

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-109
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Process Equipment Design & Drawing - I
(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 questions in each section.
 3. Assume suitable data & draw neat sketches wherever required.

Section A

- | | | |
|-----|---|----|
| Q.1 | Solve <u>any five</u> : | 10 |
| | 1) Rubber linings | |
| | 2) Ultimate stress | |
| | 3) Lap joint flange | |
| | 4) Nozzle reinforcement | |
| | 5) Conical Head | |
| | 6) Pressure vessels code | |
| Q.2 | a) What are essential properties of pipe coating? | 08 |
| | b) What are various testing method. Explain any one. | 07 |
| Q.3 | a) Why it is necessary to have optimum proportions of a vessel? | 07 |
| | b) Write down design equation for estimation of equipment weight. | 08 |
| Q.4 | a) Write down coils for heating & cooling. | 08 |
| | b) Explain classification of flanges with neat sketch. | 07 |
| Q.5 | Write short note. | 15 |
| | a) Stress characteristics | |
| | b) Closures for vessel | |
| | c) Limpet coil vessel | |

Section B

- Q.6 Solve any five: 10
- 1) Wind load
 - 2) Stiffener
 - 3) Wicking loss
 - 4) Roof curb angles
 - 5) Coupling
 - 6) Gland
- Q.7 a) Design of Bracket support for pressure vessels. 10
b) What is the meaning of no uplift & nominal uplift? 05
- Q.8 a) Describe ovalizations of a storage tank. 08
b) Estimate nozzle diameter for a drain in a storage tank. 07
- Q.9 a) Write down design of equation of cyclone. 08
b) A spherical tank 6.5m in diameter is filled upto a height of 4.5m. Estimate the volume of contents in the tank. 07
- Q.10 Write short note. 15
- 1) Loss mechanisms in storage tank
 - 2) Spherical storage tank
 - 3) Skirt bearing plate

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SUBJECT CODE NO: H-164
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Mass Transfer Operations-II
(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.6 are compulsory.
 - ii) Answer any two questions from remaining of each section.
 - iii) Assume suitable data, if required and draw neat sketches whenever needed.

Section A

- Q.1 Define and explain 10
- a) Reflux ratio
 - b) Relative volatility
 - c) Bubble point temperature
 - d) Dew point temperature
 - e) Partial pressure
- Q.2 a) Explain, with necessary equations, the McCabe-Thiele method of determining the number of ideal plates in a fractionating column. 07
- b) A liquid mixture containing 50 mole % n-heptane (A) and 50 mole % n-octane (B) at 30°C were subjected to a differential distillation at 1 std atmospheric pressure. With 60 mole % of the liquid distilled. Compute the composition of the composited distillate and residue. 08
- Equilibrium data:
- | | | | | | | |
|---------------------------|------|-----|------|------|------|-------|
| Temperature °C | 98.4 | 105 | 110 | 115 | 120 | 125.6 |
| Vap.pr.of n-heptane, mmHg | 760 | 940 | 1050 | 1200 | 1350 | 1540 |
| Vap.pr.of n-octane, mmHg | 333 | 417 | 484 | 561 | 650 | 760 |
- Q.3 a) Derive Rayleigh's equation for differential distillation. 07
- b) What is flash vaporization? Obtain relationship for liquid to vapor product ratio in terms of enthalpies of different streams. 08
- Q.4 Explain the following method. 07
- a) Steam distillation 07
 - b) Azeotropic distillation 08
- Q.5 Write short note on 05
- a) Concept of MSMR 05
 - b) Crystal formation and crystal growth 05
 - c) Extractive distillation 05

Section B

- Q.6 Explain following terms 10
- a) Plait point
 - b) Tie line
 - c) Extraction
 - d) Leaching
 - e) Decoction

- Q.7 Nicotine in water solution containing 1% nicotine is to be extracted with kerosene at 20°C. 15
Kerosene and water are insoluble. Determine the percentage of extraction if 100 milligram of feed solution is extracted once with 150 milligram of solvent. What will be the extraction if three ideal stages are used with 50 kg solvent in each stage?

Equilibrium data:

X'	0	0.00101	0.00246	0.00502	0.00751	0.00998	0.0204
Y'	0	0.00081	0.001962	0.00456	0.00686	0.00913	0.0197

Where X' is kg nicotine / kg water and Y' is kg nicotine / kg kerosene.

