

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-118
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Process Modeling and Simulation
(REVISED)

[Time: Three Hours]

[Max. Marks: 80]

- N.B Please check whether you have got the right question paper.
- 1) Question No. 1 and 6 are compulsory.
2) Answer any two questions from remaining sections.
3) Assume relevant data where necessary with justification.
- Section A
- Q.1 a) What is mathematical model? Explain in detail. 05
- b) What is mean by simulation & design? 05
- Q.2 a) List components of cost estimation routine. 07
- b) Model gas leakage through a fine capillary in wall of pressurized gas cylinder (rigid) to surrounding at atmospheric pressure, to relate changes in mass contained in cylinder, pressure inside cylinder & gas leak rate, with time. Draw the neat sketch of the system. 08
- Q.3 a) Draw neat labeled sketch of stage of vapor-liquid contactor, showing incoming and leaving stream gas and liquid phases in contact. 08
- b) Draw a neat labeled sketch of stage in continuous staged liquid-liquid extractor. 07
- Q.4 For iso-propanol vapor at 200°C, the values of virial coefficient, $B = -388 \text{ cm}^3/\text{mol}$ and $C = -26000 \text{ cm}^6/\text{mol}^2$ By using truncated virial equation determine by using successive approximation method the molar volume at 200°C And 15 bar. 15
- Q.5 Write short notes on
- a) Chemical kinetics model 05
- b) Euler method 05
- c) Runge-Kutta method 05

Section B

- Q.6 A liquid is heated in a batch stirred tank using external recirculation double pipe heat exchanger. Develop a model to predict temperature of liquid in tank as function of time. 10
- Q.7 a) A packed bed absorber is used for adsorbing polluting gas in gases stream. Draw a neat sketch of the labeled system and model system for concentration of pollutant (one component adsorbed) gas at the exit stream. Make use of suitable equations for gas-solid equilibrium. Assume operation to be isothermal. 08
b) Write model equation for packed column. 07
- Q.8 Develop a detailed dynamic model for prediction of efflux time for a overhead tank. Model should take into consideration for change in outlet flow rate with changes in liquid level. The length of drain line with fittings can be considered in equivalent length. Draw a neat sketch. 15
- Q.9 a) Draw a neat labeled sketch for packed column used to absorb a single component from gas phase. Write down notation used. Model the absorption column by developing total and component continuity equation for gas and liquid phase. 07
b) Derive a model for an ideal CSTR followed by ideal plug flow reactor for carrying out bi-molecular reaction under isothermal conditions. 08
- Q.10 a) Draw neat labeled sketch of 1-1 S & THE and write an algorithm for simulation of 1-1 S & THE for predication of steady state outlet temperature of hot fluid with change in hot fluid flow rate. 08
b) Describe the functioning of trickle bed reactor with neat labeled sketch. Discuss fundamentals equations and laws required for modeling of trickle bed reactor. 07

Total No. of Printed Pages:02

SUBJECT CODE NO: H-129
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Chemical Reaction Engineering-II
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

N.B

- 1) Q.No.01 & Q.No.6 are compulsory
- 2) Solve any two questions from remaining of each section.
- 3) Assume suitable data if required.

SECTION – A

- Q.1 Answer the following. (Any two) 10
- a) Ideal and non-ideal flow behavior.
 - b) Importance of E, C and F curves.
 - c) Determination of the rate – controlling steps.
 - d) Examples of various fluid – solid reactions.

- Q.2 a) Explain multiple steady states in CSTR for non- isothermal conditions. 07
- b) The data given below represent a continuous response to pulse input into a closed vessel which is to be used as chemical reaction. Calculate the mean residence time of fluid in the vessel and tabulate and construct E curve. 08

t, min	0	5	10	15	20	25	30	35
$C_{\text{pulse}}, gm/l$	0	3	5	5	4	2	1	0

- Q.3 a) Explain the shrinking core model for spherical particles of unchanging size when reaction is controlled by diffusion through ash layer and chemical reaction. 07
- b) Compare various models established for fluid – solid non – catalytic reactions and give your remarks. 08

- Q.4 a) Derive the rate equation for shrinking core model for spherical particles of unchanging size when reaction is controlled by diffusion through ash layer. 07
- b) First order liquid phase reaction is carried out in a reactor for which the results of (Pulse) tracer test are given below. Calculate the conversion using Ideal PFR. 08

t, min	0	1	2	3	4	5	6	7	8	9	10
C, mg/l	0	1	5	8	10	8	6	4	3	2.2	1.5

- Q.5 a) What is film conversion parameter? State various criteria of it which is used in the study of fluid – fluid reactions. 07
- b) From time V/s tracer concentration data in the reactor effluent stream, calculate fractional concentration for a first order chemical reaction whose rate constant is $5 \times 10^{-2} \text{ sec}^{-1}$. 08

