

## 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

**22531**

**Time: 3 Hrs.**

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#### 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.**

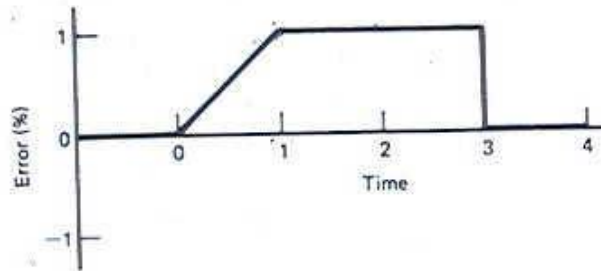
**12 Marks**

(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  $P_I(0) = 20\%$ .

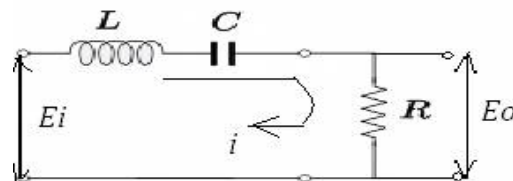


**Figure-1**

**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**

- (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

$$G(s) = \frac{5(s+1)}{s^2(s+3)(s+10)}$$

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

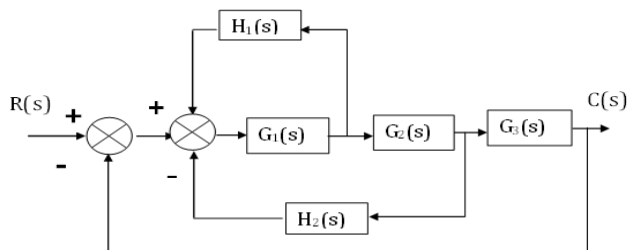
- i. Start push button starts motors M1 and
- ii. after 10 seconds motor M2 starts and
- iii. after 10 seconds motor M3 starts

**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



**Figure-3**

(c) State the Routh's criterion and describe two special cases of Routh's criterion with example

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

**22531**

**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

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

Determine:

- i) Type of system
- ii) Error constant K<sub>p</sub>, K<sub>v</sub> and K<sub>a</sub>
- (c) Find the range of values of K so that system with following characteristic equation will be stable:  $s^4 + 5s^3 + 5s^2 + 4s + k = 0$
- (d) Describe Neutral zone in ON-OFF controller mode.

## Scheme – I

### Sample Test Paper - II

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**Semester** : Fifth  
**Course Title** : Control Systems and PLC  
**Marks** : 20

**22531**

**Time: 1 Hour.**

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#### **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