CH : CHEMICAL ENGINEERING

Duration: Three Hours *Maximum Marks*: 100

Read the following instructions carefully.

1. This question paper contains **16** pages including blank pages for rough work. Please check all pages and report discrepancy, if any.

2. Write your registration number, your name and name of the examination centre at the specified locations on the right half of the Optical Response Sheet (**ORS**).

3. Using HB pencil, darken the appropriate bubble under each digit of your registration number and the letters corresponding to your paper code.

4. All questions in this paper are of objective type.

5. Questions must be answered on the **ORS** by darkening the appropriate bubble (marked A, B, C, D) using HB pencil against the question number on the left hand side of the ORS. **For each question darken the bubble of the correct answer**. In case you wish to change an answer, erase the old answer completely. More than one answer bubbled against a question will be treated as an incorrect response.

6. There are a total of 65 questions carrying 100 marks.

7. Questions Q.1 – Q.25 will carry 1-mark each, and questions Q.26 – Q.55 will carry 2-marks each.

8. Questions Q.48 – Q.51 (2 pairs) are common data questions and question pairs (Q.52, Q.53) and (Q.54, Q.55) are linked answer questions. The answer to the second question of the linked answer questions depends on the answer to the first question of the pair. If the first question in the linked pair is wrongly answered or is un-attempted, then the answer to the second question in the pair will not be evaluated.

9. Questions Q.56 – Q.65 belong to General Aptitude (GA). Questions Q.56 – Q.60 will carry 1-mark each, and questions Q.61 – Q.65 will carry 2-marks each. The GA questions will begin on a fresh page starting from page **13**.

10. Un-attempted questions will carry zero marks.

11. Wrong answers will carry **NEGATIVE** marks. For Q.1 – Q.25 and Q.56 – Q.60, ⅓ mark will be deducted for each wrong answer. For Q.26 – Q.51 and Q.61 – Q.65, ⅔ mark will be deducted for each wrong answer. The question pairs (Q.52, Q.53), and (Q.54, Q.55) are questions with linked answers. There will be negative marks only for wrong answer to the first question of the linked answer question pair i.e. for Q.52 and Q.54, ⅔ mark will be deducted for each wrong answer. There is no negative marking for Q.53 and Q.55.

12. Calculator (without data connectivity) is allowed in the examination hall.

13. Charts, graph sheets or tables are NOT allowed in the examination hall.

14. Rough work can be done on the question paper itself. Additionally, blank pages are provided at the end of the question paper for rough work.

SEAL

Q.1 – Q.25 carry one mark each.

Q.1 The critical speed (revolutions per unit time) of a ball mill of radius R, which uses balls of radius r, is

(A) $\frac{1}{2\pi}\sqrt{\frac{g}{\sqrt{Rr}}}$ (B) $\frac{1}{2\pi}\sqrt{\frac{g}{R}}$ (C) $\frac{1}{2\pi}\sqrt{\frac{g}{r}}$ (D) $\frac{1}{2\pi}\sqrt{\frac{g}{R-r}}$

Q.2 The ratio of Nusselt number to Biot number is

(A) conductive resistance of fluid / conductive resistance of solid
(B) conductive resistance of fluid / convective resistance of fluid
(C) conductive resistance of solid / conductive resistance of fluid
(D) unity

Q.3 The ratio of the thermal boundary layer thickness to the concentration boundary layer thickness is proportional to

(A) Nu (B) Le (C) Sh (D) Pr

Q.4 For a first order isothermal catalytic reaction, $A \rightarrow P$, occurring in an infinitely long cylindrical pore, the relationship between effectiveness factor, ε, and Thiele modulus, ϕ, is

(A) $\varepsilon = \frac{1}{\phi^2}$ (B) $\varepsilon = \phi$ (C) $\varepsilon = 1$ (D) $\varepsilon = \frac{1}{\phi}$

Q.5 Match the location of the poles/zeros in the s-plane, listed in **GROUP I**, with the system response characteristics in **GROUP II**.