Time (sec)	0	20	40	60	80	100	120
Concentration (gm/lit)	0	0.3	0.7	0.6	0.1	0.04	0

SECTION – B

- Q.6 Write short notes on Two the following. 10
- Classification of catalyst and preparation
 - Promoters and Inhibitors
 - Reactors used to study the catalyst deactivation
 - Fixed bed reactors
- Q.7 a) What is catalyst? Explain in details the different theories suggested for catalysis. 07
- b) From BET plot for adsorption of nitrogen at -195.8°C it was found that $I = 1 \times 10^{-4} \text{ cm}^{-3}$ and $S = 13 \times 10^{-3} \text{ cm}^{-3}$ for 0.606 gm sample of Silica gel. Estimate the surface area per kg of silica gel. 08
- Q.8 a) What are the assumptions made for pore adsorption? Explain the micro – pores and macro – pores. 07
- b) What are the different types of catalyst poisoning? Explain in detail the mechanism of catalyst deactivation. 08
- Q.9 a) Explain Mercury penetration method and Nitrogen desorption method to determine pore volume distribution of catalysts. 07
- b) What are the different methods used for the measurement of the catalyst surface area? Explain in detail the BET method. 08
- Q.10 Write short notes on
- Various Resistances encountered in slurry reaction 07
 - Tank in series model for non Ideal Reactors. 08

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-152
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Advanced Separation Processes
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
1. Q.No.1 from section A and Q.No.6 from section B are compulsory.
 2. Attempt any two questions from the remaining questions in each section
 3. Assume suitable data & draw sketches wherever required.

Section A

- | | | |
|-----|--|----|
| Q.1 | Solve any five. | 10 |
| | <ol style="list-style-type: none">1. Desorption2. MTZ3. Polarization4. Hemodialysis5. Eluant6. Azeotropic mixture | |
| Q.2 | a) Differentiate between PSA & TSA. | 07 |
| | b) Describe principle, working & construction of HPLC. | 08 |
| Q.3 | a) Describe different types of ultrafiltration separation process. | 08 |
| | b) Write down various types of membrane materials. | 07 |
| Q.4 | a) Discuss in detail ion exchange as a reactive separation process. | 08 |
| | b) List conditions necessary for carrying out relative distillation. | 07 |
| Q.5 | Write short note. | 15 |
| | <ol style="list-style-type: none">a) Application of chromatography.b) Membrane transport models.c) Application of reactive separation process. | |

Section –B

Q.6	a) Adsorptive properties of foam.	03
	b) How can joule heating be prevented.	04
	c) What isoelectric PH.	03
Q.7	a) Explain foam formation, collapse & drainage.	08
	b) Write down properties of foam related to flotation operation.	07
Q.8	a) Describe term zone electrophoresis with its application.	08
	b) Write down design procedure of any one flotation equipment.	07
Q.9	a) What is Nano technology for separation process?	08
	b) Explain exchange reaction.	07
Q.10	Write short note :	15
	a) Bubble separation.	
	b) Molecular sieves.	
	c) Recoil methods.	

Total No. of Printed Pages: 2

SUBJECT CODE NO:- H-153
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Industrial Pollution and Control
(OLD)

[Time: Three Hours]

[Max.Marks: 100]

Please check whether you have got the right question paper.

N.B

- i. Answer any three question from each section
- ii. Assume suitable data if required
- iii. Draw neat sketches wherever required

Section A

- Q.1 What are the functions and powers that the central pollution control board has to perform under water (precaution & control of pollution) Act, 1974? 16
- Q.2 With a neat sketch explain the construction, working of a pipe type electrostatic precipitator give various equations to determine efficiency of a pipe type electrostatic precipitator 16
- Q.3 Define Air pollution? Explain the plume behaviour with looping, canning, fumigation, fanning and lofting. 16
- Q.4 What are the meteorological parameters that influence air pollution? 16
- Q.5 Write notes on- 18
- a) Ecological balance
 - b) Wind rose
 - c) Proper zoning for reducing of air pollution

Section B

- Q.6 Using the following data find out dissolved oxygen at the end of 1 and 2 day. 16

	River	Waste water
Flow	$2.5m^3/s$	$2m^3/s$
DO mg/l	9.1	0
5 days BOD mg/l	2	200

Take deoxygenation constant as 0.1/day and reoxygenation constant as 0.3/day. Take saturation dissolved oxygen as 9.10 mg/l.

