

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
(AUTONOMOUS)**

III/IV B. Tech II- Semester Regular Examinations April - 2018

**Chemical Reaction Engineering-II
(CHEMICAL)**

Time: 3 hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

Unit –I

1. a) Explain the general graphical design procedure for non-isothermal reactor design. (6M)
- b) Explain the optimum temperature progression. (6M)

(OR)

2. Derive the energy balance equation for the adiabatic operation of mixed flow reactor for first- order exothermic irreversible reaction and explain the thermal stability and the significance of ignition point. (12M)

Unit-II

3. a) What are the non ideal flow patterns that exist in process equipment and briefly explain the significance of residence time distributions. (6M)
- b) Explain about C, E, and F curves and their relation in characterizing non-ideal flow. (6M)

(OR)

4. The following pulse tracer data was obtained for the reaction:
 $A \rightarrow R$, with $(-r_A) = 0.05 C_A$ mol/liter. min

| | | | | | | | | |
|---------------|----|----|----|----|----|----|----|----|
| Time, min | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 |
| Concentration | 35 | 38 | 40 | 40 | 39 | 37 | 36 | 35 |

- a) Estimate dimensionless variance (2M)
- b) Calculate Dispersion number (2M)
- c) Calculate number of tanks-in-series (2M)
- d) Estimate conversion assuming mixed flow (2M)
- e) Estimate conversion assuming tanks-in-series model (2M)
- f) Calculate conversion assuming plug flow. (2M)

Unit-III

5. a) Compare and contrast physical adsorption and chemisorption. (6M)
- b) Explain how the surface area of a porous catalyst can be estimated using BET method (6M)

(OR)

6. a) Describe any one of the methods of catalyst preparation in detail. (6M)
b) Explain the significance of catalyst poisons and catalytic deactivation. (6M)

Unit-IV

7. For the reaction, $A+B \rightarrow R+S$, taking place on a porous catalyst, derive the rate equation when surface reaction between adsorbed A and adsorbed B controls the overall reaction. (12M)

(OR)

8. a) Describe various laboratory reactors used for studying the kinetics of catalytic reactions. (6M)

b) The following data were obtained for the gaseous reaction, $A \rightarrow 4 R$, when pure A was studied with a solid catalyst, at 3.2 atm and 117° C

| | | | | |
|--------------------------|-------|--------|-------|-------|
| C_A , mol/liter | 0.039 | 0.0575 | 0.075 | 0.092 |
| $-r_A$, mol A/hr.kg cat | 3.4 | 5.4 | 7.6 | 9.1 |

Find the weight of catalyst needed in a packed bed reactor for 35% conversion, at the same operating conditions. (6M)

Unit-V

9. a) what are the factors to be considered for selecting reactors for fluid-fluid systems. (6M)
b) Describe various reactors and contacting patterns of Gas-Liquid reactions. (6M)

(OR)

10. a) Derive the kinetic model for shrinking –core spherical particle of unchanging size when diffusion through gas film controls the reaction. (6M)
b) Describe the rate-controlling steps of fluid-particle reactions. (6M)

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
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III/IV B. Tech II- Semester Regular Examinations April - 2018

**Chemical Technology
(CHEMICAL)****Time: 3 hours****Max Marks: 60****Answer ONE Question from each Unit****All Questions Carry Equal Marks****All parts of the question must be answered in one place only****UNIT-I**

- 1) What are the different methods for the production of sulphuric acid? Describe with neat flow sheet production of sulphuric acid by DCDA process. (12M)

(OR)

- 2) What are the applications of urea? Explain the manufacture of urea with neat flow diagram (12M)

UNIT-II

- 3) a) With a neat flow diagram describe the manufacture of soda ash. Mention the major engineering problems involved in the process. (12M)

(OR)

- 4) a) What are the different types of cement? (2M)
b) Explain the manufacture of ordinary Portland cement with sketch. (10M)

UNIT-III

- 5) a) What are the different types of coal and write its applications? (4M)
b) Explain in detail coal tar distillation. (8M)

(OR)

- 6) a) In brief describe the origin and classification of petroleum. (6M)
b) Explain in detail the distillation of crude petroleum. (6M)

UNIT-IV

- 7) a) Write the methods of extraction of vegetable oil. (6M)
b) Explain hydrogenation of vegetable oil with flow diagram. (6M)

(OR)

- 8) Write in detail constituents and manufacturing procedure of paints. (12M)

