University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI
Subject: Mass Transfer Operation-II **Course Code: CHC601**
Question Bank

Q1.	In minimum boiling azeotrope, total pressure curve
Option A:	passes through a maximum value
Option B:	passes through a minimum value
Option C:	continuously increases
Option D:	continuously decreases
Q2.	Flash vaporization is a
Option A:	Equilibrium distillation
Option B:	Differential distillation
Option C:	Steam distillation
Option D:	Azeotropic distillation
Q3.	For effective separation with liquid-liquid extraction, the selectivity should be
Option A:	Less than 1
Option B:	Equal to 1
Option C:	Greater than 1
Option D:	Equal to zero
Q4.	On the binodal solubility curve, the point where A-rich and B-rich curves merge is called as
Option A:	Tripple point
Option B:	Boiling point
Option C:	Dew point
Option D:	Plait point
Q.5.	Which of the following is not a step in the process of distillation?
Option A:	Vaporization

Option B:	Condensation
Option C:	Heating
Option D:	Precipitation
Q6.	The slope of a feed line for a saturated vapor feed is-----
Option A:	0
Option B:	1
Option C:	Infinity
Option D:	>1
Q7	In chemical adsorption, how many layers are adsorbed
Option A:	One
Option B:	Two
Option C:	Many
Option D:	Zero
Q8	In adsorption of oxalic acid on activated charcoal, the activated charcoal is known as
Option A:	Adsorbent
Option B:	Absorbate
Option C:	Adsorber
Option D:	Absorber
Q9.	Crystallization is based on the _____
Option A:	Difference in melting point
Option B:	Difference in boiling point
Option C:	Difference in pressure
Option D:	Difference in solubility
Q10.	The solvent rich phase in liquid-liquid extraction is
Option A:	Distillate
Option B:	Residue
Option C:	Extract

Option D:	Raffinate
Q11	In distillation where q is defined as the moles of liquid flow in the stripping section per mole of feed introduced, for saturated liquid feed
Option A:	$q > 1$
Option B:	$q < 1$
Option C:	$q = 1$
Option D:	$q = 0$
Q12	Fenske equation determines the
Option A:	maximum number of ideal plates
Option B:	height of the distillation column
Option C:	minimum number of theoretical plates.
Option D:	optimum reflux ratio.
Q13	In a counter-current extractor, as the axial mixing increases, the extraction efficiency
Option A:	increases
Option B:	decreases
Option C:	remains unchanged
Option D:	depends on the pressure of the system
Q14.	In the leaching operation, the exhausted solids phase is called as-
Option A:	The underflow
Option B:	The overflow.
Option C:	The extract.
Option D:	The raffinate.
Q15.	In distillation, overhead product contains
Option A:	only one component
Option B:	two components
Option C:	any number of components
Option D:	only saturated liquid
Q16.	_____ is the temperature at which a gas-vapor mixture becomes saturated, when cooled at constant total pressure out of contact with a liquid.
Option A:	Dew point
Option B:	Bubble point
Option C:	Dry bulb temperature
Option D:	Wet bulb temperature
Q17	In liquid-liquid extraction, the ratio of weight fraction of solute in the extract phase to that in the raffinate phase is called as
Option A:	The distribution coefficient.
Option B:	The separation factor
Option C:	The selectivity.
Option D:	The relative volatility.
Q18	A minimum boiling azeotrope is formed due to
Option A:	Ideal behavior
Option B:	Excessive positive deviations from ideality.
Option C:	Excessive negative deviations from ideality.

Option D:	Negligible positive deviations from ideality.
Q19.	The simple distillation is also called as-
Option A:	Equilibrium distillation.
Option B:	Flash distillation.
Option C:	Differential distillation.
Option D:	Continuous rectification.
Q20.	In a flash distillation operation, 73 % of the feed solution gets vaporized. The slope of the operating line in this case is-
Option A:	-0.63
Option B:	0.63
Option C:	0.37
Option D:	-0.37
Q21.	The solvent in liquid-liquid extraction should have ---less than one.
Option A:	Selectivity
Option B:	Distribution coefficient
Option C:	Both selectivity and nor Distribution coefficient
Option D:	Neither selectivity and nor Distribution coefficient
Q22.	In triangular co-ordinates, the ternary composition point falls _____ of the triangle.
Option A:	in the corners
Option B:	on the sides
Option C:	inside
Option D:	none of the above
Q23.	At the plait point on the binodal solubility curve-
Option A:	The length of the tie line is infinite.
Option B:	The tie line is vertical.
Option C:	The tie line is horizontal.
Option D:	The length of the tie line is zero.
Q24.	The physical adsorption is also called as
Option A:	Activated adsorption
Option B:	Irreversible adsorption
Option C:	Van der Waals adsorption
Option D:	Complicated adsorption
Q25.	The following is one of the basic steps in crystallization
Option A:	Nucleation
Option B:	Mixing
Option C:	Filtration
Option D:	Sedimentation
Q26.	$\Delta L's$ law of crystals growth states that
Option A:	All geometrically similar crystals of the same solute grow at the same rate in the same solution.
Option B:	All geometrically dissimilar crystals of the same solute grow at the same rate in the same solution.
Option C:	All geometrically similar crystals of the same solute grow at the different rates in the same solution.
Option D:	All geometrically similar crystals of the same solute grow at the same rate in different solution.
Q27	The most common operation used for dehumidification of air and gases is
Option A:	Distillation.
Option B:	Leaching.
Option C:	Crystallization.
Option D:	Adsorption.

Q28	The chemical adsorption is also called as-
Option A:	Reversible adsorption
Option B:	Van der Waals adsorption
Option C:	Complicated adsorption.
Option D:	Activated adsorption
Q29	What is the membrane that selectively allows certain species to pass through is
Option A:	Permeable membrane
Option B:	Semi-permeable membrane
Option C:	Impermeable membrane
Option D:	membrane
Q30	The amount of pressure to be applied in RO system depends upon
Option A:	Oraganic content
Option B:	Bacteria
Option C:	Salt concentration
Option D:	Membrane strength

Subjective Question Bank-MTO-II

1	Elaborate choice of solvent for Liquid-Liquid extraction operation.
2	Carbon disulphide (CS_2) is used to extract iodine from its aqueous solution. The distribution of iodine between Carbon disulphide (CS_2) and Water at equilibrium is given by, Y=550.X. Calculate the concentration of iodine in aqueous phase of 1 liter of water is stirred with 50 ml of Carbon disulphide (CS_2) for two stage extraction operation.
3	Write down material balance for a single stage leaching operation.
4	Explain Basket extractor with suitable diagram.
5	Differentiate between Physical Adsorption and Chemisorption.
6	Write a note on Ion Exchange with principle.
7	Perform material balance for single stage cross current L-L extraction for insoluble solvent? Explain how to calculate theoretical stages by graphical method. Consider pure solve stream.
8	Explain in detail Oslo Cooling crystallizer with diagram.
9	A hot solution containing 2000 kg of $MgSo_4$ and water at 330K, with concentration of 30 wt % $MgSo_4$ is cooled to 293K and $MgSo_4.7H_2O$ crystals are removed. The solubility of at 293K is 35.5kg $MgSo_4$ per 100 kg water. Calculate the yield of crystals. Assume that no water is evaporated. (At. Wt. Mg = 24, O = 16, H = 1)
10	Explain in detail principle of Ultrafiltration.
11	Write a note on need of membrane separation and its advantages.
12	Explain steam distillation in detail
13	Derive operating line equation of feed line with suitable diagram.
14	A mixture of Benzene and Toluene containing 40 mole % benzene is to be separated to give a product of 90 mole % of benzene at a top and bottom product with not more than 10 mole % benzene. Calculate the number of theoretical plates required at total reflux.

	Also calculate minimum reflux ratio, if feed is liquid at its bubble point.
15	Discuss various methods of creating supersaturation during crystallization process
16	Explain fractional distillation with suitable diagram. Also Explain concept of q line for various feed conditions.
17	1000 kgmoles/hr of a binary mixture contains 40 mole% light component is fed to a distillation column.The output concentrations are xD=0.92 & xW=0.07.The feed is saturated vapor. Reflux ratio=3 & relative volatility 2.1. Find the no.of theoretical plates
18	Explain: Describe Swenson walker crystalliser
19	Explain break through curve for adsorption in fixed bed. Derive equation for length of unused bed (LUB).
20	Derive the equation for the operating line for flash distillation and find its intersection point with the diagonal line of the x-y plot.
21	A solution containing 5 % acetaldehyde and 95 % Toluene is to be extracted with water in a three-stage cross current unit to extract acetaldehyde. Toluene and water are essentially insoluble. If 25 kg of water each time are used per 100 kg of feed, calculate the amount of acetaldehyde extracted and final concentration of the exit solution. The equilibrium relationship is Y=2.2X. in this case X is kg of acetaldehyde/kg of Toluene and Y is kg of acetaldehyde/kg of water
22	Differentiate between Physical and Chemical Adsorption
23	Derive the operating line equation for flash Distillation
24	A feed containing 75 mole percent of A and remaining B is to be distilled in a column. The distillate contains 98 percent A and the bottom contains 1 percent A.The feed is cold and for each mole of feed, 0.3 moles of vapour is condensed on the feed plate. The reflux ratio is 1.28 and the reflux is at its bubble point. Average relative volatility is $\alpha_{AB} = 2 . 5.$ Calculate i. the minimum reflux ratio ii. Number of theoretical plates using a reboiler and a partial condenser, where the reflux is in equilibrium with the distillate vapour.
25	A 200 cm3 portion of an aqueous solution containing 0.05 mole of a certain solute is extracted twice with the 25 cm3 of ether Calculate i) the amount of solute remaining unextracted ii) the percentage extraction
26	A batch of crude pentane containing 15 mole percentage butane and 85 mole percentage pentane is subjected to simple batch distillation at atmospheric pressure to remove 90 percentage of butane. What should be the composition of remaining liquid? Also determine quantity of pentane removed per kmol of feed. Average relative volatility of butane to pentane is 3.5.
27	A solution containing 5% acetaldehyde and 95% toluene is to be extracted with water in a five stage crosscurrent extraction unit to extract acetaldehyde. Toluene and water are essentially insoluble. If 25 kg of water each time are used per 100 kg of feed, calculate the amount of acetaldehyde extracted and final concentration of the exit solution. Equilibrium relationship,Y=2.20 X

28	Explain Reverse osmosis process.
29	Write short note on electrodialysis
30	A salt solution weighing 10,000 kg with 30 wt. percent Na_2CO_3 is cooled to 239 K. The salt crystallizes the decahydrate. What will be the yield of Na_2CO_3 .$10H_2O$ crystals if the solubility is 21.5 kg unhydrous Na_2CO_3 per 100 kg water. For (a) No water evaporated (b) 3 percent of total weight of solution is lost by evaporation of water in cooling.