- Q.7 What are the different processes by which removal of chromium from effluent can be carried out? Explain the Reduction precipitation process. 16

- Q.8 Give the various empirical equations used in design of trickling filter. 16
- Q.9 Explain the following : 16
- a) Removal of nitrogen
 - b) Removal of the phosphorus
- Q.10 write notes on : 18
- a) First stage BOD
 - b) Anaerobic system
 - c) Reverse osmosis.

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-189
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Petrochemical Engineering
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- (1) Q. No.1 & 6 are compulsory.
 - (2) Solve any two from remaining in each section.
 - (3) Draw neat sketches wherever required.

Section A

- | | | |
|-----|---|----|
| Q.1 | Solve any five | 10 |
| | (1) Natural gas | |
| | (2) Types of crude | |
| | (3) Polymers of olefins | |
| | (4) Naphtha cracking | |
| | (5) Hydro dealkylation | |
| | (6) Glycerin | |
| Q.2 | (a) Describe Reserves & deposits of the world & India. | 08 |
| | (b) Write down importance of petrochemical industry in India. | 07 |
| Q.3 | (a) Explain alkylations technique to produce Petrochemicals. | 07 |
| | (b) Classify petrochemicals according to their source. | 08 |
| Q.4 | (a) Write down production process of methanol with Neat Sketch. | 08 |
| | (b) Explain manufacturing process of ethane with Neat Sketch. | 07 |
| Q.5 | Write short Note | 15 |
| | (a) Glycol | |
| | (b) Building blocks of petrochemical industry | |
| | (c) Application of Formaldehyde | |

Section B

- | | | |
|-----|---------------------------|----|
| Q.6 | Solve any Five | 10 |
| | (1) Xylene | |
| | (2) LPG | |
| | (3) Linear Polymer | |
| | (4) Copolymerization | |
| | (5) BCM | |
| | (6) Light Sweet Crude Oil | |

Q.7	Write down production process of following chemical in Detail.	
	(a) Nitro benzene	08
	(b) Adipic acid	07
Q.8	(a) What are various types of polymerization technique Explain any one.	08
	(b) Explain special types of polymers	07
Q.9	(a) Write down various Norms & methods of elimination in petrochemical Industry	08
	(b) What are trends in petrochemical Industry.	07
Q.10	Write short Note	15
	(a) Natural gas as a petrochemical feed stock	
	(b) Terephthalic acid	
	(c) Chain Reactions.	

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-256
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-II Food Technology
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i) Q.1 and Q.6. Are compulsory.
 - ii) Solve any two from remaining each section.
 - iii) Draw neat sketches wherever required.

Section A

- Q.1 Define the following:- 10
- a) preservation
 - b) Smoking of meat
 - c) Antioxidants
 - d) Expelling in oil process
 - e) Pasteurization
- Q.2 a) Discuss the present status and future Prospectus of dairy industry in India. 08
b) Explain various quality parameters of food. 07
- Q.3 With neat flow sheet explain the post harvesting operations. 15
- Q.4 Define food dehydration? What are various factors which affect the food during dehydration? 15
- Q.5 Write notes on 15
- a) Tray drier
 - b) Triangle test
 - c) sugar

Section B

- Q.6 Define the following 10
- a) Invert sugar
 - b) Carbonation
 - c) Lagging
 - d) anthocyanin's
 - e) Winterizing in oil.
- Q.7 What are various packaging methods? Explain aseptic packaging. 15
- Q.8 Define fermentation state various fermented products and with neat flow sheet explain the manufacturing of cheese. 15

- Q.9 Explain the following. 15
- a) Refining of oil
 - b) Artificial tenderizing
 - c) Oolong tea
- Q.10 Write notes 15
- 1) Vitamins
 - 2) Hops in beer manufacturing
 - 3) Clarification of juice

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-257
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-II: Polymer Technology
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i) Q.1 & 6 are compulsory.
 - ii) Answer any two questions from remaining of each section.
 - iii) Assume suitable data if required & draw neat sketches whenever required.

