

Total No. of Printed Pages:01

**SUBJECT CODE NO:- H-118**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) REV (Sem-II)**  
**Process Modeling and Simulation**

**[Time: Three Hours]****[Max.Marks: 80]**

- N.B Please check whether you have got the right question paper.
- 1) Q.No.1 & 6 are compulsory.
  - 2) Solve any two questions from remaining of Section A & B.
  - 3) Assume suitable data & mention it.
- Section A**
- Q.1 Solve the following:- 10
- 1) What is unsteady state model?
  - 2) What is linear equation in model?
- Q.2 Define model for chemical process. Explain modeling procedure for component balance in a flow reactor. 15
- Q.3 Compare distributed is continuous parameters modeling. Explain with the help of temp. Distribution in a jacket of exothermic reactor. 15
- Q.4 What are five major points to write a simulation-model a continuous steady State flow of fluid through circular pipe. 15
- Q.5 Write model equation for flash drum. 15
- Section B**
- Q.6 Solve the following:- 10
- i) Runge Kutta method
  - ii) Newton's method
- Q.7 Write model equation with assumption for Packed distillation column. 15
- Q.8 Write model equation with assumptions for Jacketed vessel. 15
- i) Commercial simulation package selection & use in chemical industry. 08
  - ii) Numerical routine for physical & chemical properties. 07
- Q.10 Write a model equation for isothermal three CSTR in series for I<sup>st</sup> order reaction. 15

Total No. of Printed Pages:1

**SUBJECT CODE NO:- H-152**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-II)**  
**Advanced Separation Processes**  
**[Revised]**

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Question No.1 and 6 are compulsory.
  - ii) Answer any two questions from remaining sections.
  - iii) Assume relevant data where necessary.

**Section – A**

- |     |  |          |
|-----|--|----------|
| Q.1 | Explain  | 10       |
|     | <ol style="list-style-type: none"> <li>i) Adsorption isotherm</li> <li>ii) Dialysis</li> <li>iii) Separation factor</li> <li>iv) Exchange reaction</li> <li>v) Mobile phase</li> </ol>                               |          |
| Q.2 | <ol style="list-style-type: none"> <li>a) Explain membrane models?</li> <li>b) Explain TSA</li> </ol>  | 08<br>07 |
| Q.3 | <ol style="list-style-type: none"> <li>a) With a neat sketch explain electrodialysis</li> <li>b) Explain in detail ion-exchange process</li> </ol>   | 08<br>07 |
| Q.4 | <ol style="list-style-type: none"> <li>a) Explain basic concept, mechanism and characterization of liquid chromatography</li> <li>b) Differentiate between reactive distillation and reactive extraction.</li> </ol> | 08<br>07 |
| Q.5 | Write notes on <ol style="list-style-type: none"> <li>i) Mass Transfer with reaction</li> <li>ii) Ultra-filtration</li> <li>iii) Chromatography</li> </ol>   | 15       |

**Section – B**

- |      |  |    |
|------|--|----|
| Q.6  | Explain following <ol style="list-style-type: none"> <li>i) Principle and mechanism of froth floatation</li> <li>ii) Separation using molecular sieves</li> </ol>          | 10 |
| Q.7  | Give qualitative and quantitative design details of floatation column used for separation  | 15 |
| Q.8  | Discuss in detail principle, mechanism and equipment for zone refining.  | 15 |
| Q.9  | Describe in details with neat sketch, the principle, mechanism and application of centrifugation used as advanced separation process.                                      | 15 |
| Q.10 | Write note on <ol style="list-style-type: none"> <li>i) Nanotechnology based separation</li> <li>ii) Recoil method</li> <li>iii) Field based separation process</li> </ol> | 15 |

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-189**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-II)**  
**Petrochemical Engineering**  
**[REV]**

[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 in each section.
- 3) Assume suitable data wherever required.