University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI
Subject: Chemical Reaction Engineering-II **Course Code: CHC602**
Question Bank

Q1.	Tanks in series model is ----------parameter model
Option A:	Zero
Option B:	One
Option C:	Two
Option D:	Three
Q2.	The vessel dispersion number (D/μL) for plug flow is
Option A:	0
Option B:	500
Option C:	750
Option D:	∞
Q3.	F(t) is ----------
Option A:	Cumulative residence time Distribution function
Option B:	Exit age distribution function
Option C:	Dirac delta function
Option D:	Step function
Q4.	_____ resistance is not involved in the combustion of a carbon particle
Option A:	Ash
Option B:	Gas film
Option C:	None of these
Option D:	Chemical reaction
Q.5.	Which of the following resistances is not involved in a gas phase catalytic (gas-solid) reaction?
Option A:	Ash resistance
Option B:	Gas film and pore surface diffusion resistances for reactants
Option C:	Surface phenomenon resistance
Option D:	Gas film and pore surface diffusion resistances for products
Q6.	An ore of uniform size particles is to be roasted in a fluidised bed reactor. The time required for complete conversion of solid particles is 20 min and the mean residence time of particles in the bed is 48 min. The solids remain unchanged in size during reaction. Calculate the fraction of the original ore remaining unconverted assuming Ash diffusion step as rate controlling
Option A:	8.6 %
Option B:	4.5 %
Option C:	7.6 %
Option D:	10.6 %
Q7	Determine the role of pore diffusion and external mass transfer processes
Option A:	Strong pore diffusion control and mass transfer not controlling
Option B:	Mass transfer controlling

Option C:	Both pore diffusion and mass transfer not controlling
Option D:	Both pore diffusion and mass transfer controlling
Q8	Effectiveness factor of a catalyst pellet is measure of the _____ resistance.
Option A:	Pore diffusion
Option B:	Gas film
Option C:	Chemical reaction
Option D:	None of these
Q9.	The Hatta number is important in
Option A:	Multicomponent distillation
Option B:	Binary distillation
Option C:	Gas absorption without chemical reaction
Option D:	Gas absorption with chemical reaction
Q10.	For high value of kg, which contactor is suitable?
Option A:	Bubble column
Option B:	Packed column
Option C:	Spray Column
Option D:	Trickle Bed
Q11	The exit age distribution of fluid leaving a vessel is used
Option A:	to study the reaction mechanism
Option B:	to study the extent of non-ideal flow in the vessel
Option C:	to know the reaction rate constants
Option D:	to know the activation energies of a reaction
Q12	Solid particle consumption dynamics as a function of conversion for different controlling regimes of Shrinking Core Model are given below A) $\frac{t}{\tau} = 1 - (1 - X_B)^{\frac{1}{3}}$ B) $\frac{t}{\tau} = X_B$ C) $\frac{t}{\tau} = 1 - 3(1 - X_B)^{\frac{2}{3}} + 2(1 - X_B)$ Identify the controlling regime for each of these
Option A:	A-Gas film controlling, B-Ash layer controlling, C-Reaction controlling
Option B:	B-Gas film controlling, A-, B-Reaction controlling, C-Ash layer controlling
Option C:	B-Gas film controlling, A-Ash layer controlling, C-Reaction controlling
Option D:	C-Gas film controlling, B-Ash layer controlling, A-Reaction controlling
Q13	What is the dispersion number for a plug flow reactor?
Option A:	2
Option B:	1
Option C:	-1
Option D:	0
Q14.	Which of the following statement is false?
Option A:	RTD describes the deviation from ideal behavior.
Option B:	RTD is not a unique signature of a reactor.

Option C:	RTD of perfect PFR and perfect CSTR are same
Option D:	RTD can be measured using concentration of tracer
Q15.	If τ is the time necessary to consume the entire solid particle. which one of these is the correct relation for the case of reaction controlled condition? Note: All the symbols used have the usual meaning.
Option A:	$\tau = \frac{\rho_B \phi_B R_0^2}{6 D_e C_{A0}}$
Option B:	$\tau = \frac{\rho_B R_0}{8 k'' C_{A0}}$
Option C:	$\tau = \frac{\rho_B R_0}{3 k'' C_{A0}}$
Option D:	$\tau = \frac{\rho_B R_0}{k'' C_{A0}}$
Q16.	If a solid-gas non-catalytic reaction occurs at very high temperature, the rate controlling step is
Option A:	film diffusion
Option B:	chemical reaction
Option C:	ash layer diffusion
Option D:	pore diffusion
Q17	Stimulus-response techniques are commonly used to characterize the extent of non-ideal flow in vessels. Tracer input signal is used as stimulus. Any material can be used
Option A:	as tracer if it can disturb the flow pattern in the vessel
Option B:	as tracer if it does not disturb the flow pattern in the vessel and it can be detected.
Option C:	as tracer if it follows i.e deal flow patterns
Option D:	as tracer.
Q18	For the non-catalytic reaction of particles with the surrounding fluid, the time needed to achieve the same fractional conversion for particles of different unchanging sizes is proportional to the particle diameter when the _____ is the controlling resistance.
Option A:	Film diffusion
Option B:	Diffusion through ash layer
Option C:	Chemical reaction
Option D:	Either A, B or C
Q19.	Catalyst carriers
Option A:	Have very high selectivity
Option B:	Increase the activity of catalyst
Option C:	Provide large surface area with a small amount of active material
Option D:	Inhibit catalyst poisoning
Q20.	Carbon particles accumulated on the catalyst used in the gas oil cracking lies in the category of _____ poison
Option A:	Deposited
Option B:	Chemisorbed
Option C:	Selectivity

Option D:	Stability
Q21.	A promoter is added to the catalyst to improve its
Option A:	Porosity
Option B:	activity
Option C:	surface area
Option D:	none of these
Q22.	Fluidised bed reactor is characterized by
Option A:	Uniformity of temperature
Option B:	Comparatively small equipment
Option C:	Absence of continuous catalyst regeneration facility
Option D:	Very small pressure drop
Q23.	Packed towers are preferred for gas-liquid mass transfer operations with foaming liquids because
Option A:	in packed towers, high liquid to gas ratios are best handled
Option B:	in packed towers, continuous contact of gas and liquid takes place
Option C:	packed towers are packed with random packings
Option D:	in packed towers, the gas is not bubbled through the liquid pool
Q24.	The 'E' curve for a non-ideal reactor defines the fraction of fluid having age between t and t + dt
Option A:	at the inlet
Option B:	at the outlet
Option C:	in the reactor
Option D:	averaged over the inlet and outlet
Q25.	In chamber process of sulphuric acid manufacture in industry, the gas phase oxidation of SO_2 to SO_3 is accomplished by a _____ reaction.
Option A:	non-catalytic homogeneous
Option B:	non-catalytic heterogeneous
Option C:	catalytic homogenous
Option D:	catalytic heterogeneous
Q26.	BET apparatus is used to determine the
Option A:	specific surface of a porous catalyst.
Option B:	pore size distribution.
Option C:	pore diameter.
Option D:	porosity of the catalyst bed.
Q27	For the solid-gas non-catalytic reaction (spherical shape solid particles), the linear relation between conversion of solid (XB) and time (t) signifies,
Option A:	Diffusion through ash layer is controlling mechanism
Option B:	Chemical reaction is controlling mechanism
Option C:	Diffusion through gas film is controlling mechanism
Option D:	Major resistance lies in bulk of gas phase
Q28	Fluid flow in a real packed bed can be approximated as _____ model.