Section A

- Q.1 Define followings:-
- | | | |
|--|--------------------------------|----|
| | a) Effect of molecular weight | 03 |
| | b) Mechanism of polymerization | 04 |
| | c) Stereoisomerism | 03 |
- Q.2
- | | | |
|--|--|----|
| | a) Describe Thermosets & thermoplastics polymer. | 08 |
| | b) Explain structure of polymers. | 07 |
- Q.3
- | | | |
|--|--|----|
| | a) What are analysis & testing method of polymer? Explain in detail. | 08 |
| | b) Explain crystallinity in polymers. | 07 |
- Q.4
- | | | |
|--|---|----|
| | a) Explain ionic & coordination co polymerisation. | 08 |
| | b) Describe addition & condensation polymerisation. | 07 |
- Q.5 Write short note:-
- | | | |
|--|----------------------|----|
| | a) Branched polymers | |
| | b) Weight average | |
| | c) Emulsion | 15 |

Section B

- Q.6 Define followings:-
- | | | |
|--|---------------------|----|
| | a) polymer reaction | 03 |
| | b) Blow molding | 04 |
| | c) silicons | 03 |

Q.7	a) Explain manufacturing process of polyethylene with neat sketch.	08
	b) What is Nylons? How it is produced.	07
Q.8	a) What are various melding methods? Explain Extrusion melding.	08
	b) Describe compounding molding methods in detail.	07
Q.9	a) Describe kinetics of copolymerisation.	08
	b) Kinetics of free radical polymerization.	07
Q.10	Write short note:-	15
	a) Aldehydes	
	b) Injection molding	
	c) Thermoset polymers.	

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-258
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-II Computer Aided design and Optimization
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

- N.B Please check whether you have got the right question paper.
i) Q.No.1 and Q.No.6 are compulsory.
ii) Solve any two questions from the remaining of each section.
iii) Assume suitable data if required.
- Section A
- Q.1 a) What are the different software's available to draw flow sheet for simulation? 05
b) Write the short notes on Ideal binary distillation column. 05
- Q.2 How energy balance is done using modular approach? 15
- Q.3 a) What is process model? Explain the different models with at least one example for each. 07
b) Discuss different kinds of non-ideality in CSTR (w.r.t two parameter models.) Derive the equations for the conversion in a CSTR with dead zone and bypassing. The reaction order is second. 08
- Q.4 The following reaction is carried out in a batch reactor $A \xrightarrow{-k_1} B \xrightarrow{-k_2} C$ assumes first order reaction. Volume of reactor is constant and taking initial concentration of A is C_{A0} . Obtain the model equation to optimize the value of $C_B(t)$. 15
- Q.5 Write short notes on the following:- 15
a) Steps for optimization of shell and tube heat exchanger.
b) Importance of CAD in chemical engineering.
c) Model equation of absorption column.
- Section B
- Q.6 a) What is difference between linear & non-linear optimization. 05
b) Why engineers are interested in optimization? Explain. 05
- Q.7 a) Explain the general producer for solving the optimization problems. 07
b) You are the manufacturer of PCl_3 , which you sell in barrels at a rate of P barrels per day. The cost per barrel produced is $C=50+0.1P+9000/P$. Selling price per barrel is 300 Rs. Determine:
i. The production level giving the minimum cost per barrel. 08

- Q.8 a) What optimization is all about? Enlist the examples of application of optimization and explain the example of optimum insulation thickness. 07
- b) Maximize following function. 08
- $$Y = x_1 + 3x_2 - x_3$$
- $$x_1 + 2x_2 + x_3 = 4$$
- $$2x_1 + x_2 \leq 5$$
- $$x_1, x_2, x_3 \geq 0$$
- Use the simple method to solve the linear programming problem. Find the optimum value of x_1, x_2 and Y .
- Q.9 How will you find the optimum reflux ratio in a continuous column? 15
- Q.10 a) Consider the following objective function. Is it convex? Use Eigen values in the analysis. 07
- $$f(X) = 2x_1^2 + 2x_1x_2 + 1.5x_2^2 + 7x_1 + 8x_2 + 24$$
- b) A poster is to contain 300 cm^2 of printed matter with margins of 6 cm at the top and bottom and 4 cm at each side. Find the overall dimensions that minimize the total area of the poster. 08

Total No. of Printed Pages:02

SUBJECT CODE NO: H-259
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-III Catalysis
(OLD)

[Time: Three Hours]

[Max.Marks: 100]

Please check whether you have got the right question paper.

- N.B
- i) Answer any three questions in full from each sections
 - ii) All variables carry their usual meaning and state clearly any assumption made
 - iii) Assume relevant data where necessary with justification

