

QP Code : 31259

(3 Hours)

[Total Marks: 80]

- N.B:
- (1) Question No.1 is **compulsory**.
  - (2) Answer any **three** questions from Question Nos. 2 to 6.
  - (3) Assume suitable data if necessary.

- 1 Answer any FOUR of the following questions:-
- (a) Explain the measures provided for Hazard free plant. 5
  - (b) With the flow sheet symbol of distillation explain the significance of column pressure control. 5
  - (c) Explain HTST and HHST milk pasteurization techniques. 5
  - (d) Define shrinking and swelling effects in boiler. 5
  - (e) Explain the crystallization curve. 5
- 2
- (a) State the types of evaporator and justify the need of selective control scheme. 10
  - (b) Discuss feed forward and bypass control scheme of H.E. 10
- 3
- (a) Draw a neat block diagram of refinery process and explain instrumentation involved it. 10
  - (b) Define intrinsic safety. Explain hazardous area classification as per IEC and NEC standards. 10
- 4
- a) Explain any two types of dryer with their control strategies. 10
  - b) With the help of diagram explain evaporating crystallizer and its control. 10
- 5
- a) Explain the instrumentation involved in iron and steel industry. 10
  - b) Explain the runaway reaction. Discuss the temperature control scheme for reactor. 10
- 6 Write comprehensive notes on :- (any TWO) 20
- a) Safety interlocks in fired reboiler.
  - b) 80/20 rule in intrinsic safety circuit design.
  - c) Gas turbine operation and control requirement.
- .....

FW-Con. 9946-16.

Duration: 03 Hours.

Total marks assigned: 80

Instructions to the candidates if any:-

N. B. (1) Question No. 1 is **compulsory**.

(2) Answer any **Three** out of remaining questions.

(3) Assumptions made should be **clearly** stated.

Q. No.	Marks
Q. 1 Explain	20
a) Explain nerve muscular junction	
b) Explain cardio vascular system	
c) Compare direct and indirect blood pressure measurement	
d) What is mean arterial blood pressure? Write its equation	
Q.2 a) Explain types of bio-potential Electrode	10
b) Explain 12 lead electrode configuration for ECG measurement	10
Q.3 a) what is cardiac output? How it is measured	10
b) Explain EEG measurement	10
Q. 4 a) Explain defibrillator in detail	10
b) Explain indirect bold pressure measurement	10
Q.5 a) Explain working of CT machine	10
b) What is NMR? Explain MRI concepts	10
Q.6 a) Explain heart lung machine	10
b) Explain physiological effects of electric current.	10

QP Code : 31337

(3 Hours)

[Total Marks: 80]

NB:

1. Q.1 is compulsory. Attempt any three from Q.2 to Q.6
2. Figures in right indicate full marks.
3. Assume suitable data if necessary.

Q.1 Attempt any four

20

- (a) What is the relative degree for the nonlinear system with respect to output?
- (b) Differentiate Linear and Nonlinear systems.
- (c) Draw block diagram for internal model control system and write the output equation for reference and disturbance inputs.
- (d) Explain Harmonic Linearization.
- (e) Explain Lyapunov stability analysis with neat sketches.
- (f) Explain jump resonance for a spring.

Q.2 (A) Draw the phase trajectory for the following system using delta method. Assume initial condition  $x = 1, \dot{x} = 0$ .

10

$$\ddot{x} + 2\dot{x} + 4x = 0$$

(B) Consider the system given by

10

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -x_1 + x_1(1 - x_2^2 - x_1^2)x_2$$

Find the equilibrium point and show that the unit circle is a limit cycle for the system.

Q.3 (A) Investigate stability of the system using Variable Gradient Method given by

10

$$\dot{x}_1 = -x_1 + 2x_1^2x_2$$

$$\dot{x}_2 = -x_2$$

(B) Derive the describing function for relay with hysteresis nonlinearity.

10

Q.4 (A) Design the optimal controller via Riccati equation for the system

10

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

to minimize the performance index  $J = \int_0^\infty (x_1^2 + x_2^2 + \dot{u}^2) dt$ .

(B) Explain feedback linearization for simple pendulum.

10

FW-Con. 11270-16.

[Turn Over



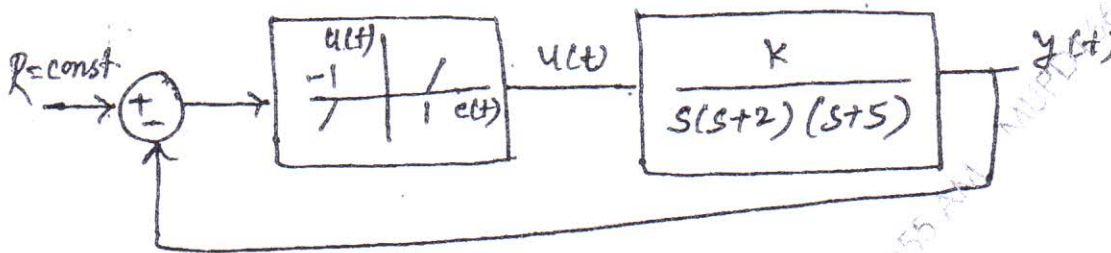
5 (A) Design IMC controller for plant model .

$\tilde{G}(s) = \frac{(-s+1)}{2s+1}$  in order to achieve the response with time constant of 1.2 sec.

10

(B) Investigate stability of the given system using describing function analysis.

10



Q.6 Write short note on

20

(i) Singular Points

(ii) Perfect Control

(iii) Krasovskij Method

**QP Code : 31398**

(3 Hours)

[Total Marks: 80]

- N.B: (1) Question No. 1 is compulsory.  
(2) Attempt any **Three** questions from remaining.  
(3) Figures to the right indicate full marks.

1. Answer the following:- [20]
  - (a) What is automation? Explain its significance.
  - (b) What is scan time of PLC? Explain its importance in process control.
  - (c) Name any five typical applications of SCADA.
  - (d) What is the difference between SIS and BPCS?
2. (a) Draw and explain the working of PLC with the help of functional block diagram. Name any four vendors of PLC with their models. [10]  
(b) Develop a ladder diagram for the car parking system with the following sequence.
  - i) If there is no car GREEN light will glow.
  - ii) If number of cars between 1 to 9 YELLOW light glows.
  - iii) If there are cars above 10 numbers then, RED light will glow.It should include GUI, I/O listing, I/O wiring diagram and ladder diagram. [10]
3. (a) What are DCS displays? Explain any two in detail. [10]  
(b) With a neat sketch explain how RTU communicates with the field and MTU in SCADA. [10]
4. (a) What are independent protection layers? Explain the significance of all these layers with reference to SIS. [10]  
(b) What is an MES ? Explain the layers of communication between business and control systems. [10]
5. (a) Explain PLC Timer and Counter instructions with their functions. [10]  
(b) Explain hierarchical computer control for large manufacturing complex. [10]
6. Write Short note on: - [20]
  - (a) Alarm lifecycle model.
  - (b) Compare DCS, PLC and SCADA.

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