Option A:	plug flow
Option B:	dispersion
Option C:	mixed flow
Option D:	tank in series
Q29	For high conversion in a highly exothermic solid catalysed reaction, use a _____ bed reactor.
Option A:	fixed
Option B:	fluidised bed reactor followed by a fixed
Option C:	fixed bed reactor followed by a fluidised
Option D:	fluidised
Q30	Rate determining step in a reaction consisting of a number of steps in series is the _____ step.
Option A:	fastest
Option B:	slowest
Option C:	intermediate
Option D:	data insufficient; can't be predicted

Subjective Question Bank-CRE-II

<table>
<tr><td>1</td><td>Write short note on Tanks in Series Model.</td></tr>
<tr><td>2</td><td>A tracer with number of dividing baffles is to be used to carry out the reaction $A \rightarrow R$ with
$-r_A = k\,C_A$, $k=0.25\ min^{-1}$
The results of a pulse tracer test are given below
<table>
<tr><td>t, min</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>12</td><td>14</td></tr>
<tr><td>Tracer output Concentration (mg/l)</td><td>0</td><td>1</td><td>5</td><td>8</td><td>10</td><td>8</td><td>6</td><td>4</td><td>3</td><td>2.2</td><td>1.5</td><td>0.6</td><td>0</td></tr>
</table>
a) Plot C (t), E (t) and F (t) curves.
b) Calculate mean residence time.
c) Find the conversion expected in the tank-in-series model and how many tanks in series would you suggest to model this reactor.
d) Calculate conversion assuming Mixed Flow reactor.</td></tr>
<tr><td>3</td><td>Develop conversion time relationship for Shrinking spherical particles when Chemical reaction control</td></tr>
<tr><td>4</td><td>Calculate the time required to burn to completion spherical particles of graphite (radius 12 mm, bulk density 2.4 g/cc) in a 12% oxygen stream at 900°C and 1 atm. Assume gas film resistance to be negligible. Surface reaction rate constant = k” = 25 cm/s</td></tr>
<tr><td>5</td><td>In a uniform gas environment, 4 mm solid particles are 87.5 % converted to product in 5 min according to shrinking core model with chemical reaction step as rate controlling. The solids remain unchanged in size during reaction. Find the mean residence time of solids needed to achieve same mean conversion of solids in a fluidized bed reactor operating with same gas environment using 1000 kg/hr of feed consisting of equal quantities of 2 mm and</td></tr>
</table>

1 mm particles. Also find solid hold-up (Weight of solids) in the bed.

6 For the catalytic reaction A→4 R following rate –concentration data are available

$C_A$mol/lt	0.039	0.0575	0.075	0.092
$-r_A$' mol A/ kg cat.hr	3.4	5.4	7.6	9.1

Determine the size of packed bed (find W) to treat 2500 mol/hr of pure A at 3.2 atm and 117 deg C to 35% conversion directly from the data given

7 Estimate the surface area (m^2/gm) of 8.01 gm of glaucosil sample. Nitrogen at -195.8 deg C is used for adsorption studies. The adsorption data obtained are given below.

Pressure (mm Hg)	6	25	140	230	285	320	430.	605
Vol. adsorbed (cc) at STP	61	127	170	197	215	230	277	335

The vapour pressure of nitrogen at -195.8 deg C is 1 atm and the density of nitrogen is 0.808 gm/cc

8 Develop Langmuir-Hinshelwood type of rate equation for

$$A + B \rightleftarrows C + D$$

i) When Adsorption of A is reaction Controlling Step
ii) When desorption of C is reaction Controlling Step

9 Sketch the concentration profile for instantaneous reaction with respect to mass transfer in case of following reaction assuming 1) High C_B 2) Low C_B

A(g→l) +bB(l) ⟶ R(l)

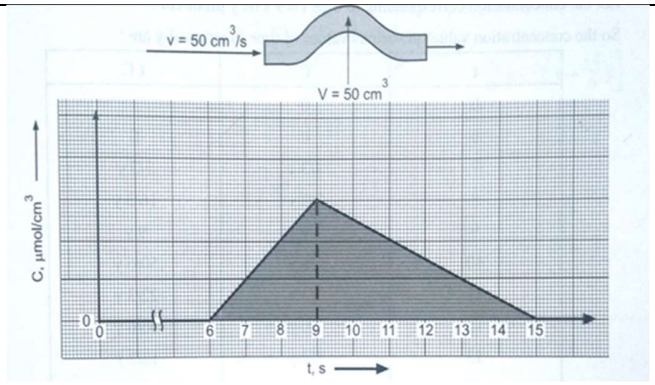
10 Gaseous A absorbs and reacts with B in liquid according to

A(g→l) +B (l) → R(l), $-r_{Al} = kC_AC_B$

In a packed bed.

a) Calculate the rate of reaction
b) Determine the location of the major resistance (gas film, liquid film and bulk liquid) and behavior in the liquid film at a point in the reactor where p_A= 100 Pa and C_B =100 mol/m^3 liquid
k= $10^8$$m^3$ liquid/mol.h
H_A= 1.0 Pa m^3liquid/mol

	$k_{Ag}a$ =0.1 mol/(h.m^3reactor.Pa) $k_{Al}a$ = 100 m^3liquid/(m^3reactor.h) a=100 m^2/m^3 reactor f_l= 0.01 m^3 liquid/m^3 reactor $D_{Al} = D_{Bl}$= 10^{-6} m^2/h For Ei<M_H/5, consider instantaneous reaction and E≈Ei
11	Explain pulse input experiment for RTD measurement.
12	The following results were obtained for a pulse tracer test carried on a piece of reaction equipment. The output concentration rise linearly from zero to *0.5 µmol/dm^3 in 5 min*, then fell linearly to zero in *10 min* (after reaching a maximum value of *0.5 µmol/dm^3*). (i) Calculate the mean residence time (ii) Calculate the total reactor volume if the flow rate is *570 l/min*.
13	Calculate the time required for complete burning of particles of graphite (size: Ro = 5 mm, density: ρ_B = 2.2 g/cm^3) in an 8% oxygen stream at 900°C and 1 atm. For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. Data: rate constant = k" = 20 cm/s
14	A solid catalysed first order reaction A → R takes place with 55% conversion in a basket type mixed reactor. Find the conversion if the reactor size is trebled- all else, i.e., temperature, composition etc remains unchanged.
15	How much catalyst is needed in a packed bed reactor (assume plug flow) for 35% conversion of A to R for a feed of 2000 mol/h of pure gaseous A at 3.2 atm and 117oC if the stoichiometry and rate are given by A → 4R, $-r_A' = 96.55$ (lit/h.kg cat) C_A
16	Derive design equation for (i) Solid catalytic PFR (ii) Solid catalytic CSTR
17	Explain step input experiment for RTD measurement.
18	The results of a pulse input to a vessel are shown in following fig.



Say, max conc of tracer = y micro.mol/cm^3

(a) Check the material balance with the experimental tracer curve to see whether the results are consistent or not.

(b) If the results are consistent, determine the amount of tracer introduced, M

19 Calculate the time required for complete burning of particles of graphite (size: Ro = 5 mm, density: ρ_B = 2.2 g/cm^3) in an 8% oxygen stream at 900^{o}C and 1 atm.
For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction.
Data: rate constant = k" = 20 cm/s

20 Explain Brunauer-Emmett-Teller method for surface area determination.

21 The RTD analysis was carried out in a liquid phase reactor as follows –

Time, min	0	2.5	2.9	3.3	3.75	4	4.6	4.33	4.58	5	5.41	6.25
Conc., (gm/cm^3)	0	0	1	3	7.4	9.4	9.7	9.4	8.2	5	2.5	0.5

i) Plot E(t) and F(t) curves

ii) Find mean residence time

iii) what fraction of material spends between 4 and 5 minutes in the reactor?

iv) what conversion can be expected for the reaction carried out in the reactor with rate constant of 0.7 min-1

22 A reactor has flow characteristics given by the non-normalised C- curve in the table and by the shape of this curve we feel that the dispersion or tanks- in- series models should satisfactorily represent the flow in the reactor.

Time, min	1	2	3	4	5	6	8	10	15	20	30	41	52	67
Conc.,	9	57	81	90	90	86	77	67	47	32	15	7	3	1

	gm/lit i) find the conversion expected in this reactor assuming that the dispersion model holds good ii) find the number of tanks in series which will represent the reactor and conversion therein. iii) Find conversion by assuming segregation model holds good.
23	Calculate the time needed to burn to completion particles of graphite (R0= 5mm, ρB= 2.2 g/cm3, Ks = 20 cm/s) in an 8% O2 stream. For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. Reaction temperature = 900C.
24	The reduction of FeS2 particle according to reaction FeS2 (g) + H2 (g) □ FeS (s) + H2S (g) is studied in lab reactor in such a condition that concentration of Hydrogen in a bulk phase was constant. H2 at 1 atm pressure was passed through the bed of FeS2 particle (0.035 cm) diameter at 450C. the result of experiment is as follows – Time, (min) 15.6 32.4 71 119.4 % XB 10 20 40 60 i) Find rate controlling step if density of FeS2 is 4 g/cc ii) Determine the rate constant (Ks) of reaction assuming it is first order reaction with respect to hydrogen occurring at FeS2-FeS interface is the rate controlling step. iii) If the diffusion through FeS produced layer is the rate controlling step with De= 3.6x10-6 cm2/s. Calculate a) time required for complete conversion of FeS2 b) time required for 80% conversion of FeS2 particles.
25	A hydrogenation catalyst is prepared by soaking alumina particles in aq NiNO3 solution. After drying and reduction, the particles contain about 7 wt.% NiO. This catalyst is then made into a large cylindrical pellet for rate studies. The gross measurements for one pellet are _ Mass = 3.15 g, Diameter = 1.00 in, Thickness = ¼ in, Volume = 3.22 cc. The Al2O3 particles contain micropores, and the pelleting process introduces macropores surrounding the particles. The macropore volume of the pellet is 0.645 cc and the

	micropore volume is 0.40 cc/g of particles. From this information calculate – 1) Density of pellet 2) Macropore volume in cc/g 3) Macropore void fraction in the pellet 4) Micropore void fraction in the pellet 5) Solid fraction 6) Density of particles 7) Density of solid phase
26	Oxidation of Nitric acid is carried out in silica gel at 1 atm pressure by the reaction – $$-r_A = \frac{p_{NO}^2 . p_{O2}^2}{a + b + p_{NO2} + C . p_{NO}^2} \ , \frac{kmol\ NO}{kg\ cat. hr}$$ Where a = 5.834 x 10^{-3}, b = 23.63, C = 3.268 x 10^{-2} Feed consists of 5% NO and 95% O2. 80% conversion of Nitric Oxide is obtained in PFR at a feed rate of 1 kmol/ hr. calculate the weight of catalyst required.
27	Determine the weight and volume of catalyst necessary to achieve 89% conversion of Toluene in Packed Bed Reactor with a bulk density of 2.3 g/cc with an entering volumetric flow rate of 400 litre/ min. $$C_6H_5CH_3 + H_2 \rightarrow C_6H_6 + CH_4$$ Rate law is – $$-r_T = \frac{1.4 \times 10^{-8} p_{H2} . p_T}{1 + 1.26 p_B + 1.01 p_T} \ , \frac{mol\ Toluene}{gm\ catalyst. sec}$$ Pressure is in atm, T – toluene, B – Benzene. The feed consists of 20% Toluene, 40% H2 and 40% inert at 600C and 10 atm.