Section A

- Q.1
- a) Explain the mechanism of homogeneous catalysis 08
 - b) Explain the types of the catalysis 08
- Q.2
- a) Explain the application of catalysis in organic industrial processes 08
 - b) For the reaction, $A \rightarrow 4R$, (gaseous reaction) run at 3.2 atm and 117°C. The rate at this temperature is measure as $-VA1 = 96CA$, Mol/kg cat.hr. Determine the amount of catalyst needed in a packed in bed reactor with a very large recycle rate of 35% conversion of A to R for a feed rate of 2000 mol/hr of pure A. 08
- Q.3
- a) Explain diffusion effect in pores of catalyst particle 08
 - b) Differentiate between Riedel Model and Langmuir Hinshelwood model for catalytic reaction 08
- Q.4
- a) What is sintering? Explain with help of neat sketch 08
 - b) What is chemical and physical adsorption and explain its significance 08
- Q.5
- a) Explain the reaction mechanism in phase transfer catalysis 06
 - b) Explain concept of Thiele's modulus and its application in catalysis 06
 - c) Compare and contrast alumina and silica as catalyst support/carrier 06

Section B

- Q.6 Write short notes
- a) Mechanism of liquid-liquid catalysis 06
 - b) Phase transfer catalysis 06
 - c) Mass transfer catalysis 06
- Q.7
- a) Describe the method of manufacture of Raney-Nickel catalyst 08
 - b) Highlight important characteristics of zeolites. Discuss the shape selectivity and industrial applications. 08

Q.8 Explain catalyst cracking and application with different catalytic cracking processes. 16

Q.9 a) Explain the M-M kinetics equation of the reaction using an enzyme as a catalyst 08
b) Explain inhibition in biocatalyst 08

Q.10 Data of enzyme catalyzed reaction $S \rightarrow P$ is as follows 16

[S] (M)	6.25×10^{-6}	7.5×10^{-5}	1×10^{-4}	1×10^{-3}	1×10^{-2}
v (nmoles/lit.min)	15	65.25	60	74.9	75

- Estimate V_{max} and K_m
- What would ' v ' be at $[S] = 2.5 \times 10^{-5} M$ and $[S] = 5 \times 10^{-5} M$
- What would ' v ' be at $5 \times 10^{-5} M$ if enzyme concentration is doubled

Total No. of Printed Pages:02

SUBJECT CODE NO: H-309
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Process Dynamics and Control
(REVISED)

[Time: Three Hours]

[Max.Marks80]

Please check whether you have got the right question paper.

N.B

- 1) Question No. 1 and 6 are compulsory
- 2) Answer any two questions from remaining sections.
- 3) Assume relevant data where necessary with justification

SECTION – A

- Q.1 Explain following 10
- a) Response equation
 - b) Manipulated variables
 - c) Decay ratio
 - d) Critically damped second order system
 - e) Control variables
- Q.2 a) Derive transfer function for first order system considering unsteady state behaviour of mercury bulb thermometer. 08
- b) What do you mean by pure capacitive system? Why it has sluggish response? 07
- Q.3 a) Derive transfer function for second order system considering an example of U – tube manometer. 08
- b) A mercury bulb thermometer having time constant 0.1 min is placed in the bath at 100°C and allowed to come to equilibrium with bath. At time $t = 0$ temperature of bath begins to vary sinusoidal way about its average temperature 100°C with an amplitude of 2°C. If frequency of oscillation is $10/\pi$ cycles per min. plot ultimate response of thermometer reading as function of time. What will be value of phase lag in time unit?
- Q.4 a) The transfer function of second order system is given as $G(S) = 5/(2S^2 + 1.63S + 5)$. A step change of magnitude 5 is given to input variables of system. Determine decay ratio, rise time, ultimate value of response and maximum value of response. 08
- b) What are the characteristics of under damped second order system? Explain them 07
- Q.5 Write note on 15
- a) Interacting system transfer function
 - b) Concept of linearization in process control
 - c) Pneumatic control valve

SECTION – B

- Q.6 Answer following 10
- a) Block diagram reduction
 - b) Offset value
 - c) Cross over frequency
 - d) Statement of Bode stability criteria
 - e) Regulatory control
- Q.7 a) Explain mechanism of PI controller using flapper- nozzle arrangement. 08
- b) Evaluate value of offset for control system with PD controller & regulator control mechanism. 07
- Q.8 a) A proportional controller having gain K_c is used to control two non-interacting liquid level tanks having time constant $\tau_1 = 1$ and $\tau_2 = 0.5$. Determine the stability for unity feedback control system using Routh's criterion. 08
- b) Give detail procedure for plotting Root locus diagram. 07
- Q.9 a) How the selection of controllers is made? Explain the different control modes with its usefulness. 08
- b) Define offset and calculate it for unit feedback control system with PI controller and consider regulator control mechanism for unit stem change to its input. 07
- Q.10 Write note on 15
- a) Feed forward control system
 - b) Gain margin and phase margin
 - c) Servo control mechanism for negative feedback system.

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-310
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Chemical Reaction Engg. II
(OLD)

[Time: Three Hours]

[Max.Marks:100]

- N.B
- Please check whether you have got the right question paper.
- 1) Answer any three questions from each section.
 - 2) Assume suitable data, if required and draw neat sketches wherever needed.

