(Time: 3 hours) [Total Marks: 80]

**N.B.:**
1. **Question no. 1 is compulsory.**
2. Attempt **any three** questions from the remaining.
3. Figures to the right indicate full marks.
4. Make and state the assumptions clearly wherever required.
5. Answers to the same questions should be grouped together.
6. Provide neat sketches to illustrate your answers.

**Q1.** Write short notes on : (20)
- **a)** Proximity Sensors.
- **b)** Programmable automation.
- **c)** Servo Hydraulics – advantages and limitations.
- **d)** Advantages of Bode plots.

**Q2.** **a)** Design and draw pneumatic circuit for the following sequence (14)
  $B^{--} / (A^+ B^+) C^{---}$ / dwell $C^+ A^{---}$

  **b)** Explain in brief Dominant on and Dominant off latch. (06)

**Q3.** **a)** Design and draw the electro pneumatic circuit $A^+ B^+ / B^- C^+ / A^- C^{---}$ (14)

  **b)** Explain in brief significant benefits of PLC and its applications. (06)

**Q4.** **a)** Sketch the complete root locus of the system having (14)

$$G(s).H(s) = \frac{K}{S(S+4)(S+2)}.$$

  Comment on the stability of the system.

  **b)** Explain with a neat sketch the construction of $5 \times 2$ Direction Control Valve . (06)

**Q5.** **a)** State and explain the types of logic gates with Boolean expressions and truth tables. (10)

  **b)** State the rules for Block Diagram reduction. What are the advantages and disadvantages of block diagram? (10)

**Q6.** **a)** For the unity feedback system (14)

$$G(s) = \frac{800(S+2)}{S^2(s+10)(s+40)}$$

  Draw the Bode plot. Determine G.M , P.M , $\omega_{gc}$ , $\omega_{pc}$ and comment on stability.

  **b)** Explain the concept of the control system and briefly discuss about the various types of control systems. (06)

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