28	Derive Langmuir-Hinshelwood type of rate equation for the reaction – $A+B \leftrightarrow C+D$ Where desorption of C is rate controlling step.
29	Explain in detail the contacting patterns in fluid- fluid reactions.
30	Write short notes on - Packed Bed Reactor, Fluidized Bed, Trickle Bed and Slurry Reactor.

University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI

Subject: Pollution Control Technology **Course Code: CHC603**

Question Bank

Q1.	_____ is called the Secondary Air pollutant.
Option A:	PAN
Option B:	Ozone
Option C:	Carbon monoxide
Option D:	Nitrogen Dioxide
Q2.	What are the agents that bring about such an undesirable change (pollution) are called?
Option A:	Pollutants
Option B:	Haptens
Option C:	Adjuvants
Option D:	Vaccine
Q3.	The polluted water is one which _____.
Option A:	contains pathogenic bacteria
Option B:	consists of undesirable substances rendering it unfit for drinking and domestic use
Option C:	is safe and suitable for drinking and domestic use is contaminated
Option D:	None of the above
Q4.	_____ is used to prevent odours of effluent.
Option A:	Coagulation
Option B:	Filtration
Option C:	Prechlorination
Option D:	Microstraining
Q.5.	The minimum particle size removes by the gravitational chamber is _____.
Option A:	>50µm
Option B:	>10µm
Option C:	>25µm
Option D:	>0.5µm
Q6.	How long does methane stay in a landfill?
Option A:	1 to 3 years or less
Option B:	4 to 10 years
Option C:	10 to 15 years

Option D:	20 to 50 years or longer
Q7	Which of the below is not an idea behind solid waste management?
Option A:	Stop waste generation
Option B:	Storage and collection
Option C:	Disposal
Option D:	Control of waste generation
Q8	Domestic water treatment is carried out under _____ conditions.
Option A:	Aerobic
Option B:	Anaerobic
Option C:	Depends on the pollution level of water
Option D:	Depends on BOD value
Q9.	Aerobic process is also called as _____
Option A:	Activated sludge process
Option B:	Sludge thickening process
Option C:	Sedimentation
Option D:	Screening
Q10.	Activated Carbon is classified as which type of treatment?
Option A:	Preliminary treatment
Option B:	Primary treatment
Option C:	Secondary treatment
Option D:	Tertiary treatment
Q11	In which unit sound is measured?
Option A:	Kilometer
Option B:	Pascal
Option C:	Kilogram
Option D:	Decibel
Q12	In anaerobic treatment the organic acid and alcohol is undergone into _____ process.
Option A:	Sedimentation
Option B:	Screening
Option C:	Catalysis
Option D:	Fermentation
Q13	The upward vertical rise prevails in _____ plume.
Option A:	Trapping
Option B:	Fanning
Option C:	Looping
Option D:	Neutral
Q14.	_____is not a water borne disease.
Option A:	Dysentery
Option B:	malaria
Option C:	typhoid
Option D:	cholera
Q15.	_____ is formed from the anaerobic oxidation of organic matter.

Option A:	NO_3
Option B:	SO_4
Option C:	H_2S
Option D:	NH_2
Q16.	In filtration, the amount of dissolved solids passing through the filters is_____.
Option A:	Difference between total solids and suspended solids
Option B:	Sum of total solids and suspended solids
Option C:	Independent of suspended solids
Option D:	None of the above
Q17	Disinfection of water in our country is mainly done by _____ .
Option A:	Oxygenation
Option B:	Hydration
Option C:	Chlorination
Option D:	Filtration
Q18	Fishes can store more quantity of _____ in their bodies.
Option A:	Mercury
Option B:	Bismuth
Option C:	Palladium
Option D:	Chlorine
Q19.	The pyramid of energy is always upright" states that
Option A:	The energy conversion efficiency of herbivores is better than carnivores
Option B:	The energy conversion efficiency of carnivores is better than herbivores
Option C:	Producers have the lowest energy conversion efficiency
Option D:	Energy conversion efficiency is the same in all trophic levels
Q20.	The process of nutrient enrichment is termed as
Option A:	Eutrophication
Option B:	Limiting nutrients
Option C:	Enrichment
Option D:	Schistosomiasis
Q21.	The upper part of an aquatic ecosystem contains
Option A:	Nekton
Option B:	Plankton
Option C:	Benthos
Option D:	both (A) and B)
Q22.	Select a non-denitrifying bacteria

Option A:	Pseudomonas aeruginosa
Option B:	Thiobacillus
Option C:	Thiobacillus denitrificans
Option D:	Bacillus ramosus
Q23.	A technique used to determine the concentration of odour compounds in a sample is known as
Option A:	Stripping
Option B:	Settling
Option C:	Flushing
Option D:	Chlorination
Q24.	If BOD_3 of a waste water is 75 mg/L and K' is 0.15 per day what is ultimate BOD?
Option A:	116.32
Option B:	120.12
Option C:	123.23
Option D:	119.32
Q25.	For Biological oxygen demand how much time and temperature required
Option A:	3 days and 27 ^{o}c
Option B:	4 days and 15 ^{o}c
Option C:	5 days and 29 ^{o}c
Option D:	2 hrs and 150 ^{o}c
Q26.	Identify the correct statement regarding the Electrostatic precipitator
Option A:	Minimum particle size removal is <0.5µm
Option B:	They can be operated at high temperature
Option C:	It has a low maintenance cost
Option D:	It does not cause any freezing problem
Q27	When Environmental Lapse Rate (ELR) is greater than Adiabatic Lapse Rate (ALR), then which of the following occurs?
Option A:	Sub adiabatic lapse rate

Option B:	Super adiabatic lapse rate
Option C:	Neutral lapse rate
Option D:	Adiabatic lapse rate
Q28	What is the ambient noise level in the residential one during night time?
Option A:	40 dB
Option B:	45 dB
Option C:	50 dB
Option D:	55 dB
Q29	Which of the following air pollution control device has maximum efficiency?
Option A:	Electrostatic precipitator
Option B:	Venturi Scrubber
Option C:	Spray tower
Option D:	Wet cyclonic scrubber
Q30	The biochemical oxygen demand is computed by _____
Option A:	Dissolved oxygen ^ Dilution factor
Option B:	Dissolved oxygen + Dilution factor
Option C:	Dissolved oxygen – Dilution factor
Option D:	Dissolved oxygen * Dilution factor

Subjective Question Bank-PCT

1	What are the various treatments for hazardous waste management? Describe any two in detail
2	Describe operational and constructional features of the flame photometer analyzer to measure stack gases concentration release from industry
3	Explain DO Sag curve and derive the formula for critical time and critical deficit
4	Describe sampling and analysis of alkalinity, bacteriological measurements and suspended solids in waste water
5	Explain Activated Sludge process of secondary biological treatment with a neat diagram.

6	Write & explain classification air pollution particulate matter in brief
7	Explain the effects of the following: (i) Ozone layer depletion (ii) Oxides of sulfur
8	Discuss the classification of hazardous waste based on material properties.
9	What is BOD? Deduce expression for BOD with time? What are the factors on which the deoxygenation constant (K) depends?
10	Explain the solid waste transfer station in detail.
11	Explain Air (prevention & control of pollution) Act & Water Act..
12	Explain Physical characteristics of water in detail.
13	What do you understand by inversion? what are the various types of inversion. Explain in details along with diagram.
14	Write short note on Oxygen Sag Curve.
15	Compare trickling filters with activated sludge systems. (min.10 points)
16	Explain Ion Exchange process with its reaction involved in it.
17	Explain in detail "Air pollution effects on Vegetation" with a neat diagram.
18	Discuss the design criteria for activated sludge process in details. Derive the necessary derivation for volume of aeration tank.
19	Explain Plume behavior depending on atmospheric stability and wind turbulence.
20	Write short note on: i) Nitrification and Denitrification ii) Ozone layer depletion
21	Write note on Gaussian dispersion model
22	Explain in detail noise pollution causes, consequences and abatement methods
23	A complete mixed activated sludge process is to be treat wastewater flow of 500 m^3/hr. having a soluble $BOD_5$of 250 mg/l. The concentration of soluble BOD_5escaping treatment is 10 mg/l. Design criteria are as follows: Y= 0.5, k = 5 day^{-1}, K_d= 0.06 day^{-1}, K_s = 100 mg/l. and the concentration of MLVSS (X) = 2000 mg/l. Compute the following