SECTION – A

- Q.1 a) Define E, F, & C curves and derive relation between them. 08
- b) What do you mean by progressive conversion model? For chemical reaction controlling derive expression for relation, for time required and conversion, Assuming unreacted core model for spherical particles of unchanging size. 08
- Q.2 a) Explain in details dispersion model for non-ideal flow and list out its usefulness. 08
- b) Explain the Arrhenius law of temperature dependency of rate equation. 08
- Q.3 a) Explain the stimulus-response technique to find RTD in reactors. 08
- b) Write short note on Dirac delta function. 08
- Q.4 a) Explain in detail concept of degree of segregation in mixing. 08
- b) The data given below represent a continuous response to pulse input into a closed vessel which is to be used as chemical reaction. Calculate the mean residence time of fluid in the vessel and tabulate and construct E curve. 08

t, min	0	5	10	15	20	25	30	35
$C_{pulse}, \text{gm/l}$	0	3	5	5	4	2	1	0

- Q.5 Write short notes: 18
- i) Tank in series model
 - ii) Hydrodynamic flow model
 - iii) Optimum temperature progression

SECTION – B

- Q.6 a) Explain the steps involved in heterogeneous catalytic reactions. 08
- b) What is catalyst? Explain the different types of catalyst poison. 08
- Q.7 a) What are the different methods used for the measurement of the catalyst surface area? Explain in detail the BET method. 08
- b) Explain the film conversion parameter and its usefulness. 08
- Q.8 Write short notes on
- a) Catalyst selection methods 08
- b) Surface area of catalyst 08
- Q.9 Discuss in brief about trickle bed reactor reaction kinetics. 16
- Q.10 Explain the following terms 18
- i) Catalyst preparation
 - ii) Thiele modulus
 - iii) Rate of reaction for heterogeneous reactions

SUBJECT CODE NO:- H-344
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Process Equipment Design & Drawing- II
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- 1) Solve any one question from Section A.
 - 2) Solve any two questions from Section B.
 - 3) Steam table & heat & mass transfer data book allowed.
- Section A**
- Q.1 A solution is conc. From 10% to 15% solid of 1.25 Kg/sec in triple effect evaporator steam at 393K and boiling point in tert. Effect 325 K. If feed is initially at 297 K and forward feed is used. What will be steam consumption the temp. distributions in the effects heat transfer area in each effect, each effect is identical. Assume $C_p = 4.18 \text{ KJ/Kg}^\circ\text{C}$ over given temp. range and conc. $U = 2.5, 2.0, 1.6 \text{ KW/m}^2\text{K}$. Design the unit with all internal features and auxiliaries considering 1.9 cm, OD of tube 2 mm thick 28 mm triangular pitch $L=2.6$. 40
- Q.2 Design shell and tube heat exchanger for the following duty 12000 Kg/hr of H₂O available at 93°C is to be cooled to 50°C in a shell & tube heat exchanger. This heat is to be utilized for preheating of water from 15°C to 45°C. Cold water is to be circulated through the tubes while hot water is to be circulated on shell side. Tubes of inside diam. 20 mm are to be used and max. velocity through the tubes should not be more than 0.5 m/s. Due to space limitations the tube length is to be restricted to 3.2 m. Overall heat transfer coefficient for heat exchanger is $1450 \text{ W/m}^2\text{K}$. Fouling resistance and metal wall resistance may be neglected. 40
- Use correction factor $F=0.86$
Use 20% clearance
Use triangular pitch of 29 mm
Friction factor $F = 0.079Re^{-0.25}$

Section B

- Q.3 Give in detail design of:-
- a) DPHE 10
 - b) Distillation column 10
- Q.4 What are various factors needed to design packed bed tower? Draw a neat sketch of packed bed tower. 20

Q.5 Explain the following in details (any four)

20

- i) Design of overhead pipeline.
- ii) Fluidized bed dryer
- iii) Vessel with external coils
- iv) Entrainment and flooding
- v) Fouling in heat exchanger
- vi) Pipe sizing for gases and liquid.

SUBJECT CODE NO:- H-379
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Transport Phenomena
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- 1) Q. No.01 & Q. No.6 are compulsory.
- 2) Solve any two questions from remaining of each section.
- 3) Assume suitable data if required.