GROUP I	**GROUP II**
P. Pole in the right half plane	I. Stable response
Q. Pole at origin	II. Integrating response
R. Zero in the right half plane	III. Unstable response
	IV. Inverse response

(A) P – I, Q – II, R – III (B) P – III, Q – IV, R – I
(C) P – III, Q – II, R – IV (D) P – I, Q – IV, R – III

Q.6 Which **ONE** of the following statements about baffles in a shell and tube heat exchanger is **FALSE**? Baffles

(A) act as a support to the tube bundle
(B) reduce the pressure drop on the shell-side
(C) alter the shell-side flow pattern
(D) help in increasing the shell-side heat transfer coefficient

Q.7 The term, **knuckle radius**, is associated with

(A) flat heads (B) torispherical heads
(C) hemispherical heads (D) conical heads

Q.8 In the manufacture of caustic soda from brine, which **ONE** of the following statements is **TRUE**?

(A) The membrane cell **CANNOT** produce concentrated NaOH solution, and **CANNOT** tolerate calcium and magnesium ions in the feed brine.
(B) The membrane cell **CANNOT** produce concentrated NaOH solution, but **CAN** tolerate calcium and magnesium ions in the feed brine.
(C) The membrane cell **CAN** produce concentrated NaOH solution, but **CANNOT** tolerate calcium and magnesium ions in the feed brine.
(D) The membrane cell **CAN** produce concentrated NaOH solution, and **CAN** tolerate calcium and magnesium ions in the feed brine.

Q.9 For making superphosphate by acidulation of phosphate rock, use of nitric acid is desirable, because

(A) nitric acid is less expensive than sulphuric acid
(B) the availability of nitrogen enhances the value of the superphosphate as a fertilizer
(C) the process produces non-hygroscopic superphospate
(D) the process produces superphosphate having higher phosphorus content than the sulphuric acid process

Q.10 Match the processes in **Group I** with the products in **Group II**.

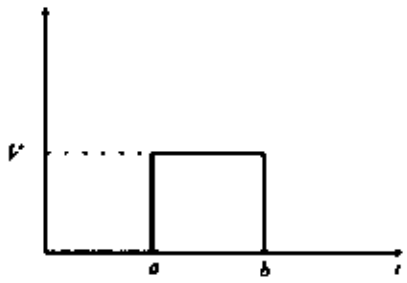
GROUP I	**GROUP II**
P. Claus process	I. Syngas
Q. Linde process	II. Oxygen
R. Lurgi process	III. Sulphur

(A) P–I, Q–II, R–III (B) P–II, Q–I, R–III (C) P–III, Q–I, R–II (D) P–III, Q–II, R–I

Q.11 The inverse of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ is

(A) $\begin{bmatrix} -2 & -1 \\ -3/2 & -1/2 \end{bmatrix}$ (B) $\begin{bmatrix} -2 & 3/2 \\ 1 & -1/2 \end{bmatrix}$ (C) $\begin{bmatrix} -2 & 1 \\ 3/2 & -1/2 \end{bmatrix}$ (D) $\begin{bmatrix} 2 & -3/2 \\ -1 & 1/2 \end{bmatrix}$

Q.12 The Laplace transform of the function shown in the figure below is



(A) $\frac{Ve^{(a-b)s}}{s}$ (B) $\frac{V}{s}\left(e^{-bs}-e^{-as}\right)$ (C) $\frac{V}{s}\left(e^{-as}-e^{-bs}\right)$ (D) $\frac{V}{s^2}\left(e^{as}-e^{bs}\right)$

Q.13 The Maxwell-Boltzmann velocity distribution for the x-component of the velocity, at temperature T, is $f(v_x)=\sqrt{\frac{m}{2\pi kT}}\exp\left(-\frac{mv_x^2}{2kT}\right)$. The standard deviation of the distribution is

(A) $\sqrt{2kT/m}$ (B) kT/m (C) $\sqrt{kT/m}$ (D) $kT/2m$

Q.14 Given that $i = \sqrt{-1}$, i^i is equal to

(A) $\frac{\pi}{2}$ (B) -1 (C) $i \ln i$ (D) $e^{-\pi/2}$

Q.15 A root of the equation $x^4 - 3x + 1 = 0$ needs to be found using the Newton-Raphson method. If the initial guess, x_0, is taken as 0, then the new estimate, x_1, after the first iteration is

(A) $\frac{1}{3}$ (B) $-\frac{1}{3}$ (C) 3 (D) -3

Q.16 An equimolar liquid mixture of species 1 and 2 is in equilibrium with its vapour at 400 K. At this temperature, the vapour pressures of the species are $P_1^{sat} = 180$ kPa and $P_2^{sat} = 120$ kPa. Assuming that Raoult's law is valid, the value of y_1 is