**SECTION – A**

- |     |   |          |
|-----|---|----------|
| Q.1 | Solve any five  | 10       |
|     | <ol style="list-style-type: none"> <li>1) Formation of petroleum</li> <li>2) Indian crude types</li> <li>3) Isomerization</li> <li>4) Propylene derivatives</li> <li>5) Glycols</li> <li>6) Amines</li> </ol> |          |
| Q.2 | <ol style="list-style-type: none"> <li>a) What are main building blocks of petrochemical industry?</li> <li>b) Describe Reserves &amp; deposits in India.</li> </ol>  | 08<br>07 |
| Q.3 | <ol style="list-style-type: none"> <li>a) Explain economic aspects of petrochemical industry in India.</li> <li>b) Write down various methods to petrochemicals.</li> </ol>                                   | 08<br>07 |
| Q.4 | <ol style="list-style-type: none"> <li>a) Write down production process</li> <li>1) Glycols</li> <li>2) Hydrogen cyanide</li> </ol>   | 15       |
| Q.5 | Write short note <ol style="list-style-type: none"> <li>1) Reserve&amp; deposits in world</li> <li>2) Carbon disulfide</li> <li>3) Ethylene derivatives</li> </ol>  | 15       |

**SECTION – B**

- |     |   |    |
|-----|---|----|
| Q.6 | Solve any five.   | 10 |
|     | <ol style="list-style-type: none"> <li>1) Terephthalic acid</li> <li>2) Uses of monochloro benzene</li> <li>3) Suspension</li> <li>4) Polymer</li> <li>5) Biodegradable polymer</li> <li>6) Natural rubber</li> </ol> |    |

- Q.7 a) Write down production process of maleic anhydride. 08  
b) Describe with neat sketch manufacturing process of BHC. 07
- Q.8 a) What are different type of polymerization techniques. 08  
b) Write down engineering & special types of polymers. 07
- Q.9 a) Write down future of petrochemical industry. 08  
b) What are various types of norms & methods of pollution control? 07
- Q.10 Write short note 15  
a) Trends in petrochemical industry  
b) Phthalic anhydride  
c) Synthetic rubber

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-256**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-II)**  
**Elective-II: Food Technology**  
**[Revised]**

**[Time: Three Hours]****[Max.Marks: 80]**

Please check whether you have got the right question paper.

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

**Section A**

- |     |   |    |
|-----|---|----|
| Q.1 | Explain the following:  | 10 |
|     | <ol style="list-style-type: none"> <li>a) Shelf life</li> <li>b) Smoking of meat</li> <li>c) Additives</li> <li>d) Vitamins</li> <li>e) Antioxidants</li> </ol> |    |
| Q.2 | Discuss the present status and future prospectus of sugar industry in India.  | 15 |
| Q.3 | Define food dehydration? What are various factors which affect the food during dehydration?   | 15 |
| Q.4 | With a neat flow sheet explain the manufacturing of chocolate.  | 15 |
| Q.5 | Write short notes on:   | 15 |
|     | <ol style="list-style-type: none"> <li>a) Tray drier</li> <li>b) Constituents of food</li> <li>c) Fermentation</li> </ol>                                       |    |

**Section B**

- |     |   |    |
|-----|---|----|
| Q.6 | Explain the following:  | 10 |
|     | <ol style="list-style-type: none"> <li>a) Blanching</li> <li>b) Tenderization</li> <li>c) Lagering</li> <li>d) Winterizing in oil</li> <li>e) Hops</li> </ol> |    |
| Q.7 | What are various types of tea available? Explain any one type with its post and pre -harvesting processes.  | 15 |
| Q.8 | Explain various packaging methods for food industry?  | 15 |

Q.9 With a neat flow sheet explain any one processing unit.

- a) Meat
- OR
- Milk

15

Q.10 Write short notes on:

- a) Ageing of meat
- b) Carbon dioxide in beverages
- c) Minerals

15

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-257**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-II)**  
**Elective-II Polymer Technology**  
**[Revised]**

**[Time: Three Hours]****[Max.Marks: 80]**

Please check whether you have got the right question paper.

- N.B
- 1) Q.No.1 and Q.No.6 are compulsory.
  - 2) Solve any two from remaining in each section.
  - 3) Assume suitable data wherever required.