Section A

- Q.1 Explain the following term 10
(a) Mechanism of energy transport
(b) Friction factors for flow in tube.
- Q.2 The lower plate is being pulled at relative velocity of 0.4 m/sec greater than the top plate. The fluid used is at 24°C, $\mu = 0.4 \times 10^{-2}$ NS/m². 15
a) How far apart should be the two plates be placed so that the shear stress $J_{yx}=0.3$ N/m²?
b) If oil of viscosity $\mu = 0.4 \times 10^{-2}$ NS/m² is used and plates are kept separated at a distance calculate as in part (a) and velocity is same as in part (a) What is T_{yx} and shear rate.
- Q.3 (a) Derive temperature profile for heat conduction through a cooling fin. 07
(b) Derive expression for the velocity distribution based on viscosity as a function of position 08
in a falling film. Use $\mu = \mu_0 e^{(-\frac{ax}{\delta})}$
- Q.4 (a) Discuss analogy between momentum and heat transfer 07
(b) Estimate the thermal conductivity of molecular oxygen at 300 K and low pressure. The molar heat capacity of oxygen at 300K and low pressure is 7.019 cal/mole k, σ is 3.433A and E/K113K, $\Omega_\mu = 1.074$. 08
- Q.5 (a) Derive the temperature equation for heat conduction with heat source like electrical. 07
(b) The plastic panel of Area $A=929$ cm² and thickness $Y=0.64$ cm was found to conduct heat 08
at a rate of 3 watts at steady state with temperature of $T_0 = 24^\circ\text{C}$ and $T_1=26^\circ\text{C}$ on the two mail surface. What is the thermal conductivity if the plastic at 25°C?

Section B

- Q.6 Explain the following terms 10
(a) Time dependent diffusion
(b) Convective transport of energy
- Q.7 (a) Derive the temperature equation for the composite wall made up of three materials. 07
(b) Derive temperature profile for a unsteady state heat conduction in solids. 08
- Q.8 Estimate D_{AB} for a mixture of 80 mole % methane and 20 mole % ethane at 2000 psi and 104°F 15
(136 atm and 313°K). the experimental value of $(P D_{AB})$ at 293°K is 0.163 atm cm²/sec.
Data : Methane: $T_c=190.7^\circ\text{K}$, $P_c=45.8$ atm,
 $P D_{AB}/(P D_{AB})^\circ=0.73$
Ethane : $T_c = 305.4^\circ\text{K}$, $P_c=48.2$ atm
- Q.9 Differentiate between:
(a) Homogenous and a heterogeneous chemical reaction 07
(b) Diffusion in gases and solids 08
- Q.10 Write short note 15
a) Stoke' law
b) Effect of chemical reaction on gas absorption
c) Heat conduction through a composite wall.

SUBJECT CODE NO: H-412
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Industrial Safety and Management
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i) Q.No.1 and Q.No.6 are compulsory.
 - ii) Answer any two questions from the remaining in each section

Section A

- Q.1 Explain the following
- a) Probability theory 03
 - b) Indian Boiler Act 03
 - c) Event trees 04
- Q.2
- a) What are the factors contributing to fire? 07
 - b) What are PPE? What are non-respiratory and respiratory PPE? 08
- Q.3 How to risk assessment in a chemical industry done? Explain with example 15
- Q.4
- a) State the factories Act 1948. 05
 - b) What is the importance of safety in process industries? 10
- Q.5 Write note on: 15
- a) SMPV Rules
 - b) Flammability limits
 - c) Hazard survey

Section B

- Q.6 Explain the following
- a) Immaturity theory 03
 - b) Resource flexibility 03
 - c) Controlling behavior 04
- Q.7 What are different motivational theory Explain any two 15
- Q.8 How can the integration of organizational goals and needs of employee be fulfilled? What are the methods to implement such approach? 15
- Q.9 What is process management? What are the methods of designing processes, rearranging and improving the processes? 15
- Q.10 Write short notes on 15
- a) Vertical integration
 - b) Predicting future behavior
 - c) Merit rating

Total No. of Printed Pages:2

SUBJECT CODE NO: H-481
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-I: Biochemical Engineering
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- 1) Q. No. 01 & Q. No.6 are compulsory.
- 2) Solve any two questions from remaining of each section.
- 3) Assume suitable data if required.

Section A

- Q.1 Define the following 10
- a) RNA
 - b) Enzyme deactivation
 - c) Molds
 - d) Biosynthesis
 - e) Immobilization
- Q.2 a) From fundamentals derive the michaelis menten kinetic equation. 07
- b) Explain “Amino acids as building block for proteins”. 08
- Q.3 Describe the factors that influence the enzyme catalyzed reaction. 15
- Q.4 a) What are the bases found in DNA and RNA nucleotide components? Give their chemical structure? 07
- b) What is the effect of temperature and pH on enzyme activity? 08
- Q.5 Write notes on 15
- a) Transport across cell membranes
 - b) Enzyme deactivation
 - c) Carbon catabolism.