(A) 0.30 (B) 0.41 (C) 0.50 (D) 0.60

Q.17 A new linear temperature scale, denoted by °S, has been developed, where the freezing point of water is 200°S and the boiling point is 400°S. On this scale, 500°S corresponds, in degrees Celsius, to

(A) 100°C (B) 125°C (C) 150°C (D) 300°C

Q.18 A saturated liquid at 1500 kPa and 500 K, with an enthalpy of 750 kJ/kg, is throttled to a liquid-vapour mixture at 150 kPa and 300 K. At the exit conditions, the enthalpy of the saturated liquid is 500 kJ/kg and the enthalpy of the saturated vapour is 2500 kJ/kg. The percentage of the original liquid, which vaporizes, is

(A) 87.5% (B) 67% (C) 12.5% (D) 10%

Q.19 The stream function in a xy-plane is given below:

$$\psi = \frac{1}{2}x^2y^3$$

The velocity vector for this stream function is

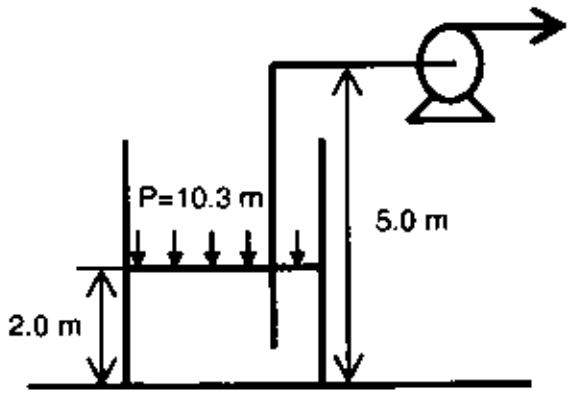
(A) $xy^3\vec{i} - \frac{3}{2}x^2y^2\vec{j}$ (B) $\frac{3}{2}x^2y^2\vec{i} - xy^3\vec{j}$

(C) $\frac{3}{2}x^3y^2\vec{i} + xy^3\vec{j}$ (D) $xy^3\vec{i} + \frac{3}{2}x^2y^2\vec{j}$

Q.20 The height of a fluidized bed at incipient fluidization is 0.075 m, and the corresponding voidage is 0.38. If the voidage of the bed increases to 0.5, then the height of the bed would be

(A) 0.058 m (B) 0.061 m (C) 0.075 m (D) 0.093 m

Q.21



A storage vessel exposed to atmosphere (absolute pressure = 10.3 m of water) has a diameter of 3 m and is initially filled with water to a height of 2 m. The pump draws water from the vessel and is located at an elevation of 5 m above the bottom of the vessel. The frictional head loss in the suction pipe is 2 m of water. If the vapour pressure of the liquid at the temperature of operation is 3 m of water, then the available NPSH is

(A) 2.3 m (B) 5.3 m (C) 6.3 m (D) 8.3 m

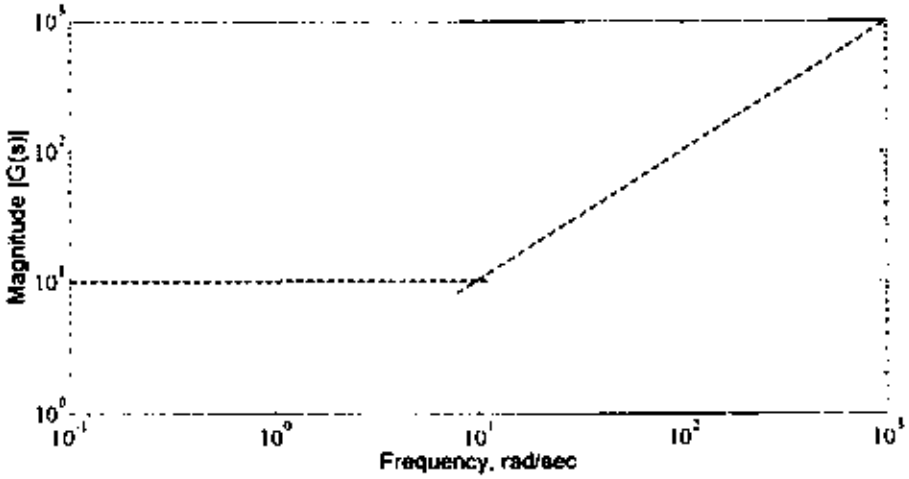
Q.22 In Hagen-Poiseuille flow through a cylindrical tube, the radial profile of shear stress is