**Section A**

- |     |  |    |
|-----|--|----|
| Q.1 | Solve following                                      |    |
|     | a) Classification of polymers                        | 04 |
|     | b) Properties of polymer                             | 03 |
|     | c) Testing of polymer                                | 03 |
| Q.2 | a) Explain in detail types of polymerization.        | 08 |
|     | b) Describe in detail thermo sets & thermo plastics. | 07 |
| Q.3 | a) What are factors influencing polymer properties.  | 08 |
|     | b) Describe in detail transition in polymers.        | 07 |
| Q.4 | Describe following in detail                         | 15 |
|     | 1) Bulk polymerization                               |    |
|     | 2) Suspension polymerization                         |    |
| Q.5 | Write short note                                     | 15 |
|     | 1) Linear polymer                                    |    |
|     | 2) Number average                                    |    |
|     | 3) Mechanism of polymerization                       |    |

**Section B**

- |     |  |    |
|-----|--|----|
| Q.6 | Solve following  |    |
|     | a) Chain transfer agents                               | 04 |
|     | b) Slush molding                                       | 03 |
|     | c) ABC polymers  | 03 |
| Q.7 | a) Write down kinetics of free radical polymerization. | 08 |
|     | b) Describe coordination polymerization.               | 07 |
| Q.8 | a) Describe in detail extrusion molding.               | 08 |
|     | b) What are coating type, explain in detail.           | 07 |

Q.9 Briefly describe manufacturing process of

- 1) Polyether's
- 2) Flaoro carbon polymers

15

Q.10 Write short note

- 1) Isocyanate reactions
- 2) Blow molding
- 3) Step growth

15



Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-309**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Process Dynamics and Control**  
**[OLD]**

**[Time: Three Hours]****[Max.Marks: 80]**

N.B

Please check whether you have got the right question paper.

1. Q.No.1 and Q.No.6 are compulsory.
2. Answer any two questions from remaining of each section.
3. Assume suitable data, if required and draw neat sketches wherever required.

**Section A**

- Q.1 Explain the following: 10
- a) Time constant
  - b) Overshoot
  - c) Gain of process
  - d) Manipulated variables
  - e) Damping
- Q.2 Derive the transfer function for non-interacting system consisting of two tanks? 15
- Q.3 A mercury bulb thermometer having time constant 0.2 min is placed in the bath at  $90^{\circ}\text{C}$  and allowed to come to equilibrium with bath. At time  $t = 0$  temperature of bath begins to vary sinusoidal way about its average temperature  $100^{\circ}\text{C}$  with an amplitude of  $2^{\circ}\text{C}$ . 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? 15
- Q.4
  - a) Explain in detail with the help of example the concept of linearization in process control. 10
  - b) Feed forward control mechanism explain. 05
- Q.5 Write notes on: 15
- a) Mixing process
  - b) Transportation lag
  - c) Importance of transfer function

**Section B**

- Q.6 Explain: 10
- a) Tuning of controller
  - b) Pole and zero
  - c) Gain margin
  - d) Ratio control
  - e) Stability

- Q.7 Evaluate value of offset for control system with PD controller and regulator control mechanism. 15
- Q.8 Sketch bode plot for non-interacting system consisting of two tanks in series with respective time constants are  $T_1 = 1 \text{ min}$  and  $T_2 = 2 \text{ min}$  15
- Q.9 a) Explain in detail the RouthHorwitz's stability criteria. 10  
b) Differentiate between phase margin and gain margin. 05
- Q.10 Write short notes on: 15  
a) Cascade control system  
b) Characteristic equation of control system  
c) Distributed control system

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-344**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Process Equipment Design & Drawing- II**  
**[OLD]**

[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) Assume suitable data, if necessary & state it clearly.
- 4) Steam table/ Heat & mass transfer data book is allowed.

**Section A**

- Q.1 A solution is to be concentrated from 10% to 50% by solid at 1.25 kg/sec in triple effect forward feed evaporator. Heating media as steam at 393K, boiling point in third effect 325K. Feed solution is at 297 K. Find the quantity of steam required temperatures in I, II & third effect. Total heat transfer area in three effects. Assume that each effect is similar. Specific heat is 4.18 kJ/kg°C over given temperature range 40

$$U_1 = 2.5 \text{ kW/m}^2\text{K}$$

$$U_2 = 2.0 \text{ kW/m}^2\text{K}$$

$$U_3 = 1.6 \text{ kW/m}^2\text{K}$$

Use tube of 19mm outside diameter & 2mm thick. Triangular pitch = 28 mm length of tube 2.6m

- Q.2 Design a heat exchanger for the given duty Gas oil at 200°C is to be cooled to 40°C. The flow rate is 22500 Kg/hr cooling liquid is water. Available at 30°C & temperature rise allowed to be 20°C. Pressure drop allowance for each stream is 100 kN/m<sup>2</sup> F<sub>t</sub>=0.94 40