	A. The treatment efficiency, B. Mean cell residence time θ_c, C. hydraulic retention time θ, D. Volume of aeration tank, E. F/M ratio
24	Carbon monoxide is present in standard atmospheric air at a concentration of 60 ppm. Compute y_p, ρ_p and w_p values for the CO concentration in the atmosphere. Air density at standard condition is 1.1885 Kg/m^3
25	A multi tray settling chamber having 7 trays, including the bottom surface, handles 5 m^3/s air at 20^0C. The trays are spaced 0.25 m apart and the chamber is to be 1 m wide and 4 m long. What is the minimum particle size of density 2000 kg/m^3 that can collected with 100% efficiency? What will be the efficiency of the settling chamber if 45 micrometer particles are to be removed? Laminar flow conditions within the chamber and no dust initially on trays may be assumed. Viscosity of gas at 20^0C=1.81×10^{-5} kg/m-s
26	A chimney with a design stack height of 250m is emitting SO2 at a rate of 500g/s on a sunny day in June with moderate wind speed at the stack altitude. The stack diameter is 5m, the sulphur dioxide exit velocity is13m/s and the gas temperature of exit is 1450C, what is the plume rise for an ambient room temperature of 300C?calculate the ground level concentration on the plume centerline at the downward distance of 1km U1 at reference height is 2.5m/s A=0.295,B=0.119,P=0.986,α=0.25
27	What are the various methods employed for recovery of material from process effluent? What is its importance? Explain any three methods and its application.
28	How are air pollutants classified? List the major types of Air pollutants. Briefly explain the dry deposition mechanism and wet precipitation mechanism of nature for removal of particulate matter.
29	Explain non dispersive infrared analyzer used for analysis of carbon monoxide in air pollution.
30	In a completely mixed activated sludge system determine I. The aeration basin volume. II. The Hydraulic retention time III. The Sludge volume wasted daily IV. The mass of sludge wasted daily V. The fraction of sludge recycled VI. The F/M ratio Given: Population equivalent 50,000 (11250 m3/day) Influent BOD = 200 mg/l; Effluent BOD5 = 10 mg/l; Y = 0.6 ; kd = 0.06 d-1 Assume: MLSS in aeration basin = 3.5 kg/m3; MLSS in clarifier sludge = 15 kg/m3 Mean residence time = 10 days

University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI

Course Code: CHC604 **Course Name: Process Engineering and Economics**

Question Bank

Q1.	Commodity or bulk chemicals_____
Option A:	Are produced in large volumes and purchased on the basis of chemical composition, purity and price.
Option B:	Are produced in small volumes and purchased on the basis of chemical composition, purity and price.
Option C:	Are produced in small volumes and purchased on the basis of chemical composition only
Option D:	Are produced in large volumes and purchased on the basis of chemical composition only
Q2.	Which of the Following statement is NOT TRUE for Onion model of process
Option A:	Alternative way to present the hierarchical approach to process design
Option B:	Process Design begin a the centre of the onion and proceed outwards
Option C:	It is impossible to fully evaluate the diagram unless a complete design is furnished for the outer layers of the onion
Option D:	Building a reducible structure
Q3.	What is static discharge head of a pump if the pump is below the free surface of the liquid? P = Absolute pressure at free surface of liquid in receiver and Z = vertical distance between free surface of liquid in receiver and centreline of pump
Option A:	P-Z
Option B:	P+Z
Option C:	Z
Option D:	P+2Z
Q4.	Estimate optimum pipe diameter for flow of chlorine gas of 10000 kg/h at 6 atma and 20°C through a carbon steel pipe. Density of chlorine gas at given conditions is 17.71 kg/m^3.
Option A:	150.5 mm
Option B:	190.7 mm
Option C:	173.8 mm
Option D:	220 mm
Q5.	In case of multi-component liquid mixture having N number of components with different boiling points, to separate each component in pure form, how many

	distillation columns in series will be required?
Option A:	N
Option B:	N+1
Option C:	N-1
Option D:	N+2
Q6.	In distillation column operation, as reflux ratio approaches to minimum i.e. R_m, number of trays raquired approaches to _____
Option A:	∞
Option B:	1
Option C:	0
Option D:	3
Q7.	In distillation column, if number of theoretical trays required for desired separation is 10 and actual number of trays required is 14, then tray efficiency is equal to_____
Option A:	1.41
Option B:	0.91
Option C:	1.21
Option D:	0.71
Q8.	In a gas-liquid absorption column, for obtaining the maximum absorption efficiency.
Option A:	Liquid stream should be distributed uniformly
Option B:	Gas stream should be distributed uniformly
Option C:	Both gas as well as liquid streams should be distributed uniformly
Option D:	By passing should be completely avoided
Q9.	To determine the column diameter we design the column to run at _____percent of the flooding velocity.
Option A:	80
Option B:	50
Option C:	20
Option D:	95
Q10.	A loan of Rs.5000is made for for period of 15 months at a simple interest rate of 15% what future amount is due at the end of loan period
Option A:	5937.50
Option B:	5873.20
Option C:	5712.40
Option D:	5690.12
Q11.	Order of magnitude method for capital cost estimates has accuracy
Option A:	less than 40 %

Option B:	less than 5%
Option C:	less than 15%
Option D:	less than 3 %
Q12	Present sum of Rs. 100 at the end of one year, with half yearly rate of interest at 10%, will be Rs.
Option A:	121
Option B:	110
Option C:	97
Option D:	91
Q13	A series of equal payments made at equal interval of time is called
Option A:	Perpetuity
Option B:	Capital charge factor
Option C:	Annuity
Option D:	Future worth
Q14.	Following method of cost estimation is most accurate
Option A:	Study estimates
Option B:	Preliminary estimate
Option C:	Definitive estimate
Option D:	Detailed estimate
Q15.	Commodity chemicals have
Option A:	Low added value and large sales volume
Option B:	High added value and large sales volume
Option C:	Low added value and low sales volume
Option D:	High added value and low sales volume
Q16.	What is NPSH?
Option A:	(Total suction head) – (Vapor pressure of liquid)
Option B:	(Total discharge head) – (Vapor pressure)
Option C:	(Total discharge head) – (Suction head)
Option D:	Total dynamic head
Q17	Water is flowing through a pipe of diameter 30 mm at 35 m/s. What is the mass flow rate of water?
Option A:	2137.5 tons/day
Option B:	1.15 kg/s
Option C:	74.24 kg/s
Option D:	1683.6 tons/day
Q18	If liquid mixture contains components A, B, C, D, E and F. As per thumb rules, one of these components is light key and pother is heavy key component. if vapor pressures of A, B, C, D, E and F are 200, 80, 350, 700, 130 and 550 respectively, then List out the distributed components among these.
Option A:	D, B, A, F
Option B:	A, C, E, F
Option C:	A, C, D, E
Option D:	A, B, C, D
Q19.	The absorber is being designed to recover component ‘P’ from inlet gas mixture

	containing components 'P' and 'Q'; the absorption factor for 'P' is 1.4 and vapour pressures of 'P' and 'Q' are 500 and 250 mm Hg respectively. Then what will be the absorption factor for component, 'Q'?
Option A:	1.4
Option B:	0.7
Option C:	0.36
Option D:	2.8
Q20.	For a specific heat exchanger, the values of material factor, pressure factor and design factor are 1.5, 0.25 and 1 respectively. Then what will be value of material & pressure factor for this heat exchanger?
Option A:	1.875
Option B:	0.375
Option C:	2.75
Option D:	0.25
Q21.	Most important factor to be considered in the selection of packings for absorbers is the _____ of packing.
Option A:	Size
Option B:	Durability
Option C:	Porosity
Option D:	Cost
Q22.	Find the future amount of Rs. 18000 invested at the rate of 8% nominal interest for 2 years, if interest is compounded monthly.
Option A:	Rs. 21057.45
Option B:	Rs. 21089.86
Option C:	Rs. 21111.98
Option D:	Rs. 20995.20
Q23.	If we arrange the types of capital cost estimates in order of their accuracy from highest accuracy to the least accuracy, then one which will come at 2^{nd} position will be:_____
Option A:	Study estimate
Option B:	Order of magnitude estimate
Option C:	Definitive estimate
Option D:	Detailed estimate
Q24.	The fixed and working capital investment for a company are Rs. 37500000 and Rs. 10000000 respectively. The total annual income and the total annual expenses are Rs. 42500000 and 29000000 respectively. Then approximate % rate of return (before income taxes) for this company will be _____
Option A:	89.47%
Option B:	36.54%
Option C:	61.05%
Option D:	28.42%
Q25.	_____ includes the symbolic representation for process measurement, control functions & instrumentation.
Option A:	PBD
Option B:	PFD

Option C:	P & ID
Option D:	All of the above
Q26.	The total number of theoretical stages for absorption column is calculated by_____
Option A:	Edmister's equation
Option B:	Kremser's equation
Option C:	Guthrie's equation
Option D:	Undrwood's equation
Q27	A machine has an initial value of Rs. 5000, service life of 5 years and final salvage value of Rs. 1000. The annual depreciation cost by straight line method is Rs.
Option A:	300
Option B:	600
Option C:	800
Option D:	1000
Q28	Effective and nominal interest rates are equal, when the interest is compounded
Option A:	Annually
Option B:	Monthly
Option C:	Quarterly
Option D:	Weekly
Q29	FUG method is used for design of _____
Option A:	Absorption column
Option B:	Heat exchangers
Option C:	Multiple effect evaporators
Option D:	Multicomponent distillation
Q30	Which of the following distillation unit is a compact purification method for laboratory applications.
Option A:	Flash distillation
Option B:	Azeotropic distillation
Option C:	Multicomponent distillation
Option D:	Short path distillation

Subjective questions:

1. What is onion diagram? Explain guidelines for selection of batch and continuous process.

2. Benzene at 37.80 C is pumped through the system at a rate of 10.09 m^3/h with the help of a centrifugal pump. The reservoir is at atmospheric pressure. Pressure at the end of discharge line is 345 kPa g. The discharge head is 4.05 m and the pump suction head is 2.22 m above the level of liquid in reservoir. The friction loss in suction line is 3.45 kPa and that in the discharge line is 37.9 kPa. The mechanical efficiency of the pump (η) is 0.6. The density of benzene is 865 kg/m^3 and its vapour pressure at 37.80 C is 26.2 kPa.Calculate (a) $(NPSH)_A$ and (b) power required by centrifugal pump.