(A) constant (B) cubic (C) parabolic (D) linear

Q.23 Flow measuring instruments with different specifications (zero and span) are available for an application that requires flow rate measurements in the range of 300 litres/h to 400 litres/h. The appropriate instrument for this application is the **ONE** whose specifications are

(A) zero = 175 litres/h, span = 150 litres/h (B) zero = 375 litres/h, span = 100 litres/h
(C) zero = 275 litres/h, span = 150 litres/h (D) zero = 475 litres/h, span = 100 litres/h

Q.24 The transfer function, $G(s)$, whose asymptotic Bode diagram is shown below, is



(A) $10s + 1$ (B) $s - 10$ (C) $s + 10$ (D) $10s - 1$

Q.25 The flooding velocity in a plate column, operating at 1 atm pressure, is 3 m/s. If the column is operated at 2 atm pressure, under otherwise identical conditions, the flooding velocity will be

(A) $3/\sqrt{2}$ (B) 3/2 (C) 1 (D) 3/4

Q.26 – Q.55 carry two marks each.

Q.26 The solution of the differential equation

$$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+2y=0$$

with the initial conditions $y(0)=0$, $\left.\frac{dy}{dt}\right|_{t=0}=-1$, is

(A) $-t\sin t$ (B) $-e^{-t}(1-\cos t)$ (C) $-(t+\sin t)/2$ (D) $-e^{-t}\sin t$

Q.27 If $\vec{u}=y\,\hat{i}+xy\,\hat{j}$ and $\vec{v}=x^2\,\hat{i}+xy^2\,\hat{j}$, then $\mathbf{curl}(\vec{u}\times\vec{v})$ is

(A) $(2xy^2)\hat{i}-(x+y^2)\hat{j}$ (B) $(xy-x^2)\hat{i}-(y-3xy)\hat{j}$

(C) $(2x^2y^2-3x^3)\hat{i}-(y^3-3xy^2)\hat{k}$ (D) $(3xy^2-x^3)\hat{i}-(y^3-3x^2y)\hat{j}$

Q.28 X and Y are independent random variables. X follows a binomial distribution, with $N=5$ and $p=1/2$. Y takes integer values 1 and 2, with equal probability. Then the probability that $X=Y$ is

(A) $\frac{15}{64}$ (B) $\frac{15}{32}$ (C) $\frac{1}{2}$ (D) $\frac{15}{16}$

Q.29 A box contains three red and two black balls. Four balls are removed from the box one by one, without replacement. The probability of the ball remaining in the box being red, is

(A) $\frac{609}{625}$ (B) $\frac{3}{5}$ (C) $\frac{2}{5}$ (D) $\frac{81}{625}$

Q.30 For a function $g(x)$, if $g(0)=0$ and $g'(0)=2$, then

$$\lim_{x\to 0}\int_0^{g(x)}\frac{2t}{x}\,dt$$

is equal to

(A) ∞ (B) 2 (C) 0 (D) $-\infty$

Q.31 At constant T and P, the molar density of a binary mixture is given by $\rho=1+x_2$, where x_2 is the mole fraction of component 2. The partial molar volume at infinite dilution for component 1, $\bar{V}_1^{\infty}$, is

(A) 0.75 (B) 1.0 (C) 2.0 (D) 4.0

Q.32 A saturated solution at 30°C contains 5 moles of solute (M.W.=50 kg/kmol) per kg of solvent (M.W.=20 kg/kmol). The solubility at 100°C is 10 moles of the solute per kg of the solvent. If 10 kg of the original solution is heated to 100°C, then the weight of the additional solute that can be dissolved in it, is

(A) 0.25 kg (B) 1 kg (C) 2 kg (D) 3.34 kg

Q.33 The products of combustion of methane in atmospheric air (21% O_2 and 79% N_2) have the following composition on a dry basis:

Products	Mole %
CO_2	10.00
O_2	2.37
CO	0.53
N_2	87.10

The ratio of the moles of CH_4 to the moles of O_2 in the feed stream is

(A) 1.05 (B) 0.60 (C) 0.51 (D) 0.45

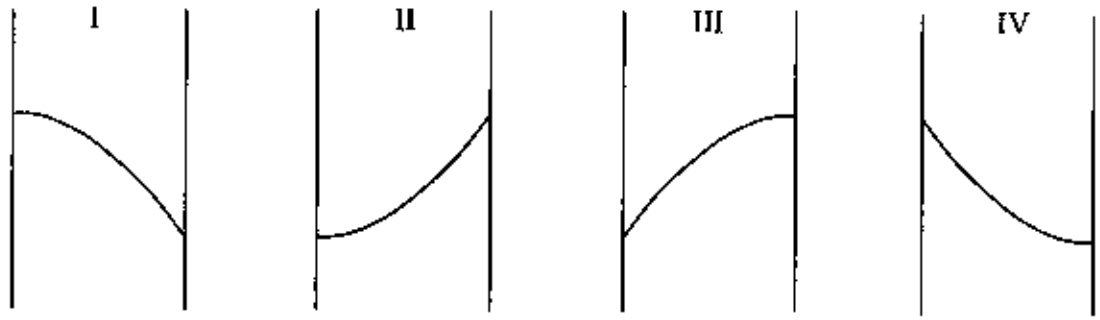
Q.34 A hydrometer, with stem cross-sectional area of $2.82 \times 10^{-5}\ m^2$, is immersed in a very large vessel containing water as shown in the figure. The immersed volume is $15 \times 10^{-6}\ m^3$ and the length of the stem above water surface is L_w. If the entire volume of water is replaced by a liquid with specific gravity 1.5 and if the length of the stem above the liquid surface is L_l, then the difference, $L_l - L_w$, is

(A) –177 mm (B) 177 mm (C) –266 mm (D) 266 mm

Q.35 The diameter of a drop of liquid fuel changes with time, due to combustion, according to the relationship, $D = D_0\left(1 - \frac{t}{t_b}\right)$. While burning, the drop falls at its terminal velocity under Stokes' flow regime. The distance it will travel before complete combustion, is given by

(A) $\frac{D_o^2 \Delta \rho t_b g}{18\mu}$ (B) $\frac{D_o^2 \Delta \rho t_b g}{36\mu}$ (C) $\frac{D_o^2 \Delta \rho t_b g}{54\mu}$ (D) $\frac{D_o^2 \Delta \rho t_b g}{108\mu}$

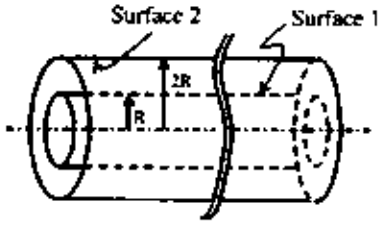
Q.36 The figure below shows steady state temperature profiles for one dimensional heat transfer within a solid slab for the following cases:
P: uniform heat generation with left surface perfectly insulated
Q: uniform heat generation with right surface perfectly insulated
R: uniform heat consumption with left surface perfectly insulated
S: uniform heat consumption with right surface perfectly insulated



Match the profiles with appropriate cases.

(A) P – I, Q – III, R – II, S – IV
(B) P – II, Q – III, R – I, S – IV
(C) P – I, Q – IV, R – II, S – III
(D) P – II, Q – IV, R – I, S – III

Q.37 The view factor matrix for two infinitely long co-axial cylinders, shown in the figure below, is

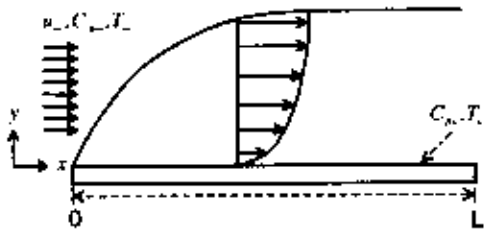


(A) $\begin{bmatrix} 0 & 1 \\ 0.5 & 0.5 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 0.5 & 0.5 \\ 0 & 1 \end{bmatrix}$

Q.38 At 25°C and 90% relative humidity, water evaporates from the surface of a lake at the rate of 1.0 kg/m^2/h. The relative humidity that will lead to an evaporation rate of 3.0 kg/m^2/h, with other conditions remaining the same, is

(A) 30% (B) 50% (C) 60% (D) 70%

Q.39 A liquid flows over a flat naphthalene plate of length L, at a Reynolds number ($\mathrm{Re}_L = L\rho u_\infty / \mu$) of 1500, as shown in the figure. The surface concentration of naphthalene is $C_{As} > C_{A\infty}$, and the surface temperature is $T_s > T_\infty$. Assume $\mathrm{Pr} = \mathrm{Sc} = 1$.



