

Total No. of Questions—8]

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**[4957]-1047****S.E. (E&TC/Electronics) (II Sem.) EXAMINATION, 2016****CONTROL SYSTEM****(2012 PATTERN)****Time : Two Hours****Maximum Marks : 50**

**N.B. :—** (i) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 and Q. 7 or Q. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

(vi) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam table is allowed.

(v) Figures to the right indicate full marks.

1. (a) Write short note on Stepper Motor. [6]

(b) A unity feedback system has,  $G_{(s)} = \frac{K}{s(s+1)(1+0.45s)}$

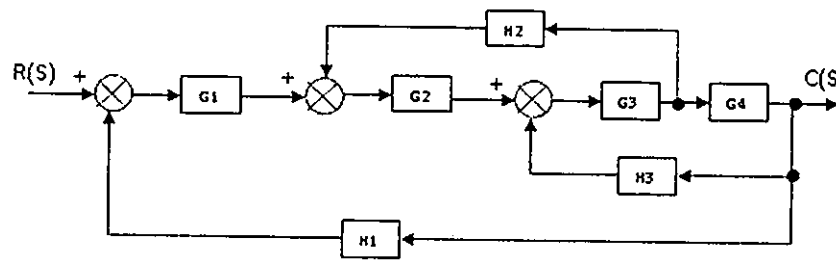
(i) If  $r(t) = 4t$  and  $K = 2$ , find steady state error.

(ii) If the desired value of steady state error to be 0.2, find corresponding value of K. [6]

P.T.O.

Or

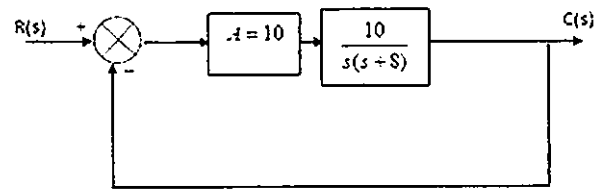
2. (a) Reduce the following block diagram and obtain  $\frac{C(s)}{R(s)}$ . [6]



- (b) For the system with transfer function  $\frac{1}{(s+3+7j)(s+3-7j)}$  find peak time and maximum peak overshoot. [6]
3. (a) Find range of K so that the system will be stable using Routh-Hurwitz criterion for the characteristic Equation : [4]
- $$D(s) = s^4 + 5s^3 + 5s^2 + 4s + K = 0$$
- (b) Draw Bode Plot for unity feedback system given by  $G(s) = \frac{40(s+5)}{s(s+2)(s+10)}$  and comment on stability. [8]

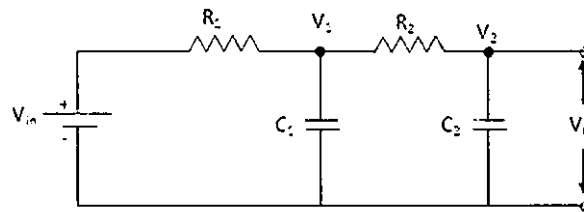
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4. (a) An unity feedback system has the open loop transfer function  $G(s) = \frac{K}{s(s+1)(s+3)(s+4)}$  Sketch complete root locus and comment on stability. [8]
- (b) Figure below shows schematic diagram of unity feedback control system, calculate  $\omega_r$  and  $M_r$ .



[4]

5. (a) Find state model of following Electrical network. [6]



- (b) Consider a system having state model

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} u \quad \text{and} \quad Y = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} \quad \text{with } D = 0.$$

Obtain its transfer function. [7]

Or

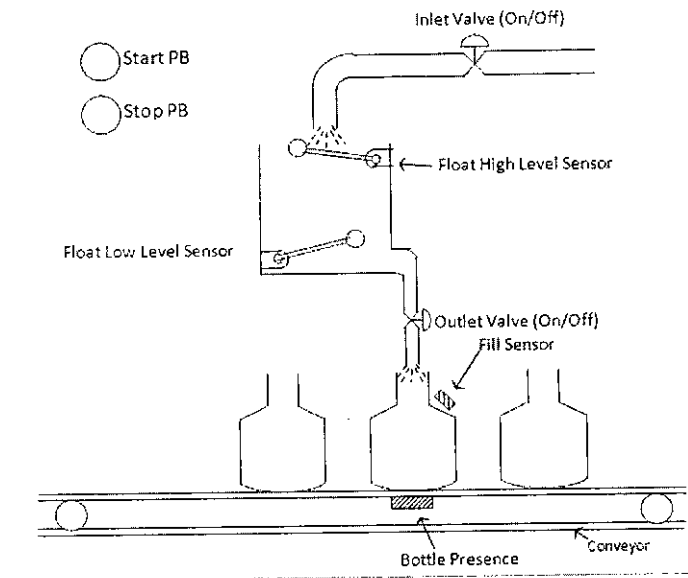
6. (a) Find controllability and observability of the system described by state equation : [6]

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad Y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

- (b) Write short note on state transition matrix and its properties. [7]

7. (a) Explain digital control system with its advantages. [6]

- (b) Draw a PLC ladder diagram for the bottle filling system as shown in figure below. [7]



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Or

8. (a) Write short note on PID controllers. [6]  
(b) Obtain the pulse transfer function of the system shown in figure. [7]