- Q.8 Explain the graphical method of determining the number of theoretical stages in a multistage counter-current leaching. 15
- Q.9
- a) Discuss briefly the typical equilibrium diagrams in leaching. 07
 - b) What is liquid – liquid extraction? What properties solvent must possess? 08
- Q.10 Answer the following
- a) Explain single stage leaching operation in detail. 07
 - b) Concept of HTU and HETP. 08

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SUBJECT CODE NO: H-199
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Plant Design & Process Economics
(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) Attempt any two from the remaining of each section
 - iii) State any assumptions made
 - iv) All variable have their usual meanings

Section A

- Q.1 Define the following 10
- a) Cost index
 - b) Asset
 - c) Depreciation
 - d) Obsolescence
 - e) Income tax
- Q.2 10
- a) Draw a neat diagram of cash flow required for industrial operation
 - b) What is the principles of similarity criteria 05
- Q.3 Draw a neat plant layout for a chemical industry (manufacture of calcium carbonate) 15
- Q.4 What is the total cost involved for the total product cost for a chemical process plant 15
- Q.5 Write notes on 15
- a) Pilot plant
 - b) Insurance
 - c) Literature survey

Section B

- | | | |
|------|--|----|
| Q.6 | Explain the following | |
| | a) Fire explosion hazards | 03 |
| | b) Salvage value | 02 |
| | c) Optimization | 03 |
| | d) Event in PERT | 02 |
| Q.7 | What are the causes of depreciation? Give various methods for calculating depreciation | 15 |
| Q.8 | Differentiate between | |
| | a) Linear programming & dynamic programming | 08 |
| | b) PERT & CPM | 07 |
| Q.9 | a) What is the importance of network analysis technique | 08 |
| | b) Give the breakdown of indirect cost | 07 |
| Q.10 | Write notes on | 15 |
| | a) Patents | |
| | b) Breakeven analysis | |
| | c) Project scheduling | |

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SUBJECT CODE NO:- H-271
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Chemical Process Industries
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

- N.B
- Please check whether you have got the right question paper.
- (1) Q.1 & 6 are compulsory.
 - (2) Solve any two questions from remaining in each section.
 - (3) Draw neat sketches wherever required.

Section A

- | | | |
|-----|--|--------------|
| Q.1 | Solve any five | 10 |
| | <ol style="list-style-type: none">(1) Nitro lime(2) Wet process(3) Natural gas(4) Kellogg process(5) Fuel cells(6) Super Phosphate | |
| Q.2 | <ol style="list-style-type: none">(a) What are salient features of chemical process Industries in India.(b) Write down Role of Chemical Engineer in process industries. |
08
07 |
| Q.3 | With Neat Sketch explain production process of following chemical | |
| | <ol style="list-style-type: none">(1) Urea(2) Caustic Soda. |
08
07 |
| Q.4 | Write down production process of following chemical in Detail | |
| | <ol style="list-style-type: none">(a) Sulfuric acid(b) Water gas |
08
07 |
| Q.5 | Write Short Note | 15 |
| | <ol style="list-style-type: none">(a) Sodium Chlorate(b) Chlorine(c) LPG | |

Section – B

Q.6	Solve any five (1) Saponification process (2) Pigment Extender (3) Dextrin (4) Fermentation (5) Capro lactum (6) Cumene	10
Q.7	(a) What are methods of synthesis of butadiene Explain any one. (b) Write down Hydro dealkylation process to mate benzene	08 07
Q.8	(a) Explain Butadiene styrene rubber process in Detail. (b) How is Ethyl Alcohol produced by Fermentation process.	08 07
Q.9	(a) Write down production process of vinyl chloride via ethylene dichloride pyrolysis. (b) Explain process for making acetaldehyde directly from ethylene in Detail.	08 07
Q.10	Write short Note (1) Styrene (2) Wine (3) Types of oil	15

SUBJECT CODE NO: H-299
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Industrial Pollution & Control
(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. Answer any two questions from remaining of each section.
 - iii. Assume suitable data, if required and draw neat sketches whenever needed.

