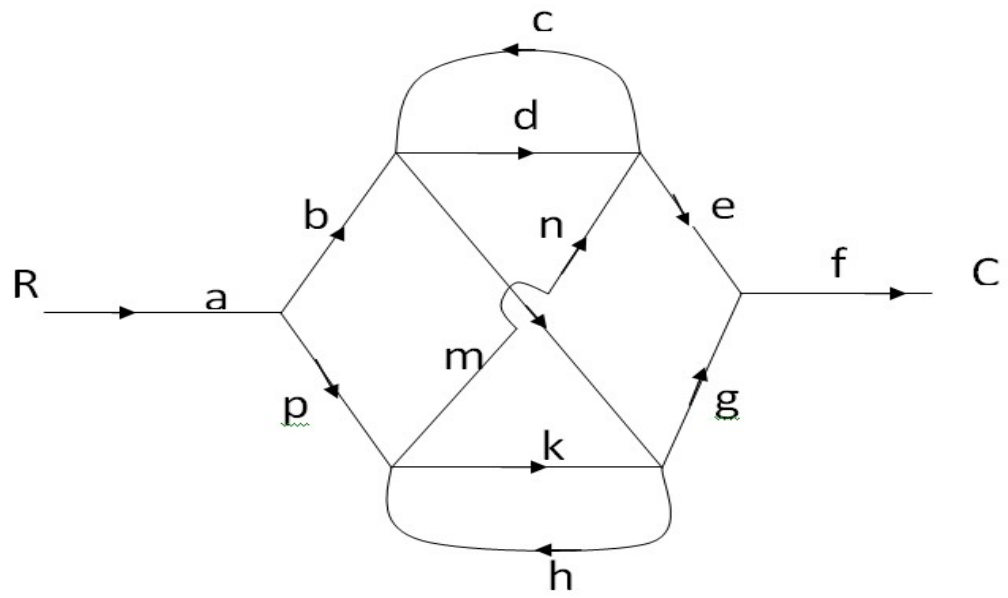

Figure: 2

Using Mason's gain formula find the overall transfer function of the system represented by the Signal Flow Graph as shown in Figure 2.

12

Group - C

4. For a unity feedback control system G(S) is given as $16/s^2+1.6s$. Determine the rise time, peak time and % of overshoot for closed loop system with a step input. Hence derive the relation (any two) of the above mentioned transient parameters.

12

5. A second order control system is represented by a transfer function given below

$$T(s) = 1/ (as^2 +bs +c)$$

A step input of 10 units is applied to the system and results are given below Mp=6%, tp=1sec and the steady state value of the output is 0.5 units. Determine the value of a, b and c.

(3 × 4) =12

Group - D

6. Determine the value of k such that the roots of the characteristics equation $s^3 + 10s^2+18s+k=0$ lie to the left of the s plane.

12

7. Construct the Bode plot for the system whose open loop transfer function is given below and determine the gain margin, phase margin and comment on the closed loop stability.

$$G(S)H(S)=4/(s(1+0.5s)(1+0.8s))$$

4 + 4 + 4 = 12

Group - E

8. Explain the operation of field controlled DC motor with necessary diagram. Explain PID controller with necessary diagram.

6 + 6 = 12

9. Explain the operation of armature controlled DC motor with necessary diagram.

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