UNIT-V

- 9) Write the preparation of pulp by Kraft process (12M)

(OR)

- 10) Describe the manufacture of Nylon 6 and Nylon 6,6 (12M)

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
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III/IV B. Tech II- Semester Regular Examinations April - 2018

**Industrial Pollution and Control (Elective-I)
(CHEMICAL)**

Time: 3 hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT-I

- 1) a) Write briefly on effect of noise pollution on earth. (4M)
b) Discuss in detail about the consequences of population growth in effecting environment. (8M)

(OR)

- 2) a) Define Biosphere and list the different cycles that balances the ecosystem. (4M)
b) Explain in detail about the carbon cycle and the sulphur cycle. (8M)

UNIT-II

- 3) a) Write a note on temperature lapse rate and stability. (4M)
b) Explain about the classification and properties of air pollutants. (8M)

(OR)

- 4) Determine the Gaussian plume model and its limitations in the estimation of ground level concentration of gaseous pollutants. (12M)

UNIT-III

- 5) Elaborate the method of estimating stack height of chimneys. (12M)

(OR)

- 6) A wet scrubber is to be used to separate suspended particulates from industrial flue gas mixture. The liquid flow rate through the scrubber is 0.15 gpm for 1000 m³ per minute of the gas mixture. The relative velocity of the gas to liquid is 92 m/s. The gas mixture is having 29 C and 1 atm pressure carrying suspended particulates of density 1000 kg/m³. Determine the efficiency of scrubber as a function of particle diameter. (12M)

UNIT-IV

- 7) a) Classify the waste water by their origin. (4M)
b) Explain Oxygen Sag curve along with a neat diagram (8M)

(OR)

- 8) Discuss in detail about trickling filters and their design. (12M)

UNIT-V

- 9) Write in detail on methods of collection and disposal of solid waste (12M)

(OR)

- 10) Define hazardous waste and describe different treatment methods to treat it. (12M)

Hall Ticket No :

Question Paper Code :

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
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III/IV B. Tech II- Semester Regular Examinations April - 2018

**Mass Transfer-II
(CHEMICAL)**

Time: 3 hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT-I

1) a) How do you choose minimum solvent required for the single stage extraction? Explain. (6M)

b) A liquid mixture of A, B and C has the mass fraction of A and B (at equilibrium) at 25°C as follows:

$$y_A = 0.40$$

$$y_B = 0.30$$

Locate the exact point of this mixture in an equilateral triangular diagram. (4M)

c) Give some applications for liquid-liquid extraction (2M)

(OR)

2) a) Write short notes on one pair of soluble system in Liquid Liquid Extraction (LLE) (4M)

b) Explain about countercurrent counter current multi stage extraction operation with neat sketch (8M)

UNIT-II

3) a) Describe the method to determine number of stages analytically for counter current stage wise Leaching operation for constant underflow condition. (8M)

b) Explain in detail about the solid liquid extraction Equilibrium (4M)

(OR)

4) a) A solid feed containing 22% solute, 3% water and 75 % inerts (insolubles) is to be leached at a rate of 1 ton per hour with water in a counter current leaching cascade. The strong leachate leaving the unit should have 16% of the solute in it. Desired recovery of the solute in the feed is 99%. The overflow does not have any entrained inert in it, and the amount of the solution retained in the sludge is 0.45kg solution per kg inert. Analytically determine the number of stages. (8M)

b) write short notes about percolation tanks. (4M)

UNIT-III

- 5) a) Experiments on decolourization of oil yielded the equilibrium relationship as $y = 0.5x^{0.5}$, where y =gm colour removed/g adsorbent and x = colour in oil, g colour/1000 g colour free oil. 100 kg oil containing 1 part of colour to 3 parts of oil is agitated with 25 kg adsorbent. Calculate the percentage colour removed if all 25 kg of adsorbent used in one step. (8M)
- b) Explain Breakthrough curve in fixed bed adsorbers. (4M)

(OR)

- 6) a) Write Freundlich equation. How it is applied to two-stage cross current adsorption? (6M)
- b) Discuss types of adsorption and nature of adsorbents in detail. (6M)

UNIT-IV

- 7) a) Write short notes on Bound Moisture, Unbound moisture, Equilibrium Moisture and free Moisture (6M)
- b) Explain in detail about the Drying rate curve. (6M)

(OR)

