**B. E. 6th Semester (Mech. Engg.) Examination,
May–2010**

AUTOMATIC CONTROLS

Paper–ME–308–E

Time allowed : 3 hours]   [Maximum marks : 100

Note : Attempt *five* questions. All questions carry equal
marks.

1. (a) Discuss the applications of control system in
        machine tool control and boiler control.   10

    (b) Explain the various types of control
        actions.   10

2. For the block diagram in Fig. 1, draw the signal
    flow diagram and derive expression for c/r using
    Mason's formula and also check by block diagram
    algebra.

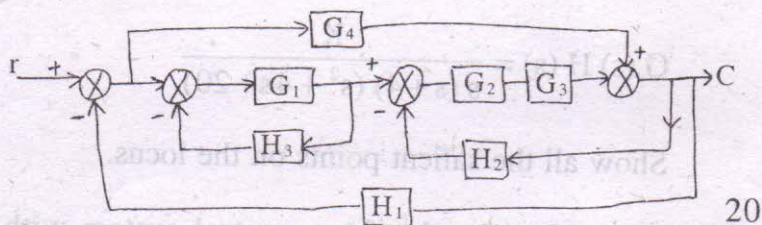Fig. 1   20

3. What are the time domain quantities which
    characterise a transient response ? Derive an
    expression for percentage overshoot of a second order
    system.   20

4. For the system as shown in Fig. 2 find the peak value of 1 M′ and the frequency at which it occurs. Use

(i) M-circle

(ii) Nichols charts after finding equivalent unity feedback system. Check the results by calculations.
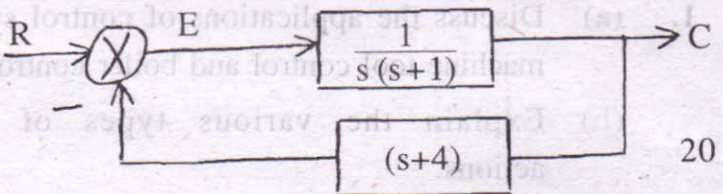

Fig. 2

5. Draw the root locus for a system whose open loop transfer function is given by

$$G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$$

20

Show all the salient points on the locus.

6. Draw Nyquist plot for a control system with open loop transfer function of

$$G(s)H(s) = \frac{50}{(1+0.2s)(s^2+10s+20)}$$

and find if the system is stable or not.   20

7. Find free solution for the following state equations :

$$[x\,(t)] = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix}[x\,(t)] + \begin{bmatrix} 0 \\ 2 \end{bmatrix}u\,(t)$$

where initial conditions are

$$[x\,(0)] = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$ 20

8. Discuss the following :

   (i)   Pulse Transfer function

   (ii)   Hydraulic controllers

   (iii) Open loop control system.   7+8+5=20