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SE-8278

B. E. - III (Sem. V) (Instrumentation & Control) Examination

May / June – 2011

Industrial Control Systems

(Institute Elective-II) (New Syllabus)

Time : **3** Hours] [Total Marks : **100**

Instructions : (1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 3 (SEM. 5) (INSTRUMENTATION & CONTROL)**

Name of the Subject :

☛ **Industrial Control System (New)**

☛ Subject Code No. : **8 2 7 8** ☛ Section No. (1, 2,.....) : **NIL**

Seat No. :

Student's Signature

1) Assume suitable data if required.
2) Use of non programmable calculator is allowed.
3) Duration of examination is 3 hrs.
4) Draw neat diagrams whenever required.
5) Figures to the right indicate full marks.

Q-1 (a) Answer the following questions in brief: (10)

(i) State the Classification of controllers.
(ii) Draw circuit diagram of Proportional controller with op-amp.
(iii) Explain Process Lag.
(iv) Define Process Load and Nominal load.
(v) Draw the response of PD and PID controller for step input.

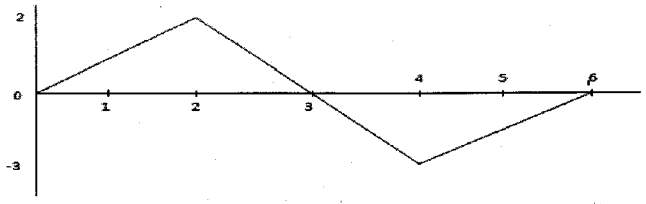
(b) What is cascade control? Explain in detail. Also discuss its advantages and Disadvantages over Feedback Control. (10)

Q-2 (a) Derive the equation for the Integral Time and Damping ratio for the Integral Controller In closed loop. (10)

(b) Design motor speed controller with a proportional band of 45%. The speed varies from 100-150 rpm and the controller output is 0-5 v for the range. A speed transducer linearly changes its output from 2-5 v for the same range. Set point of 125 rpm is desired. (5)

OR

Q-2 (a) A PI Controller has Kp=2.0, Ki=2.2sec^{-1} and Pi(0)=40% plot the output for an Error given in below diagram. (10)



(b) Explain Ziegler-Nicholas tuning rules for PID tuning. (05)

Q-3(a) Explain in detail ON-OFF Controller around Schmitt Trigger. (8)

(b) An integral controller is used for level control with a set point of 12m within the range of 10 to 15m. The controller output is 22% at setpoint. The constant Ki is 0.15% per sec per percent error. If the level jumps to 13.5m, calculate the controller output after 2 second. (7)

OR

Q-3 (a) Explain in detail ON-OFF Controller using Op-Amp . (6)

(b) A PI controller is used to control the pressure in a tank which varies from 40 psi to 140 psi. Desired pressure is 90 psi. controller output is to change by 100% upon 40 psi pressure deviation. Reset action is 1/5 repeats per min and controller output at zero error is 50%. Calculate the controller output at the end of 2 min, when pressure in the tank becomes 80 psi. (9)

Q-4 (a) Answer the following questions in brief: 10

1. What is program scan in PLC?
2. Calculate memory sizing for plc system with(Take 25% spare)
   (i) 100 DI, 100 DO, 50AI, 20AO.
   (ii) 50DI, 20AO, 50DO System.
3. Give address of Analog output of Pump Run command situated at 4th rack, 8th Module 20th channel.
4. State advantages of DCS?
5. Brief about typical micro PLC wiring diagram.

(b) Draw a ladder diagram for three motor systems having following conditions. 04
Motor 2(M2) can start 5 second after Motor 1(M1) starts, when M2 is running, Motor 3 (M3) can be started. When M2 is turned OFF, M3 is OFF. When M1 is turned OFF, both M2 and M3 Stop.

(c) Explain basic part of PLC with block diagram. state the Difference between PLC & Computer 06

Q-5 (a) Write an expression for C_v, List four function of control valve. 05

(b) Compare the sensitivities of the three valve characteristics. 04

(c) Draw the neat diagram of Control valve and explain each part of it. 06

OR

Q -5 a) A 1.5 inch control valve has the following specifications: 4

At 40% valve opening , C_v=1.5

At 30% valve opening, C_v=0.9.

At 80% valve opening , C_v=1.5

Calculate, $C_{v\ at}$ 90% valve opening when the control valve has equal percent characteristics.

b) Explain in brief: Alarm, Balloon,Board mounted,Controller,Final control element, Shared instrument. 6

c) Explain the role of "functional identification" and "loop identification" in P& I diagrams. 5

Q-6 (a) Explain 'Three element control' of boiler drum level control& 05

(b) Explain 'end point control' configuration of ratio control configuration. 05

OR

Q-6 (a) List the six features provided by POC (PROCESS OPERATOR CONSOL). 05

(b) difference between client layer and data server layer 05

Q-6 c Draw a ladder diagram for agitator motor systems having following conditions. 05
Agitator starts, After 5 seconds the pump can be started, when pump is switched off, the agitator also stops, when the agitator goes off, it cannot be started for 3 second.