If, at $x = L$, $\left.\dfrac{\partial C_A^*}{\partial y^*}\right|_{y^*=0} = 10$ where $C_A^* = \dfrac{C_A - C_{As}}{C_{A\infty} - C_{As}}$ and $y^* = \dfrac{y}{L}$, then the Nusselt number and the friction coefficient at $x = L$, are

(A) $10, \dfrac{1}{75}$ (B) 10, 10 (C) 20, 10 (D) $\dfrac{1}{75}, 5$

Q.40 Two reactors (reactor 1 and reactor 2) with average residence times, τ_1 and τ_2, respectively, are placed in series. Reactor 1 has zero dispersion and reactor 2 has infinite dispersion. The residence-time distribution, $E(t)$ of this system, is given by

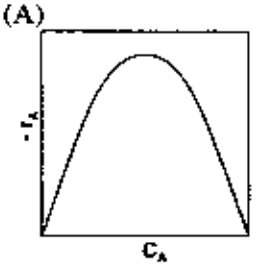
(A) $\begin{cases} 0 & t \le \tau_1 \\ \dfrac{1}{\tau_2}\exp\left(-\dfrac{t-\tau_1}{\tau_2}\right) & t > \tau_1 \end{cases}$

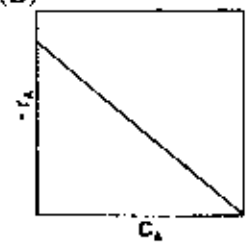
(B) $\begin{cases} 0 & t \le \tau_2 \\ \dfrac{1}{\tau_1}\exp\left(-\dfrac{t-\tau_2}{\tau_1}\right) & t > \tau_2 \end{cases}$

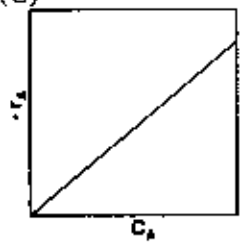
(C) $\begin{cases} 0 & t \le \tau_1 \\ \dfrac{1}{\tau_1}\exp\left(-\dfrac{t-\tau_1}{\tau_2}\right) & t > \tau_1 \end{cases}$

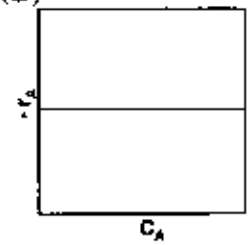
(D) $\begin{cases} 0 & t \le \tau_2 \\ \dfrac{1}{\tau_2}\exp\left(-\dfrac{t}{\tau_1}\right) & t > \tau_2 \end{cases}$

Q.41 An autocatalytic liquid phase reaction, $A + R \rightarrow 2R$ is conducted in an isothermal batch reactor with a small initial concentration of R. Assume that the order of reaction with respect to both reactants is positive. The rate of reaction $(-r_A)$ versus concentration, C_A, as the reaction proceeds, is depicted by

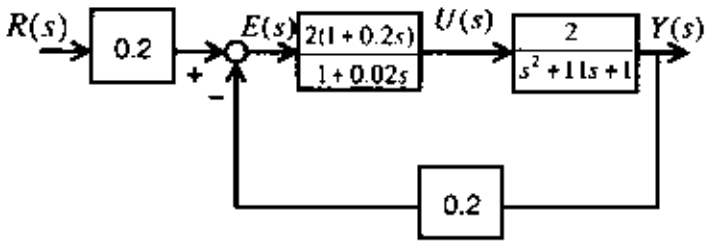
(A)


(B)


(C)


(D)


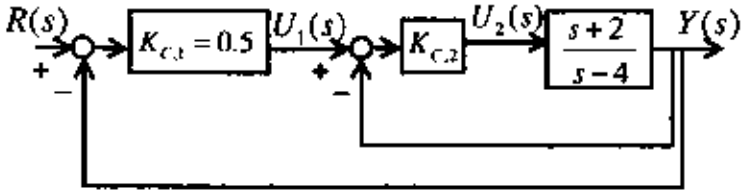
Q.42 A block diagram for a control system is shown below:



The steady state gain of the closed loop system, between output $Y(s)$ and set point $R(s)$, is

(A) 5/9 (B) 4/9 (C) 1/3 (D) 2/9

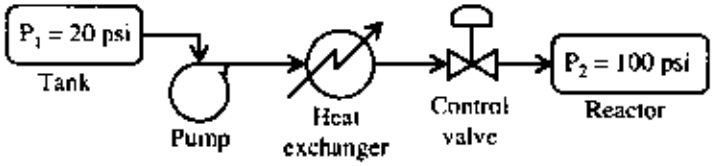
Q.43 Consider the cascade control configuration shown in the figure below:



