

N.B. (1) Question no.1 is compulsory

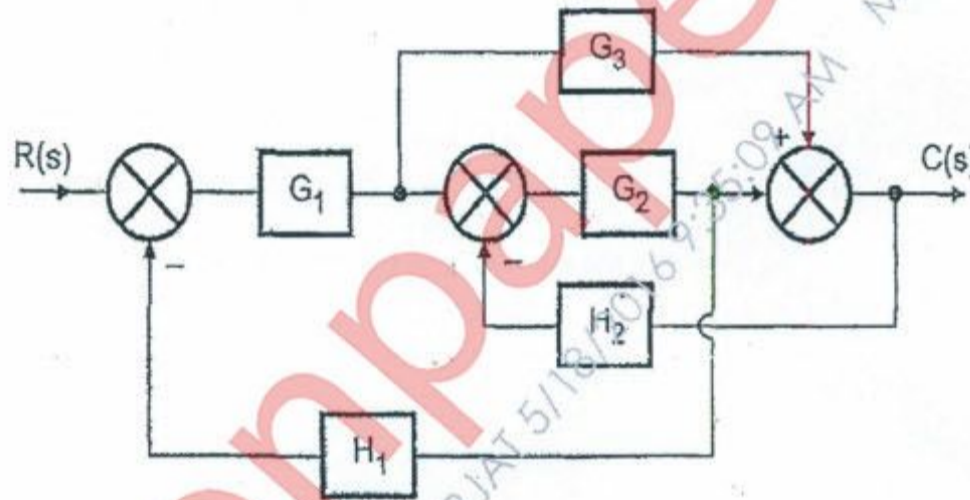
(2) Answer any 3 questions out of the remaining questions.

(3) Assume suitable data if necessary.

Q.1. Write Short notes on the following: --

- (a) Low-Cost Automation
- (b) Digital Hydraulics
- (c) Proximity Sensors
- (d) Classification of Control Systems

Q.2. (a) Reduce the following block diagram and obtain the simplified transfer function. 12



- (b) Write a short note on PLC. 04
- (c) State the advantages of Root Locus method. 04

Q.3. (a) Use Routh criterion to determine the number of roots in the left half & right half of 'S' plane along with no. of roots on imaginary axis for following. 15

(1) $s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$

(2) $s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0$

(b) With a neat sketch explain the construction of a 5 x 2 Directional Control Valve. 05

Q.4. (a) Design and Draw a Pneumatic control circuit for the following sequence 15

(A+B+) / B- C+ / B+ / dwell B- (A-C-)

(b) Differentiate between microprocessor and microcontroller. 05

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- Q.5. (a) Design and Draw an Electro-pneumatic control circuit for the following 14 sequence using double solenoid valves and groups.
 A+B+ delay C+ / A- delay C-B-
- (b) For the following system, calculate the angle of asymptotes and the centroid. 06

$$G(s)H(s) = \frac{K}{(s+1)(s+2+j2)(s+2-j2)}$$

- Q.6. (a) A unity feedback control system has 14

$$G(s) = \frac{80}{s(s+2)(s+20)}$$

Draw the Bode Plot. Determine G.M. P.M. ω_{gc} and ω_{pc} . Comment on the stability.

- (b) For the inputs a, b, c and output Y, the equation for an 'OR' logic operation 06 is as below,

$$Y = \bar{a} \bar{b} \bar{c} \vee a \bar{b} \bar{c} \vee \bar{a} \bar{b} c \vee a \bar{b} c$$

Using K. Map, simplify this equation and draw the circuit diagram.