3. A distillation column is used to separate 5000 mol/h of feed containing 35% A, 30% B, 20% C and 15% D (molar basis). A & B are light and heavy key components respectively. 90% of original A is recovered in distillate while 95% of original B is recovered in residue. 98% of

original C appears in distillate and there is no D present in distillate. Assume constant volatility for all components throughout the column operation. Vapor pressures for components A, B, C & D are 4.5, 1.9, 1.4 and 0.5 atm respectively. The value of constant, v in Underwood's equation is 1.7.

Then calculate—

i. Rm by Underwood's method
ii. 'q' by Underwood's method and conclude about feed condition
iii. Nm by FUG method

4. Explain the role and responsibility of process engineer towards

i. safety concerns
ii. Environment
iii. Ethics

5. Explain the design and working of short path distillation unit along with its operation.

6. Given the following feed stream at 10 atm, 350 K is as below:

Component	**Flow rate (Kmol/hr)**	**Vapor Pressure (mmHg)**
Methane	20	330918
Methanol	70	1220
Water	60	315

Design an absorber to recover 95% of methanol using water as the solvent. Specify all of the stream flow rates around the absorber. Find out theoretical no. of stage and flow rates of other components.

7. A bond has a maturity value of rs.50, 000 and is paying discrete compound interest at an effective annual rate of 5%. Determine the following at a time four years before the bond reaches maturity value i.) Present value ii) Discount iii) Present value if the nominal Bond interest is 5% compounded continuously.

8. A company is looking at 4 machings

	Type A	Type B	Type C	Type D
Initial cost	100000	160000	200000	260000
Operating cost/year	1000	1000	1000	1000
Fixed charge % of initial cost /year	20	20	20	20
Cash flow /year	41000	36000	73000	88500

Company wants at least 15% return, which design would you recommend?

9. Find out area of heat exchanger according to the following specifications and calculate the total installed cost (updated bare module cost) in year 2019.

Heat exchanger specifications:

Identification = condenser

Function – to condense overhead vapor from methanol fractionating column

Type – horizontal fixed tube sheet, expansion ring in shell.

Heat duty – 930 kW, U (overall heat transfer coefficient = 915.7 w/m^2K

Type of flow – counter current

Tube side specifications:

Fluid – cooling water , T_{in} = 25^0C,

T_{out} =40^0C.

Tube material – Stainless steel

Shell side specifications:

FluidMethanol – T = 65^0C (constant)

Shell material – Carbon steel

Data:

Design type	**Kettel reboiler**	**U tube**	**Fixed tube sheet**
F_d	1.35	0.85	0.80

Surface area (m^2)	**Shell and tube material (F_m)**	
	CS/CS	**SS/SS**
0 – 10	1.0	2.50
10 – 50	1.0	3.10

Equipment type	**Co (Rs.)**	**So (m^2)**	**Range(S) (m^2)**	**α**	**MF**
	$25x10^4$	37.18	10 – 900	0.65	3.29
	$1.5x10^4$	0.51	0.1 – 10	0.024	1.83

Cost Index (2019) = 511. Cost Index (base year) = 395, F_p = 0.2

10. What is depreciation? Explain different methods to calculate depreciation.

11. The annual direct production costs for a plant operating at 70% capacity are Rs. 14000000 while the sum of the annual fixed charges, overhead costs and general expenses is Rs. 10000000. What is the break even point in units of production per year if total annual sales are Rs. 28000000 and the product sells at Rs. 2000 per unit? What were the annual gross earnings and net profit for this plant at 100% capacity if corporate income taxes required 15% tax on the first Rs. 2500000 of annual gross earnings, 25% on annual gross earnings of Rs. 2500000 to Rs. 3750000, 34% on annual gross earnings above Rs. 3750000 and 5% on gross earnings from Rs. 5000000 to Rs. 16750000?

12. A person want to obtain home equity loan of Rs. 9,25,000 for renovation. The interest rate is 8.5% compounded monthly and it is agreed to settle down the loan in 5 years. How much will the monthly payments be?

13. An existing plant loose large amount of heat through waste gases. Aim is to save money through waste heat recovery. Four different designs of heat exchangers can be used for this purpose. Total initial installed cost for design 1, 2, 3 and 4 are Rs. 500000, Rs. 800000, Rs. 1000000 and Rs. 1300000 respectively. Operating cost for all the designs is same and it is Rs. 5000 per year. Fixed charges for all the designs are 20% of their initial installed costs. Value of heat saved from design 1, 2, 3 and 4 are Rs. 205000, Rs. 300000, Rs. 345000 and Rs. 442500 respectively. The company expects at least 10% annual return based on initial investment for any unnecessary investment. Only one of the four designs can be accepted. Neglecting effects due to income taxes and time value of money, which of the four designs should be recommended?

14. Benzene at 37.8 ^{o}C is pumped through the system at a rate of 10.09 m^3/h with the help of a centrifugal pump. The reservoir is at atmospheric pressure. Pressure at the end of discharge line is 345 kPa g. The discharge head is 4.05 m and the pump suction head is 2.22 m above the level of liquid in reservoir. The friction loss in suction line is 3.45 kPa and that in the discharge line is 37.9 kPa. The mechanical efficiency of the pump (η) is 0.6. The density of benzene is 865 kg/m^3 and its vapour pressure at 37.8 oC is 26.2 kPa. Calculate (a) (NPSH)A and (b) Power required by centrifugal pump.

15. Calculate bare module cost of the tray stack in distillation column using following data: Diameter of tray stack = 1.06 m; Number of trays in tray stack = 30; Tray spacing = 18 inch; L_o = 3.05 m; D_o = 0.61 m; C_o = Rs. 12600; α = 0.97; β = 1.45; F_t = 1.8; F_s = 1.4; F_m = 0; MF = 1; Cost index in year of cost estimation = 400; Cost index in base year = 120

16. Describe three broad categories of chemical products with suitable examples of each.

17. Discuss about the relation between, pipe size, pressure drop in pipe and cost of the pipe and Define Optimum pipe size.

18. Write design equations used for sizing of a) Reactor b) Compressor c) Pump d+) Heat Exchanger

19. Verify if the flow is turbulent and calculate total pressure drop in pipe line on the basis of following data:
Fluid flowing through pipe line: Carbon Monoxide; Length of pipe = 5 km; Flow rate of fluid = 2000 kg/h; No. of gate valves in pipeline: 2; No. of 45^{o} elbows in pipeline: 3; Viscosity of fluid = 0.018 cP; Density of fluid = 1.056 kg/m^3; Equivalent number of velocity heads for gate valve and 45^{o} elbows are 0.17 and 0.35 respectively. Inside diameter of the pipe = 305 mm.

20. Write a short note on “NPSH of pump”

21. The original value of a piece of equipment is Rs. 22,000, completely installed and ready for use. Its salvage value is estimated to be Rs. 2000 at the end of a service life estimated to be 10 years. Determine the asset (or book) value of the equipment at the end of 5 years using

(i) Straight-line method.
(ii) Textbook declining-balance method.

22. A proposed manufacturing plant requires an initial fixed-capital investment of Rs. 900,000 and Rs.100,000 of working capital. It is estimated that the annual income will be Rs. 800,000 and the annual expenses including depreciation will be Rs. 520,000 before income taxes. A minimum annual return of 15 percent before income taxes is required before the investment will be worthwhile. Income taxes amount to 34 percent of all pre-tax profits
Determine the following:
(a) The annual percent return on the total initial investment before income taxes.
(b) The annual percent return on the total initial investment after income taxes.
(c) The annual percent return on the total initial investment before income taxes based on capital recovery with minimum profit.
(d) The annual percent return on the average investment before income taxes assuming straight-line depreciation and zero salvage value.

23. Calculate the pipe size based on following data. Fluid flowing through pipe is carbon monoxide. Discharge pressure of carbon monoxide required from the pipe is atmospheric
Available pressure at inlet of pipe = 50 kPa g
Length of pipe = 4 km
Flow rate of CO = 1500 kg/h
Temperature of gas = 50°C
No. of gate valves in pipeline = 2
No. of 45° elbows = 3
No. of 90° elbows = 6
Viscosity of CO = 0.018 cP
Equivalent Velocity Head (K) gate valve = 0.17
Equivalent Velocity Head (K) for 45 0 elbow = 0.35
Equivalent Velocity Head (K) for 90 0 elbow = 0.75

24. Explain in detail the five standard locations of pressure taps.

25. Calculate the number of theoretical stages for an absorption column with mixture of 9 gmol/sec of air & 1 gmol/sec of acetone using water as the solvent. Recovery of acetone is 95% at temperature of 300K & column pressure of 10 bar. The vapour pressure of acetone & water is 0.337& 0.032 bar respectively. Also determine the solvent flowrate & absorption factors for all components. State the 12 steps in the Process design of Distillation Column

26. State the short cut method for the design of absorption column.

27. A project expected to have cash flow for the five years as follows after all expenses & taxes. The initial fixed capital investment is Rs. 1000000 & the working capital investment is 20% of the fixed capital investment. Find the rate of return using SLM depreciation.Explain Tree diagram showing cash flow for industrial operations.

