



17536

15116

3 Hours / 100 Marks

Seat No.

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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) Mobile Phone, Pager and any other Electronic Communication devices are **not** permissible in Examination Hall.

Marks

1. A) Attempt **any three** :

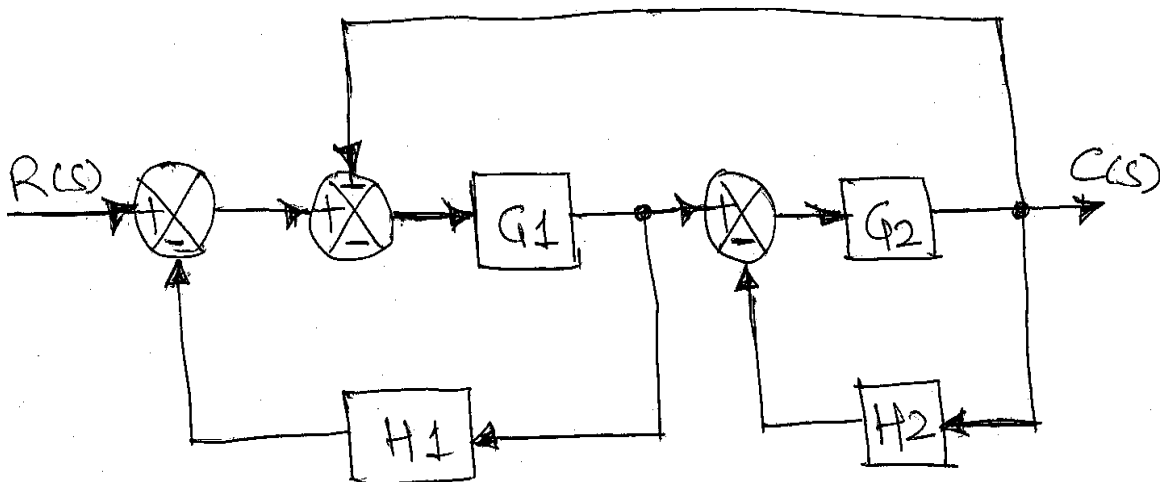
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- i) Compare open loop and close loop control system.
- ii) Define the terms :
 - a) Poles
 - b) Zeros
 - c) Order of system
 - d) Characteristic equation
- iii) State the advantages of PLC.
- iv) Draw block diagram of process control system. State functions of its block.

B) Attempt **any one** :

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- i) Draw block diagram of PLC. Describe working of different parts of PLC.
- ii) Derive transfer function of block diagram shown in fig. using block diagram reduction rules.



P.T.O.

2. Attempt **any two** :

a) A system is given by differential equation $\frac{d^2y}{dx} + 4 \cdot \frac{dy}{dx} + 8 \cdot y = 8 \cdot x$. Where y is output and x is input. Determine time domain specification.

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|--------------------|---------------------|
| i) Rise time | ii) Peak time |
| iii) Settling time | iv) Peak overshoot. |

b) 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 $r(t) = R/2 \cdot t^2$. | |
- c) Draw the ladder diagram for two motor system with following condition :
- | | |
|--------------------------------|------------------------------------|
| i) Start switch starts motor 1 | ii) 10 second later motor 2 starts |
| iii) Stop switch stops motor 1 | iv) 15 second later motor 2 stops |

3. Attempt **any four** :

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- a) Derive transfer function of RC Network.
- b) Describe the proportional control action w.r.t. eqn and response. State significance of proportional band.
- c) Draw block diagram of servo system. State function of its component.
- d) Define the terms :
- | | |
|-----------------------------|---------------------------------|
| i) Stable system | ii) Unstable system |
| iii) Critical stable system | iv) Conditionally stable system |
- e) Draw block diagram of DC input module of PLC. Describe its working.

4. A) Attempt **any three** :

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|---|
| i) State Routh's stability criteria. State its advantages. |
| ii) Draw block diagram of PLC power supply. State functions of its component. |
| iii) Explain ON/OFF delay timer instruction with diagram. |
| iv) Develop ladder diagram for logical operation. |
- | | |
|-------|----------|
| a) OR | b) EX-OR |
|-------|----------|

B) Attempt **any one** :

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| i) Describe the wiring details of AC output module of PLC with diagram. |
| ii) Explain PD control action w.r.t. equation and response. State their advantages and drawback. |

**5. Attempt any two :**

- a) Consider sixth order system with characteristic equation $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$. Determine stability of system using Routh's criterion.
- b) 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.
- c) Describe the concept of sinking and sourcing in DC input module. Differentiate between fixed PLC and modular PLC.

6. Attempt any four :

- a) Describe PI control action. State their advantages.
 - b) List different input and output devices used in PLC.
 - c) Differentiate between linear time invariant and linear time varying system.
 - d) Draw block diagram of AC output module of PLC. Describe its working.
 - e) The transfer function of system is $\frac{C(S)}{R(S)} = \frac{K(S+6)}{S(S+2)(S+5)(S^2+7S+12)}$. Determine poles, zeros and pole-zero plot of system.
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