SECTION - A

- Q.1 Explain following terms. (Any five) 10
- a) Function of CPCB in Air act.
 - b) Water analysis kit.
 - c) Chlorosis
 - d) Looping
 - e) Particle resistivity.
 - f) Demerit of fabric filters.
- Q.2
- a) Explain pollution control aspects of waste water treatment. 07
 - b) Describe Industrial gaseous Effluent analysis. 08
- Q.3
- a) Explain following terms 08
 - i) Lapse rate
 - ii) Adiabatic lapse rare
 - iii) Wind rose
 - b) What are characteristics of particulate? Explain in detail. 07
- Q.4
- a) Explain with neat sketch principle, construction and working of ESP. 08
 - b) A packed filter handling $1m^3/s$ of std. air is packed with fibers of size $100 \mu m$ in diam. Dust laden air passes through the filter with velocity of $1.5m/s$ and the packing density is 0.1. The ave. diameter of the particles in the air is $1 \mu m$ and individual fiber efficiency. 07
- Q.5 Write short note on. 15
- a) Types of smog.
 - b) Economic effect of Air pollution.
 - c) High efficiency cyclones.

SECTION – B

- Q.6 Explain following terms. (Any five) 10
- a) TOC
 - b) Dilution factor.
 - c) Flocculent settling
 - d) Protoplasm
 - e) Lime coagulation
 - f) Electrolysis
- Q.7 a) $10 \text{ m}^3/\text{day}$ of liquid effluent from food processing unit is to be treated by the activated sludge process at 30°C from an initial $(BOD)_5$ days of 650 mg/l to a final $(BOD)_5$ days of 25 mg/l . Bench scale studies at 20°C and mixed liquor biomass conc. Of 3000 mg/l gave BOD removal rate coefficient of 14 per days. Estimate the retention time and size of unit $\theta_1 = 1.02$ 08
- b) Explain in detail oxygen sag curve. 07
- Q.8 a) Write down sedimentation treatment method with neat sketch. 07
- b) Describe Advanced water treatment methods Explain Electro dialysis. 08
- Q.9 a) Explain pollution control in pulp and paper industries. 08
- b) Describe removal of mercury from liquid streams. 07
- Q.10 Write short Note on. 15
- a) Dissolved oxygen
 - b) Flotation
 - c) Comparison of tricking filter and activated sludge process.

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SUBJECT CODE NO:- H-320
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Chemical Reaction Engineering-I
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

N.B Please check whether you have got the right question paper.

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

Section A

- Q.1 Answer following terms. 10
- a) First order reaction.
 - b) Space time and space velocity
 - c) Rate of reaction
 - d) Elementary and Non Elementary reaction
 - e) Autocatalytic reaction
 - f) Order of reaction.
- Q.2 a) Explain temperature dependency of rate of reaction with Arrhenius law. 07
- b) The activation of energy of a bimolecular reaction is about 9150 cal/mole. How much faster is this reaction takes place at 500 K than at 400 K. 08
- Q.3 a) Explain the integral method of analysis for rate equation. State major differences between differential & integral method of analysis. 07
- b) After 8 minutes in a batch reactor a reactant is 80% converted, after 18 min the conversion is 90%. Find a rate expression to represent this reaction. 08
- Q.4 a) Explain the temperature dependency term in rate equation using thermodynamics and collision theory. 07
- b) Derive the rate expression for first order reversible reaction. 08
- Q.5 a) Derive the performance equation of steady state Plug flow reactor for the first order reaction with change in density case. 07
- b) A gaseous feed with $C_{A0} = 100$, $C_{B0} = 200$ and $C_{i0} = 100$ enters a steady flow reactor in which the isothermal gas phase reaction $A + 3B \rightarrow 6R$ takes place. Determine C_B, X_B, X_A at the exit of the reactor if C_A at exit is 40. 08

Section B

- Q.6 Answer the following terms:- 10
- a) Series and Parallel reactions
 - b) Non-adiabatic operations
 - c) Size comparison of reactors
 - d) Effect of temperature on equilibrium constant
 - e) Successive irreversible reactions
 - f) Optimum temperature progression
- Q.7 a) What are the different ideal reactors used to carry out homogeneous reaction? Derive performance equation of Batch reactor. 07
- b) Assuming a stoichiometry $A \rightarrow R$ for a first order gas phase reaction, the size of a plug flow reactor for 99% conversion of pure A is calculated to be 32 litres. In fact, however, the stoichiometry of the reaction is $A \rightarrow 3R$. For this corrected stoichiometry, find the required volume of a reactor. 08
- Q.8 a) Derive the equation of space time for N equal size mixed flow reactors connected in series. 07
- b) Suggest the Free radical reaction mechanism for the formation of HBr. Which satisfied the following rate equation? $H_2 + Br_2 \rightarrow 2HBr$. 08
- Q.9 a) Compare the performance of single mixed and plug flow reactors for the nth order reaction. 07
- b) Show that total volume required is minimum, when two equal sizes CSTR is connected in series. 08
- Q.10 a) Presently 90% of reactant A is converted into product by a second order reaction in a single mixed flow reactor. We propose to place a second reactor similar to the one being used in series with it. For the same treatment rate as that used presently, how will this addition of reactor affect the conversion of reactant? 07
- b) Give in detail this classification of the Chemical reactions with examples. 08

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-355
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Material Science & Technology
(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- (i) Q.1 & Q.6 are compulsory.
 - (ii) Solve any two from remaining each section.
 - (iii) State clearly any assumptions made.
 - (iv) Draw neat sketches wherever required.