Time (years)	**Cashflow (Rs.)**
0-1	200000

1-2	240000
2-3	330000
3-4	400000
4-5	473000

28. Write a short note on following:

i. Short Path Distillation Unit (SPDU)

ii. Packed tower distillation column

29. A GLR of 150 gal capacity purchased in 2001 has cost of Rs. 50000. Cost index in 2001 is 429. Calculate the cost of the reactor of 400 gal capacity in 2008 if cost index in 2008 is 651.

30. What is Break Even analysis? Explain with graphical representation.

University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI
Subject: Department Optional Course 2 (Piping Engineering) Course Code: CHDO6021
Question Bank

Q1.	------- is used in gas flow control
Option A:	Ball valve
Option B:	Gate valve
Option C:	Globe valve
Option D:	Needle valve
Q2.	Y type Strainer is used for
Option A:	Heating
Option B:	Cooling
Option C:	To remove dirt
Option D:	For a venting
Q3.	In globe valves, the flow rate control is determined by _____
Option A:	Size of the opening
Option B:	Lift of the valve plug
Option C:	Pressure difference
Option D:	Gravity
Q4.	Steam trap is used to remove ------ from flowing fluid
Option A:	Dirt
Option B:	Condensate
Option C:	Solids
Option D:	Vapour
Q.5.	ASMEB --------is process piping code
Option A:	31.1
Option B:	31.2
Option C:	31.3
Option D:	31.4
Q6.	Which of the following valve is known as a safety valve _____
Option A:	Scour valve
Option B:	Pressure Relief valve
Option C:	Reflux valve
Option D:	Altitude valve
Q7	Which material is used for pipes which are in contact with milk or product?
Option A:	Stainless steel
Option B:	Copper
Option C:	Ceramic

Option D:	Plastic
Q8	What are the reasons causing pressure drop in Piping systems?
Option A:	Long length of pipe
Option B:	Friction
Option C:	Type of fluid
Option D:	Losses in valves and bends
Q9.	------ support allows directional movement
Option A:	Anchor
Option B:	Guide
Option C:	Hanger
Option D:	Saddle
Q10.	ASMEB -------- is Power piping code
Option A:	31.1
Option B:	31.11
Option C:	31.8
Option D:	31.5
Q11	------account expansion in pipe
Option A:	Socket joint
Option B:	Bellows
Option C:	Miter joint
Option D:	Union
Q12	A Gate valve------
Option A:	has more restriction in a line than a globe valve
Option B:	should be operating either fully open or fully closed
Option C:	is used to throttle flow
Option D:	is used for different applications than a globe valve
Q13	What is roughly a gauge pressure of 195 psi when converted in absolute psi
Option A:	195
Option B:	210
Option C:	235
Option D:	178
Q14.	Which valve is used when a straight line of fluid and minimum restriction is required?
Option A:	Gate valve
Option B:	Lift check valve
Option C:	Butterfly valve
Option D:	Plug valve
Q15.	How much space is kept in between column of pipe rack?
Option A:	3-4 feet
Option B:	0.5-0.6 km
Option C:	5-6 feet
Option D:	50-60 m
Q16.	From which size onwards NB of pipe equal to OD of pipe?

Option A:	14inch
Option B:	6 Inch
Option C:	4 Inch
Option D:	8 Inch
Q17	Std length of C.I. Pipe in meters is
Option A:	5
Option B:	5.5
Option C:	4
Option D:	4.5
Q18	What is the function of valves?
Option A:	Isolation
Option B:	Regulation
Option C:	Non Return
Option D:	All of above
Q19.	Which among the following is not a permanent welding connection?
Option A:	Bends
Option B:	Reducers
Option C:	Sampling device
Option D:	Tees
Q20.	What are the reasons causing pressure drop in piping systems?
Option A:	Long length of pipe
Option B:	Type of fluid
Option C:	Friction
Option D:	All of the abive
Q21.	Which formula is used to calculate head loss in valves?
Option A:	$k^2(v/2g)$
Option B:	$k(v/2g)$
Option C:	$k(v^2/2g)$
Option D:	$k^3(v^2/2g)$
Q22.	Temporary closure of pipe line by
Option A:	Blind Flange
Option B:	Valve
Option C:	Block
Option D:	Welded Flange
Q23.	What is the ASME Code followed for design of Piping Systems in process piping (Refineries & Chemical Industries)?
Option A:	B 31.1
Option B:	B 31.3
Option C:	B 31.5
Option D:	B 31.9
Q24.	Types of piping engineering diagram---
Option A:	Process flow diagram

Option B:	Process block diagram
Option C:	Piping and instrumentation diagram
Option D:	All above
Q25.	Pick out wrong statement pertaining to NDT test.
Option A:	Radioactive test
Option B:	Ultrasonic test
Option C:	Dye penetrant test
Option D:	Impact test
Q26.	Flexibility factor for straight pipe is ----
Option A:	zero
Option B:	one
Option C:	less than one
Option D:	greater than one
Q27	Minor energy losses in pipe take place when
Option A:	sudden expansion of pipe
Option B:	sudden contraction of pipe
Option C:	change in direction of fluid
Option D:	all above
Q28	Which of the following is used to block the pipe at the end
Option A:	Plug
Option B:	Reducer
Option C:	Union
Option D:	coupling
Q29	Calculate area of a pipe if, flow rate is 20 l/min and flow velocity is 5 cm/s.
Option A:	66.66 cm2
Option B:	60 cm2
Option C:	62 cm2
Option D:	64 cm2
Q30	To prevent the product flow in the wrong direction which of the following valve is used?
Option A:	Seat valve
Option B:	Butterfly valve
Option C:	Seat valve and butterfly valve
Option D:	Check valve

Subjective Question Bank-Piping Engineering

1	Discuss important factor in selection of material of construction of pipes. Explain With example?

2	Explain classification of piping material.
3	List the various non-ferrous materials of construction and their use in piping.
4	What are different methods of protecting above ground and underground Piping from corrosion?
5	What is cathodic protection of a pipe line?
6	Name at least five insulation materials. Describe with the help of neat sketch
7	Application of insulation to a pipe.
8	Explain role of insulation & painting in pipe Engineering.
9	Enlist different piping material and its application
10	Explain properties of insulation
11	Write short note on • Flame Arresters. • Steam Traps • High –point vent and low point Drain
12	What are pipe fittings and its types?
13	Write short note on ASME 31.1 AND ASME 31.3
14	How to minimize Head Losses in pipe? Explain in detail
15	Name various types of valves with their application (explain any three types).Explain with neat diagram the construction, working and application of Globe Valve.
16	What is NDT? Explain any four methods .Write down its advantages and applications.
17	Explain in detail Iron – carbide diagram.
18	Discuss the important factors in the selection of material of construction of pipes. Explain with examples.
19	Explain water hammer in pipeline; also discuss its effects and prevention.
20	Explain the manufacturing process each of seamless and welded pipe.
21	What is the ASME Code followed for design of Piping Systems in process piping (Refineries & Chemical Industries)?
22	Which American Institute Standard does Piping Engineer refer ?
23	Where the ERW & Seamless pipes are used?
24	How can flanges be classified based on Pipe Attachment?

25	What are Weldlet and Sockolet ? And where they are used?
26	How the valves are classified based on their function?
27	What are the common welding defects?
28	How the intensification factor depends on thickness of foil?
29	What are the essential data / documents required for preparation of equipment layout ?
30	. How do you calculate the width of pipe rack?

University of Mumbai
Program: Chemical Engineering
Curriculum Scheme: Rev2019
TE Semester: VI
Course Code: CHDO6022 **Course Name: Polymer Technology**

QUESTION BANK

Q1.	Molecular weight of a polymer is equal to the molecular weight of the repeat unit multiplied by the degree of polymerisation. What is the molecular weight of poly vinyl chloride (PVC), if its degree of polymerisation is 800?
Option A:	50000
Option B:	51600
Option C:	49200
Option D:	50800
Q2.	Polymerisation of poly functional monomers produces polymers having
Option A:	Good mechanical strength
Option B:	Low viscosity
Option C:	Low melting point
Option D:	None of these
Q3.	The inter particle forces between linear chains in nylon-66 are bonds.
Option A:	Hydrogen
Option B:	Covalent
Option C:	Ionic
Option D:	None of these
Q4.	Polymerisation process in which two or more monomers of chemically different nature take part is called
Option A:	Copolymerisation
Option B:	Addition polymerisation
Option C:	Chain polymerisation
Option D:	None of these
Q.5.	Condensation polymerisation is not involved in the manufacture of
Option A:	Teflon
Option B:	Polythene
Option C:	Terylene
Option D:	Nylon
Q6.	Linear polymers are normally
Option A:	Thermosetting
Option B:	Thermoplastic
Option C:	Elastometric
Option D:	Having extremely high softening point
Q7	Typical solvent polymerisation reaction conditions for the production of high density

	polythene by Zeigler process is
Option A:	7 kgf/cm2 and 70 °C
Option B:	1000 kgf/cm2 and 100°C
Option C:	7 kgf/cm2 and 700°C
Option D:	1 kgf/cm2 (gage) and 70°C
Q8	Consider a reaction of polymer formation by condensation polymerization, completed in n-steps, with the liberation of a certain byproduct. How many total molecules of byproduct are released as a result of complete reaction?
Option A:	n+1
Option B:	n
Option C:	n-1
Option D:	n/2
Q9.	A copolymer is formed by the combination of two or more monomer molecules
Option A:	In a chain without the elimination of water
Option B:	With the elimination of small amount of water
Option C:	Of the same monomer by elimination of small molecules of water
Option D:	None of these
Q10.	Condensation polymerisation of produces Bakelite.
Option A:	Propylene
Option B:	Phenol & formaldehyde
Option C:	Phenol & acetaldehyde
Option D:	Urea & formaldehyde

