Scheme – I

Sample Question Paper

Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Fifth
Course Title : Control Systems and PLC
Marks : 70

Time: 3 Hrs.

Instructions:

(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) Preferably, write the answers in sequential order.

Q.1) Attempt any FIVE of the following: - 10 Marks

(a) Draw electrical symbol used to represent NO pushbutton, NC pushbutton.
(b) Define: Stable system and marginally stable system.
(c) Give two practical examples of: i) Open loop system ii) Closed loop system.
(d) Define following terms with respect to PLC
   i. Scan time
   ii. Speed of execution
(e) Find order of system for the unity feedback system with

\[ C(s) = \frac{16}{s(s + 8)} \]

(f) Compare Linear and non-linear system on the basis of additive property and homogeneous property.
(g) Find the output of derivative controller mode if error is zero.

Q.2) Attempt any THREE of the following: - 12 Marks

(a) Give any four rules for block diagram reduction technique.
(b) Illustrate Proportional- Derivative control(PD) action with output Equation and nature of output response
(c) Draw and describe the block diagram of AC discrete output module of PLC.
(d) Name any four input and output devices which can be interfaced with PLC.
Q.3) Attempt any THREE of the following.  
12 Marks
(a) Transfer function of a second order system is given by
\[ \frac{C(s)}{R(s)} = \frac{64}{s^2 - 5s + 64} \]
Find
i. Natural frequency of oscillation
ii. Damping Ratio
iii. Peak Time
iv. Settling Time
(b) State four points of information associated with a counter instruction of PLC.
(c) Draw block diagram of PLC and give the function of isolator used in it.
(d) Plot a graph of proportional-Integral (PI) controller mode output as a function of time for the given error in figure-1. \( K_P = 5, K_I = 1.0 \text{ S}^{-1} \) and \( P_I(0) = 20\% \).

![Figure-1](image1)

Q.4) Attempt any THREE of the following.  
12 Marks
(a) Justify ‘Modular PLCS are preferable in automation industry.
(b) Draw and describe Proportional band in Proportional controller mode.
(c) List the different types of standard test input signals to test the control system. Also give their Laplace transform with sketch.
(d) Derive transfer function for the system given in figure-2:

![Figure-2](image2)

(e) Describe sinking and sourcing concept in DC input modules of PLC
Q.5) Attempt any TWO of the following. 12 Marks

(a) For unity feedback system with

\[ G(s) = \frac{5(s+1)}{s^5(s+3)(s+10)} \]

Find type of system, static error coefficient and steady state error when input to the system is \( r(t) = 1 + 3t + \frac{t^2}{2} \)

(b) With respect to PLC

i. State the importance of PLC in automation
ii. Describe memory organization of PLC.

(c) Draw ladder diagram for 3 motor operation for following conditions

i. Start push button starts motors M1 and
ii. after 10 seconds motor M2 starts and
iii. after 10 seconds motor M3 starts

Q.6) Attempt any TWO of the following. 12 Marks

(a) Draw the ladder diagram to verify: AND gate, NAND Gate and NOR Gate logic

(b) Obtain transfer function for the system given in figure -3, using block diagram reduction technique

(c) State the Routh’s criterion and describe two special cases of Rouths criterion with example
Scheme – I

Sample Test Paper - I

Program Name : Electronics Engineering Programme Group
Program Code : DE/EJ/ET/EN/EX/EQ
Semester : Fifth
Course Title : Control Systems and PLC
Marks : 20

Time: 1 Hour.

Instructions:
(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) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. 08 Marks
(a) Define following terms with respect to controller –
   i. Offset error  ii) Proportional band.
(b) For time response of second order system state formula for:
   i. Rise time  ii ) Settling time
(c) Compare Open Loop and Closed Loop Control system based on Transfer function and
Stability.
(d) Give the values of damping ratio for critically damped system and over damped
   system.
(e) Draw the block diagram of DC Servo System.

Q.2 Attempt any THREE. 12 Marks
(a) Define transfer function. Derive an expression for transfer function of simple closed
loop system.
(b) For a unity feedback system having open loop transfer function
   \[ G(s) = \frac{K(s + 2)}{s(s^2 + 7s^2 + 12s)} \]
   Determine:
   i) Type of system
   ii) Error constant Kp, Kv and Ka
(c) Find the range of values of K so that system with following characteristic equation
   \[ s^4 + 5s^3 + 5s^2 + 4s + k = 0 \]
   will be stable.
(d) Describe Neutral zone in ON-OFF controller mode.
Scheme – I

Sample Test Paper - II

Program Name : Electronics Engineering Programme Group
Program Code  : DE/EJ/ET/EN/EX/EQ
Semester      : Fifth
Course Title  : Control Systems and PLC
Marks         : 20

Time: 1 Hour.

Instructions:
(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) Preferably, write the answers in sequential order.

Q.1 Attempt any FOUR. 08 Marks
(a) List out functions of PLC output module.
(b) List two types of PLC programming devices
(c) Explain the terms normally open and normally closed contact.
(d) Draw PLC Scan Cycle.
(e) List any four compare instructions of PLC.

Q.2 Attempt any THREE. 12 Marks
(a) State stepwise procedure of PLC installation.
(b) Draw the ladder diagram to verify:
   i) OR gate ii) NOR Gate logic.
(c) Draw the block diagram of AC discrete input module of PLC.
(d) Illustrate Proportional-Integral (PI) control action with output Equation and nature of output response