Section A

- Q.1 Define the following 10
- (a) Dispersion bonding
 - (b) Bond energy
 - (c) Electron affinity
 - (d) Crystal
 - (e) Deformation
- Q.2 (a) What is the importance of periodic table? How does it help in selection of elements for new material? Give example. 10
- (b) Differentiate between primary bonding and secondary bonding. 05
- Q.3 (a) Differentiate between Ionic bonds and covalent bonds 05
- (b) Explain the wave nature of electron. Give the Schrodinger wave equation. 10
- Q.4 (a) What is Boher atomic theory? Explain 07
- (b) With neat sketch explain powder crystal method. 08
- Q.5 Write notes on the following 15
- (a) Bravais lattice
 - (b) Elastic deformation
 - (c) Quantum states

Section B

- Q.6 Explain the following 15
- (a) Fracture
 - (b) Magnetism
 - (c) Critical temperature
 - (d) Eutectic point
 - (e) Pearlite

- Q.7 Explain the phase diagram and its various transformation of steel to Austenite and pearlite. 15
- Q.8 (a) How electrical and magnetic properties of materials is important in selection of material. 07
(b) With neat sketch explain hysteresis. 08
- Q.9 Give the mechanical, physical, chemical and electrical properties of the following 15
(a) Ceramic
(b) Aluminium
- Q.10 Write notes on 15
(a) Corrosion
(b) Creep mechanism
(c) Type I super conductors.

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-389
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E. (Chemical)
Chemical Engineering Thermodynamics
(REVISED)

[Time: Three Hours]

[Max.Marks: 80]

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 the remaining of each section.
- 3) Assume suitable data, if required.

Section A

- Q.1 Explain following terms. 04
- a) Fugacity coefficient. 03
 - b) Concept of equilibrium state. 03
 - c) Gibb's Phase rule.
- Q.2 a) Derive clausius-clapeyron equation give its significance. 07
b) What are the fundamental differential equations for energy properties? List the canonical variable for all energy properties. 08
- Q.3 a) What are Maxwell's equations and what is their importance in establishing relationship between thermodynamics properties. 08
b) Will it be possible to prepare 0.1m^3 of alcohol-water solution by mixing 0.03m^3 alcohol with 0.07m^3 pure water? If not possible, what volume should have been mixed in order to prepare a mixture of same strength and of required volume? Density of ethanol and water are 789 and 997 respectively. Partial molar volume of ethanol and water are $53.6 \times 10^{-3}\text{m}^3/\text{mol}$. and $18 \times 10^{-3}\text{m}^3/\text{mol}$. respectively at the desired composition. 07
- Q.4 Explain any three methods for estimating the fugacity of a pure gas. 15
- Q.5 Write short note on 05
- a) Physical meaning of Partial molar properties. 05
 - b) Duhem theorem. 05
 - c) Chemical potential and its significance. 05

Section B

- Q.6 Explain following terms. 04
- a) Pointing correction. 03
 - b) Reaction coordinate. 03
 - c) Standard heat of reaction. 03
- Q.7
- a) What are the factors which are affecting equilibrium conversion? 07
 - b) How equilibrium constant related to standard free energy change? Does k vary with pressure? 08
- Q.8
- a) N-heptane and toluene form ideal solution at 373K, their vapour pressure are 106.74kPa and 101.3kPa respectively. Determine the composition of the liquid and vapour in equilibrium at 373K and 101.3kPa. 07
 - b) For a heterogeneous multicomponent system, what is the general criterion of phase equilibrium? 08
- Q.9 What is the effect of temperature on the equilibrium constant? Using van't Hoff equation predict the effect of increasing the temperature on endothermic and exothermic reaction. 15
- Q.10 Write short notes on. 15
- a) Criteria of chemical reaction equilibria.
 - b) UNIQUAC Equation.
 - c) Feasibility of a reaction.