Section B

- Q.6 Define the following 10
- a) Substrate
 - b) Optimization
 - c) Orientation effect
 - d) Isoelectric point
 - e) Passive diffusion

- Q.7 a) Discuss giving specific examples what are the different methods of enzyme immobilization? 07
b) Why is biomass sterilized? Explain the continuous sterilization technique. 08
- Q.8 Explain with neat sketch growth cycle phases for batch cultivation. Explain how these phase would affect the design of reactor. 15
- Q.9 What are different biological and mechanical needs to be considered in bio reactor design? 15
- Q.10 Explain following biochemical terms. 15
- a) Amino acid
 - b) DNA
 - c) Commercial Enzymes

Total No. of Printed Pages:2

SUBJECT CODE NO: H-482
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-I Industrial Piping
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- 1) Q.1 & 6 are compulsory.
- 2) Solve any two from remaining question in each section.
- 3) Assume suitable data & draw neat sketches wherever required.

Section A

- | | | |
|-----|--|----|
| Q.1 | Solve <u>any five</u> | 10 |
| | <ol style="list-style-type: none">a) Anchorb) Blindc) Guided) Hangere) Spool numberf) Pipe sizing | |
| Q.2 | <ol style="list-style-type: none">a) Discuss the importance of schedule numbers. | 08 |
| | <ol style="list-style-type: none">b) What are various properties of piping materials? | 07 |
| Q.3 | <ol style="list-style-type: none">a) What are different types of piping joints? Explain their selection criteria. | 08 |
| | <ol style="list-style-type: none">b) Write down safety value with neat sketch. | 07 |
| Q.4 | <ol style="list-style-type: none">a) Discuss the factors considered for the piping layout. | 08 |
| | <ol style="list-style-type: none">b) Explain erection & maintenance of supporting. | 07 |
| Q.5 | Write short note. | 15 |
| | <ol style="list-style-type: none">1) Plug & cap2) Restraining & Bracing system3) Single phase flow | |

Section B

Q.6	Solve <u>any five</u> .	10
	a) Adiabatic flow	
	b) Heterogeneous slurries	
	c) Reboiler piping	
	d) Optimum thickness	
	e) Pipeline in series	
	f) Reactor piping	
Q.7	a) What are the various equations used for pipeline design for transportation of crude oil.	08
	b) Design pipeline for sea water.	07
Q.8	a) What are various types of insulations used in piping system? Explain at least four with examples.	08
	b) Derive an equation to estimate optimum thickness of insulations.	07
Q.9	a) Explain pipeline design on fluid dynamics.	08
	b) Describe pipeline storage capacity	07
Q.10	Write short note	15
	1) Single phase & two phase flow	
	2) Piping & components as gas expands	
	3) Reboiler piping.	

Total No. of Printed Pages:2

SUBJECT CODE NO: H-483
FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. (Chemical)
Elective-I Energy Engineering
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i) Q. No. 1 & Q. No. 6 are compulsory
 - ii) Solve any two form remaining in each section
 - iii) Draw neat sketches whenever required

Section A

- Q.1 Solve any five 10
- 1) Gaseous fuel
 - 2) Types of coal
 - 3) Solar stills
 - 4) Water pump
 - 5) Biomass
 - 6) Geothermal energy
- Q.2 08
- a) Describe energy conservation act of India (2001)
 - b) What are environmental effects of energy use? 07
- Q.3 08
- a) Explain thermodynamic & heat transfer aspect of solar energy collection
 - b) Write down design education of wind machine 07
- Q.4 08
- a) What are scope of biogas as a large scale energy source
 - b) Explain term hydrogen power 07
- Q.5 Write short note 15
- a) Biodiesel
 - b) Cogeneration concept
 - c) Solar photo voltaic cells

Section B

- Q.6 Solve any five 10
- 1) Energy recovery system
 - 2) Topping cycle
 - 3) Convective recuperator
 - 4) Boiler Economizer
 - 5) Power factor
 - 6) HVAC

Q.7	a) Write down construction & working of thermal wheels with neat sketch.	08
	b) Describe cogeneration in sugar industries.	07
Q.8	a) Explain efficient use of stem condensate.	08
	b) Describe energy conservation in cement industries	07
Q.9	a) Explain concept of comprehensive energy conservation & planning	08
	b) Describe investments for resources development cost & efficiencies	07
Q.10	Write short note	15
	a) Heat pumps	
	b) Optimizing input energy requirement	
	c) Fluidized bed boilers	