T.Y. Diploma : Sem. V
[ET/EN/EX/EJ/DE/ED/EI]

Control System & PLC

Prelim Question Paper

Time: 3 Hrs.] **[Marks : 100**

Instruction : (1) **All** Questions are **compulsory**.
(2) Illustrate your answers with neat sketches **wherever** necessary.
(3) Figures to the **right** indicate **full** marks.
(4) **Assume** suitable data, **if** necessary.
(5) **Use** of Non-programmable Electronic Pocket Calculator is **permissible**.

1. (a) Attempt any **THREE** of the following : **[12]**

(i) Compare open loop and close loop control system.

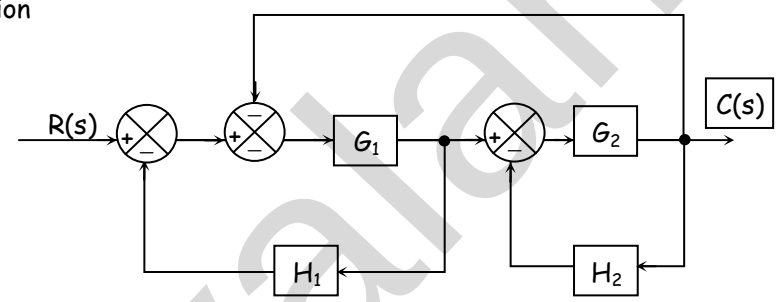
(ii) State the advantages of PLC.

(iii) Consider a system with characteristic equation
$S^5 + 2S^4 + 2S^3 + 4S^2 + 11S + 10 = 0$
Determine stability using Routh's criteria.

(iv) Draw block diagram of process control system. Explain the function of each block.

1. (b) Attempt any **ONE** of the following : **[6]**

(i) Derive transfer function of block diagram shown in fig. using block diagram reduction



(ii) Explain the memory organization of PLC.

2. Attempt any **TWO** of the following : **[16]**

(a) For unity feedback system having open loop transfer function

$$G(S) = \frac{K(S+2)}{S(S^3+7S^2+12S)}$$

Find : (i) Type of system
(ii) All error coefficients
(iii) Steady state error for input $r(t) = R/2.t^2$

(b) Draw ladder diagram to verify following logic gates truth table :
(i) NAND gate (ii) EXOR gate (iii) NOR gate (iv) AND gate

(c) Define the time response specifications delay time T_d, rise time T_r, setting time T_s and peak overshoot M_p.

3. Attempt any **FOUR** of the following : **[16]**

(a) Derive transfer function of RC Network.

(b) Draw block diagram of servo system. State function of its component.

(c) Define the terms:
(i) Stable system (ii) Unstable system
(iii) Critical stable system (iv) Conditionally stable system

(d) Define : (i) Stability (ii) Relative stability

(e) Define scan time of PLC. Explain the significance of scan time.

4. (a) Attempt any **THREE** of the following : **[12]**

(i) Draw block diagram of PLC power supply. State functions of its component.

(ii) Explain ON/OFF delay timer instruction with diagram.

(iii) Explain the offset in proportional controller. Draw the response of proportional controller.

(iv) List any four specifications of AC input module.

(v) Write the Laplace transform for the following input signal.

(i) step (ii) ramp (iii) parabolic (iv) impulse

4. (b) Attempt any **ONE** of the following : **[6]**

(i) Describe the wiring details of AC output module of PLC with diagram.

(ii) Compare PL, PD and PID controller (four points).

5. Attempt any **TWO** of the following : **[16]**

(a) State output time response relationship of second order system for step input. Give meaning of different terms in it. Show the effect of damping on time response with waveforms.

(b) (i) Define critically stable and conditionally stable system.

(ii) For the characteristic equation $S^4 + 20KS^3 + 5S^2 (10 + K) S + 15 = 0$. Determine the value of K for stable system.

(c) T.F. of a second order system is given by $\frac{C(s)}{R(s)} = \frac{2s}{s^2 + 6s + 2s}$. Find out T_r, T_p, T_s and % Mp for unit step input.

6. Attempt any **FOUR** of the following : **[16]**

(a) State Routh's criteria. Describe different cases to find stability of system (any two).

(b) State and explain any two rules of block diagram reduction.

(c) Explain Relay instruction of PLC.

(d) Draw any four ladder diagram symbols.

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Paper Discussion Schedule for T.Y. Diploma (Sem. V) – All Subjects

Date	Day	Timing	Centres
14 Nov. 2016	Monday	9 a.m. to 11 a.m.	Dadar
14 Nov. 2016	Monday	12 p.m.to 2 p.m.	Thane