

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VII Examination-Nov/Dec.-2011

Subject code: 170802

Date: 22/11/2011

Subject Name: Industrial Automation

Time: 10.30 am-01.00 pm

Total marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**

- Q-1 (a)** Draw block diagram of PLC. Explain each block in detail (7)
- (b)** Explain in detail the following terminology with reference to process industry: (7)
- (i) Self regulation (ii) Control lag (iii) Dead Time (iv) Process Lag
- Q-2 (a)** Explain three mode controller (PID) (7)
- (b) (1)** A stepper motor has a step angle = 3.6° . (1) How many pulses are required for the motor to rotate through ten complete revolutions? (2) What pulse frequency is required? for the motor to rotate at a speed of 100 rev/min? (4)
- (2)** Advantages and Disadvantages of Automation (3)
- OR
- (b) (1)** A 5m diameter cylindrical tank is emptied by a constant outflow of $1.0\text{m}^3/\text{min}$. A two position controller is used to open and close a fill valve with an open flow of $2.0\text{m}^3/\text{min}$. For level control, the neutral zone is 1m and the set point is 12m. (a) Calculate the cycling period (b) Plot the level vs. time. (4)
- (2)** Explain basic block diagram of process control loop. (3)
- Q-3 (a)** Explain in detail with suitable diagram, Direct Digital Control (7)
- (b)** Explain in detail the input-output module used in PLC. (7)
- OR
- Q-3 (a)** Explain the block diagram of distributed control system. (7)
- (b)** Explain supervisory digital control with suitable diagram. (7)
- Q-4 (a)** With the importance of DCS in automation, Explain the hierarchical evolution and functional distribution of DCS. (7)
- (b)** Explain Timer and counter instructions for PLC with timing diagram. (7)
- OR
- Q-4 (a)** Explain different types of displays in DCS. (7)
- (b)** An integral controller is used for speed control with a set point of 12 rpm within a range of 10 to 15rpm. The controller output is 22% initially. The constant $K_I = -0.15\%$ controller output per second per percentage error. If the speed jumps to 13.5rpm, calculate the controller output after 2sec for a constant e_p . (7)
- Q-5 (a)** Explain following discontinuous controller modes (7)
- (i) Two position mode (ii) Multi position mode
- (b) (1)** Enlist types of network topology and explain any one with figure. (4)
- (2)** A controlling variable is a motor speed that varies from 800-1750 rpm. If (3)

the speed is controlled by a 25 to 50v dc signal, calculate (a) the speed produced by an input of 38v and (b) the speed calculated as a percent of span.

OR

Q-5 (a) Explain elements of ladder diagram and its application. (7)

(b) To control the operation of tank for following steps: (7)

- (1) When start PB is pressed the whole system enable.
- (2) Fill the tank up to middle level using valve 1.
- (3) Fill remaining tank is valve 2
- (4) Drain the tank using valve V3 when tank is full and Drain PB pressed.
- (5) Start the heater when tank is full and stop when middle level is reached.