Subjective Question Bank-Polymer Technology

1	Explain linear, branch and cross linked polymers
2	Enlist different types of polymerization techniques
3	Explain Interfacial Polymerisation with Advantages and disadvantages.
4	Define Thermoforming polymer processing.
5	Explain in detail thermal polymer degradation with relevant examples
6	What are the requirement for Crystallinity in morphology
7	Compare Thermo plastic Vs Thermosetting polymers(properties, type of polymerisation n uses)
8	Draw and explain manufacturing of LDPE
9	Draw and explain manufacturing of HDPE
10	Draw and explain manufacturing Nylon 6.
11	Explain Solution Vs suspension polymerisation.
12	Describe kinetics of Co Polymerisation.

13	What is degradation of polymers. Elaborate the types.
14	What are the types of Avg.Mol.wts ? Explain 2 methods to find Avg.Mol.wt.
15	Explain the importance of Rheology in Polymer Technology.

Question Bank

TE Chemical/Semester: VI (R 2019)

Subject: Department Optional Course 2 (Industrial Organization and Management)

Course Code: CHDE6023

Q1.	Identify the best definition of planning:
Option A:	An integrated process in which plans are formulated, carried out and controlled
Option B:	Devising ways of achieving the objectives of an organization.
Option C:	Setting an organization's objectives and the means of reaching them.
Option D:	The core activity of planners and planning departments.
Q2.	**Personnel management is also called as**
Option A:	Personnel Administration
Option B:	Manpower management
Option C:	Both (A) and (B)
Option D:	None of the above
Q3.	Share allotment account is a ----------.
Option A:	personal account
Option B:	Real account
Option C:	Nominal account
Option D:	Impersonal account
Q4.	In which of the following business organisations there is separation of ownership and management?
Option A:	Sole proprietorship
Option B:	Partnership
Option C:	Hindu undivided family
Option D:	Company
Q.5.	For a partnership firm comprising of professionals who are governed by a separate act, the maximum number of partners can be
Option A:	50
Option B:	20
Option C:	100
Option D:	10
Q6.	Planning lays down the overall objective, strategies and polices for the total enterprise is _____.
Option A:	corporate planning
Option B:	divisions planning.
Option C:	unit planning
Option D:	department planning

Q7	The process of establishing a time sequence for the work is known as _____.
Option A:	Objective
Option B:	schedules.
Option C:	Procedures
Option D:	budgets.
Q8	Which of the following processes is not a part of the Production Planning and Control system?
Option A:	Integration of processes
Option B:	Routing
Option C:	Expediting and follow up
Option D:	All of the above
Q9.	Rules, duties and responsibilities or workers are given in writing in_____.
Option A:	formal organization
Option B:	informal organization
Option C:	business or organisation
Option D:	strategic organization
Q10.	**Sale has _____ function in an organization.**
Option A:	Only loss generating
Option B:	only revenue generating
Option C:	both loss as well as revenue generating
Option D:	neither loss nor revenue generating
Q11	Which of the following Organization structure provides Unity of Command in its working process?
Option A:	Functional
Option B:	Line
Option C:	Line and Staff
Option D:	Committee
Q12	Which of the following Organization structure is formed by a group of individuals that suggest solution to the critical problems of the organization?
Option A:	Committee
Option B:	Functional
Option C:	Matrix
Option D:	Line
Q13	Middle management in organization structure includes the following?
Option A:	Departmental manager
Option B:	Managing director
Option C:	Workers
Option D:	Other Staff
Q14.	Organization culture consists of the following?
Option A:	Rules

Option B:	Assumptions
Option C:	Both a & b
Option D:	Job moral
Q15.	Which of the following is not an objective of purchasing in material management?
Option A:	Right Quantity
Option B:	Right Quality
Option C:	Right place
Option D:	Right price
Q16.	What is a social enterprise concerned with?
Option A:	Profit maximization
Option B:	Maximizing market share
Option C:	Providing public service
Option D:	Running a business to create social benefits
Q17	A good planning system must consider:
Option A:	What are we going to make?
Option B:	What does it take to make it?
Option C:	What do we have and need?
Option D:	All of the above
Q18	- _____ is the first step in a manufacturing planning and control system.
Option A:	Maintaining the planned backlog
Option B:	Maintaining the required inventory levels
Option C:	Achieving the forecast
Option D:	Production planning
Q19.	All major inputs to the MRP system include:
Option A:	Master production schedule, inventory records, and bills of material
Option B:	Master production schedule and bill of material
Option C:	Bill of material and inventory records
Option D:	Inventory records and master production schedule
Q20.	What is a Gantt chart a type of?
Option A:	Work flow design
Option B:	Work schedule design
Option C:	Work rate design
Option D:	Work output design
Q21.	----------must satisfy the demands of the marketplace. It does so by using plants, machinery, equipment, labor, and materials as efficiently as possible.
Option A:	Production
Option B:	Marketing
Option C:	Finance
Option D:	Engineering
Q22.	----------is the first step in a manufacturing planning and control system.
Option A:	Maintaining the planned backlog
Option B:	Maintaining the required
Option C:	inventory levels Achieving the forecast
Option D:	Production planning

Q23.	All major inputs to the MRP system include:
Option A:	Master production schedule, inventory records, and bills of Material
Option B:	Master production schedule and bill of material
Option C:	Bill of material and inventory records
Option D:	Inventory records and master production schedule
Q24.	----------linked to production planning.
Option A:	MRP
Option B:	Capacity requirements planning
Option C:	Rough-cut capacity planning
Option D:	Resource planning
Q25.	If the workload in a manufacturing plan cannot be changed, an alternative is to:
Option A:	Schedule overtime
Option B:	Schedule undertime
Option C:	Adjust the workforce by hiring
Option D:	All of the above
Q26.	It is possible to increase the available capacity by:
Option A:	Limiting subcontracting
Option B:	Using fewer workers
Option C:	Rerouting away from other work centers
Option D:	Scheduling overtime
Q27	- _____ is concerned with the production of high-volume standard products.
Option A:	Intermittent manufacturing
Option B:	Product manufacturing
Option C:	Flow manufacturing
Option D:	All of the above
Q28	An example of project manufacturing is:
Option A:	Large shipbuilding
Option B:	Gasoline
Option C:	Automobiles
Option D:	Appliances
Q29	- _____specifications and standard specifications are the two major sources of specifications or ways of describing a product.
Option A:	Buyer
Option B:	Marketing
Option C:	Production
Option D:	Functional
Q30	The correct sequence of operations in production planning and control is
Option A:	Routing-Scheduling-Dispatching-Follow up
Option B:	Scheduling-Routing- Dispatching-Follow up
Option C:	Dispatching-Routing-Scheduling- Follow up
Option D:	Routing-Scheduling-Follow up-Dispatching

Subjective Question Bank- Industrial Organization and Management

1	Define Business. Explain different forms of business ownerships.

2	Define Organization.Explain the types of business Organizations
3	What are the functions involved in HRM?
4	Define Quality management. Write a note on total quality management.
5	Define the term Sales Management. Explain functions of Sales Management in detail, quoting suitable examples.
6	Explain Organs of Company Management with their Functions as: Shareholders, Board of Directors, CEO, Managing Director and Manager.
7	Define Finance and Account. Explain the Role and Scope of Financial Management
8	Write a short note on: a. Assets b. Liabilities c. Book Keeping d. Capital e. Difference between Data and Information
9	Explain Marketing with following terms: a. Marketing Research. b. Pricing Policies c. Sales Forecasting d. Advertising e. Sales Promotion.
10	What is Personnel Management? Explain the Role of a Personnel Manager and Functions of Personnel Management.
11	Advantages & disadvantages single ownership?
12	Explain general partnership with advantages and disadvantages?
13	Explain input –output model?
14	Explain concept of the production?
15	Explain production system?
16	Explain factor affecting productivity?
17	Explain Regulatory Measures as to Company Management?
18	Explain Direct Restrictions on Company Management?

19	Explain role of shareholder?
20	Write a short note : role of personnel management
21	Difference Between Personnel Management And Human Resources
22	Explain advantages of personnel policy
23	Explain managerial function and operative function in a personnel management
24	Definitions & concept of Personnel Management
25	What is the sales forcasting? Explain two types of forcasting in detail
26	Write an explanatory note on marketing mix.
27	What is 'Marketing Management'? Explain the various functions of marketing
28	Definitions of Assets, Liabilities, Book Keeping, Capital and Types of Capital, Discounts, Commission, Debtor, Creditor and Turnover.
29	Difference between Guarantee and Warranty
30	Explain Role and Scope of Financial Management