- 8) a) A wet solid of 28% of moisture is to be dried to 0.5 % Moisture in a tray dryer. A laboratory test shows that it requires 8 hours to reduce the moisture content of the same solid to 2%. The critical moisture content is 6% and the equilibrium moisture is 0.2%. The falling rate of drying is linear in the free moisture content. Calculate the drying time of the solid if the drying conditions similar to those in the laboratory test are maintained. All moistures are expressed as percent of 'bone dry' mass of the solid (8M)
- b) Briefly explain about through circulation drying (4M)

UNIT - V

- 9) a) Briefly Discuss about Nucleation and Crystal growth (8M)
- b) With a neat sketch explains about Draft tube Baffle crystallizer (4M)

(OR)

- 10) a) Briefly Discuss about Reverse Osmosis (6M)
- b) Explain in Detail about the membranes for liquid separation (6M)

Note: Triangular Graph and ordinary graph sheets to be supplied.

Hall Ticket No :

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**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
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**Material Science and Engineering
(CHEMICAL)**

Time: 3 hours

Max Marks: 60

Answer ONE Question from each Unit

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All parts of the question must be answered in one place only

UNIT-I

- 1) a) Discuss in detail about the Rutherford model and Wave mechanical model. (6M)
b) Differentiate between inter-atomic bonding between atoms. Explain secondary bonding in detail. (6M)

(OR)

- 2) a) With neat sketches discuss about the crystal systems. (6M)
b) Explain X-ray diffraction technique to determine the structure of an atom. (6M)

UNIT-II

- 3) a) Write short notes on Burgers circuit and Burgers vector. (4M)
b) Describe the surface defects in detail with the help of a neat sketch. (8M)

(OR)

- 4) a) What do you mean by imperfections? Differentiate between point and line imperfections. (4M)
b) Explain in detail about the edge and screw dislocations. (8M)

UNIT-III

- 5) a) Define stress and strain. (4M)
b) Differentiate between cold and hot working in detail. (8M)

(OR)

- 6) a) What are the various types of hardness tests available for a material? Explain any two. (6M)
b) Discuss about various visco-elastic models with neat diagrams in detail. (6M)

UNIT-IV

- 7) a) Define fracture and Bauschinger effect. (4M)
b) Describe about creep mechanism and fatigue mechanism. (8M)

(OR)

- 8) a) Discuss the advantages of composite materials. (4M)
b) Explain in detail about the particulate reinforced composites. (8M)

UNIT-V

- 9) a) What do you mean by unary and binary phase diagram? Explain. (4M)
b) With a neat sketch explain about Ag-Cu phase diagram. (8M)

(OR)

- 10) a) Define eutectic and peritectic points. (4M)
b) Discuss the effect of alloying on the properties of steels. Explain the types of steels used in chemical industry. (8M)

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
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III/IV B. Tech II- Semester Regular Examinations April - 2018

Petrochemicals (Elective-I)

(CHEMICAL)**Time: 3 hours****Max Marks: 60****Answer ONE Question from each Unit****All Questions Carry Equal Marks****All parts of the question must be answered in one place only****UNIT-I**

- 1 a) Discuss the present Indian scenario of petrochemicals industry (4M)
b) List out the feed stocks used for petrochemicals production. What are their specifications (8M)

(OR)

- 2 a) Enlist various petrochemicals derived from methane (4M)
b) Discuss the manufacturing of any two derivatives from methane (8M)

UNIT-II

- 3 With a neat flow diagram explain the production of ethylene glycol (12M)

(OR)

- 4 a) Describe various chemicals produced from ethylene and acetylene and give their industrial applications (12M)

UNIT-III

- 5 a) Describe the manufacture of acrylonitrile (6M)
b) Describe the process for the production of phenol with neat flow sheet (6M)

(OR)

- 6 a) What are the various ingredients used to alter the polymer properties of PVC (6M)
b) Describe the process of production of high density polyethylene (6M)

UNIT-IV

- 7 a) What are the applications of petroleum aromatics (4M)
b) Explain industrial production of terephthalic acid with a neat flow sheet. (8M)

(OR)

- 8 What is caprolactam? What are the methods of production of it? Describe one method of production of caprolactam with neat diagram (12M)

UNIT-V

- 9 a) Discuss the production of Acrylic fibres (6M)
b) Explain the production of SBR with neat flow sheet (6M)

(OR)

- 10 a) Explain the manufacture of phenol formaldehyde resins with neat diagram (6M)
b) Explain the general manufacturing of sulphonates with neat flow sheet (6M)