The system is stable when $K_{C,2}$ is

(A) 3/4 (B) 1 (C) 5/4 (D) 3/2

Q.44 Consider the process as shown below:



A constant head pump transfers a liquid from a tank maintained at 20 psi to a reactor operating at 100 psi, through a heat exchanger and a control valve. At the design conditions, the liquid flow rate is 1000 litres/min, while the pressure drop across the heat exchanger is 40 psi, and that across the control valve is 20 psi. Assume that the pressure drop across the heat exchanger varies as the square of the flow rate. If the flow is reduced to 500 litres/min, then the pressure drop across the control valve is

(A) 30 psi (B) 50 psi (C) 80 psi (D) 150 psi

Q.45 A reactor needs to be lined with a corrosion resistant lining. One type of lining costs Rs. 5 lakhs, and is expected to last for 2 years. Another type of lining lasts for 3 years. If both choices have to be equally economical, with the effective interest rate being 18%, compounded annually, the price one should pay for the second type of lining is

(A) Rs. 6.1 lakhs (B) Rs. 6.5 lakhs (C) Rs. 6.9 lakhs (D) Rs. 7.6 lakhs

Q.46 Match each of the following techniques of polymerization in **Group I**, with the corresponding process characteristics in **Group II**.

GROUP I	**GROUP II**
P. Bulk	I. Polymer with very high molecular weight can be obtained
Q. Solution	II. Heat removal is crucial but very difficult
R. Suspension	III. Small amount of undesired low molecular weight polymer is formed
S. Emulsion	IV. Polymer concentration in the product stream is low

(A) P – I, Q – II, R – III, S – IV (B) P – II, Q – IV, R – III, S – I
(C) P – II, Q – III, R – IV, S – I (D) P – II, Q – III, R – I, S – IV

Q.47 Match each of the polymers in **Group I**, with the raw material in **Group II**, from which they are made.

GROUP I	**GROUP II**
P. Polyester	I. Ethylene Glycol
Q. Polyamide	II. Adipic acid
R. Viscose rayon	III. Cellulose
S. Epoxy resin	IV. Bisphenol

(A) P – I, Q – II, R – III, S – IV (B) P – II, Q – I, R – III, S – IV
(C) P – I, Q – II, R – IV, S – III (D) P – III, Q – II, R – IV, S – I

Common Data Questions

Common Data for Questions 48 and 49:

Hot oil at 150°C is used to preheat a cold fluid at 30°C in a 1 : 1 shell and tube heat exchanger. The exit temperature of the hot oil is 110°C. Heat capacities (product of mass flow rate and specific heat capacity) of both the streams are equal. The heat duty is 2 kW.

Q.48 Under co-current flow conditions, the overall heat transfer resistance $(1/UA)$ is

(A) 0.4 °C/W (B) 0.04 °C/W (C) 0.36 °C/W (D) 0.036 °C/W

Q.49 Under counter-current flow conditions, the overall heat transfer resistance $(1/UA)$ is

(A) 0.4 °C/W (B) 0.04 °C/W (C) 0.36 °C/W (D) 0.036 °C/W

Common Data for Questions 50 and 51:

A plant produces phenol. The variable cost in rupees per tonne of phenol is related to the plant capacity P (in tonnes/day) as 45,000 + 5P. The fixed charges are Rs. 100,000 per day. The selling price of phenol is Rs. 50,000 per tonne.

Q.50 The optimal plant capacity (in tonnes per day) for minimum cost per tonne of phenol, is

(A) 101 (B) 141 (C) 283 (D) 422

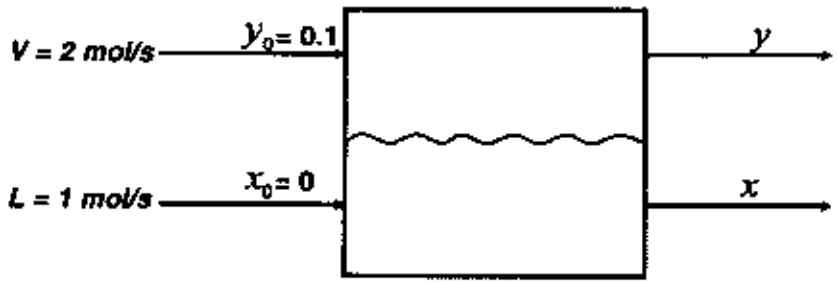
Q.51 The break-even capacity in tonnes per day, is

(A) 50 (B) 40 (C) 30 (D) 20

Linked Answer Questions

Statement for Linked Answer Questions 52 and 53:

Water is used to absorb ammonia from a gas mixture in a single separation stage contactor. The process is schematically represented in the figure below.



