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**Time: 3 Hours**                    **Marks: 80**

N.B. (1) Question **No. 1** is compulsory.
(2) Attempt any **Three** questions out of remaining **five** questions.
(3) Assume any suitable data if necessary.
(4) Figure to the right indicate full marks.

Q.1 Answers the following questions:- **(Attempt any Four)**                    (20)

(a) Draw and explain physical diagram and block diagram of basic Level control loop.

(b) Why pneumatic instrumentation is preferred and used in plants?

(c) Compare Feedback and Feed-forward control system.

(d) Incorporation of P-I action may lead to instability in the closed loop performance- Justify.

(e) Draw symbol and explain function of following elements are used in physical ladder diagram .
    i) Relays, ii) Motor, iii) Solenoid, iv) Lights, v) Switch.

Q.2 (a) Explain P, I, D Control Actions. Discuss their advantages, disadvantages and applications.                    (10)

(b) Explain Cascade and Ratio Control Schemes with suitable example.                    (10)

Q.3 (a) Explain inverse response behavior of the process with example and also explain inverse response compensator.                    (10)

(b) For a proportional controller, the controlled variable is a process temperature with a range of 50 to 130° C and a setpoint of 73.5° C. Under nominal conditions, the set point is maintained with an output of 50%. Find the proportional offset resulting from a load change that requires a 55% output if the proportional gain is (a) 0.1 (b) 0.7 (c) 2.0 and (d) 5.0.                    (10)

Q.4 (a) With suitable example explain Split Range and Adaptive Control Schemes.                    (10)

(b) Explain with a neat sketch the working of Pneumatic PID Controller.                    (10)

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**Q.5** (a) Develop the physical ladder diagram for a motor with the following: NO start button, NC stop button, thermal overload limit switch opens on high temperature, green light when running, red light for thermal overload. (10)

(b) Explain Relative Gain Array method for multivariable control system and compute RGA and recommended controller pairs of following system. (10)

$$K = \begin{bmatrix} -2 & 1.5 \\ 1.5 & 2 \end{bmatrix}$$

**Q.6** (a) Explain the procedure for tuning PID controller using zielger Nicholas method. In an application while tuning by Z-N method process begins oscillations with 30% proportional band in 11.5 minutes. Find nominal PID control settings. (10)

(b) Explain features of PID controller. (10)

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