The molar gas and liquid flow rates, and the inlet mole fractions are given in the figure. Both the liquid and the gas phases are well mixed, and the equilibrium relation between y and x is given by $y^* = x$.

Q.52 If the stage is ideal, then the value of y is

(A) 1/15 (B) 1/10 (C) 2/15 (D) 1/6

Q.53 If the stage efficiency is 50%, then the value of y is

(A) 1/12 (B) 1/6 (C) 1/4 (D) 1/3

Statement for Linked Answer Questions 54 and 55:

A liquid phase reaction, $A \rightarrow B$, is conducted isothermally in a CSTR having a residence time of 2 s. The inlet concentration of species A is 2 moles/litre, and the outlet concentration is 1 mole/litre. The rate law for the reaction is $-r_A = \dfrac{kC_A}{K + C_A}$ where $k = 5$ moles/litre/s.

Q.54 The value of K, in moles/litre, is

(A) 11 (B) 9 (C) 5 (D) 2

Q.55 If the same reaction is conducted in a series of two CSTRs with residence times 1 s and 0.2 s, then the inlet concentration of A, in moles/litre, required to attain an outlet concentration of A of 1 mole/litre, is

(A) 2.64 (B) 2.00 (C) 1.64 (D) 0.54

General Aptitude (GA) Questions

Q.56 – Q.60 carry one mark each.

Q.56 *Choose the most appropriate word from the options given below to complete the following sentence:*
His rather casual remarks on politics _____ his lack of seriousness about the subject.

(A) masked
(B) belied
(C) betrayed
(D) suppressed

Q.57 *Which of the following options is the closest in meaning to the word below:*
Circuitous

(A) cyclic
(B) indirect
(C) confusing
(D) crooked

Q.58 *Choose the most appropriate word from the options given below to complete the following sentence:*
If we manage to _____ our natural resources, we would leave a better planet for our children.

(A) uphold
(B) restrain
(C) cherish
(D) conserve

Q.59 25 persons are in a room. 15 of them play hockey, 17 of them play football and 10 of them play both hockey and football. Then the number of persons playing neither hockey nor football is:

(A) 2 (B) 17 (C) 13 (D) 3

Q.60 *The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair.*
Unemployed : Worker

(A) fallow : land
(B) unaware : sleeper
(C) wit : jester
(D) renovated : house

Q.61 – Q.65 carry two marks each.

Q.61 If 137 + 276 = 435 how much is 731 + 672?

(A) 534 (B) 1403 (C) 1623 (D) 1513

Q.62 Hari (H), Gita (G), Irfan (I) and Saira (S) are siblings (i.e. brothers and sisters). All were born on 1st January. The age difference between any two successive siblings (that is born one after another) is less than 3 years. Given the following facts:

i. Hari's age + Gita's age > Irfan's age + Saira's age.
ii. The age difference between Gita and Saira is 1 year. However, Gita is not the oldest and Saira is not the youngest.
iii. There are no twins.

In what order were they born (oldest first)?

(A) HSIG (B) SGHI (C) IGSH (D) IHSG

Q.63 **Modern warfare has changed from large scale clashes of armies to suppression of civilian populations. Chemical agents that do their work silently appear to be suited to such warfare; and regretfully, there exist people in military establishments who think that chemical agents are useful tools for their cause.**

Which of the following statements best sums up the meaning of the above passage:

(A) Modern warfare has resulted in civil strife.
(B) Chemical agents are useful in modern warfare.
(C) Use of chemical agents in warfare would be undesirable.
(D) People in military establishments like to use chemical agents in war.

Q.64 5 skilled workers can build a wall in 20 days; 8 semi-skilled workers can build a wall in 25 days; 10 unskilled workers can build a wall in 30 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, how long will it take to build the wall?

(A) 20 days (B) 18 days (C) 16 days (D) 15 days

Q.65 Given digits 2, 2, 3, 3, 3, 4, 4, 4, 4 how many distinct 4 digit numbers greater than 3000 can be formed?

(A) 50 (B) 51 (C) 52 (D) 54

END OF THE QUESTION PAPER

Space for Rough Work

Space for Rough Work

SEAL