Physical Properties of water-

Temperature, °C	30	40	50
$C_p, \text{KJ/kg}^\circ\text{C}$	4.18	4.18	4.18
$K, \text{KW/m}^\circ\text{C}$	$618 \times 10^{-6}$	$631 \times 10^{-6}$	$643 \times 10^{-6}$
$\mu, \text{mN/m}^2\text{S}^{-1}$	$979 \times 10^{-3}$	$671 \times 10^{-3}$	$544 \times 10^{-3}$
$\rho, \text{kg/m}^3$	995.2	992.8	990.1

Physical Properties of Gas Oil

Temperature, °C	200	120	40
$C_p, \text{KJ/kg}^\circ\text{C}$	2.59	2.28	1.97
$K, \text{KW/m}^\circ\text{C}$	0.13	0.125	0.12
$\mu, \text{mN/m}^2\text{S}^{-1}$	0.06	0.17	0.28
$\rho, \text{kg/m}^3$	830	850	870

For water overall coefficient at average temp is  $500 \text{ W/m}^2\text{°C}$ , use steel tube of outer dia 20 mm, thickness 2 mm, length 4.0 m, triangular pitch of 1.25 do. With usual notations.

### Section B

- |     |  |    |
|-----|--|----|
| Q.3 | Give the detail design of                    | 20 |
|     | i) Double Pipe heat exchanger                |    |
|     | ii) Tray column                              |    |
| Q.4 | Draw a neat diagram & design a packed tower. | 20 |
| Q.5 | Explain the following in detail.             | 20 |
|     | i) Fluidised bed dryer                       |    |
|     | ii) Design of over head piping               |    |
|     | iii) Vessels with external coil              |    |
|     | iv) Weeping & coining                        |    |

Total No. of Printed Pages:1

**SUBJECT CODE NO:- H-379**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Transport Phenomena**  
**[OLD]**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Q.no.1 & Q.no.6 are compulsory.
  2. Solve any two questions from section A & B of remaining questions.

## Section A

- |     |   |    |
|-----|---|----|
| Q.1 | Solve the following.  |    |
|     | 1) Thermal conductivity   | 03 |
|     | 2) Creeping flow  | 03 |
|     | 3) Fourier's Law  | 04 |
| Q.2 | Derive the equation of velocity distribution in a falling film.                                 | 15 |
| Q.3 | Derive temperature profile for heat conduction through a cooling fin.                           | 15 |
| Q.4 | Explain the creeping flow around a sphere in the flow of liquid in circular tube with equation. | 15 |
| Q.5 | Explain the Newtonian & non Newtonian fluid on the basis of transportation & power requirement. | 15 |

## Section B

- |      |  |    |
|------|--|----|
| Q.6  | Solve the following  |    |
|      | 1) Diffusion in porous solids  | 03 |
|      | 2) Convective transport of energy                                      | 03 |
|      | 3) Friction factor for flow in tubes                                   | 04 |
| Q.7  | Derive equation for Fick's law of binary diffusion.                    | 15 |
| Q.8  | Derive an equation for diffusion through stagnant film.                | 15 |
| Q.9  | Derive expression for heat conduction with a viscous heat source.      | 15 |
| Q.10 | Derive an equation for diffusion with a homogeneous chemical reaction. | 15 |

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-412**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Industrial Safety and Management**  
**[OLD]**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

N.B

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

**Section A**

- |     |  |    |
|-----|--|----|
| Q.1 | Solve following  |    |
|     | 1) ESI Act   | 03 |
|     | 2) Fire triangle   | 02 |
|     | 3) HAZOP   | 03 |
|     | 4) Types of Accidents  | 02 |
| Q.2 | a) Discuss in detail factories Act 1948 & factories rule 1963. | 15 |
| Q.3 | a) Distinction between fire and explosion.                     | 08 |
|     | b) Write down concept of ignition in detail                    | 07 |
| Q.4 | a) Explain HAZAN in detail.                                    | 08 |
|     | b) Describe revealed and unrevealed failure.                   | 07 |
| Q.5 | Write short note   | 15 |
|     | 1) SMPV Rules  |    |
|     | 2) Maintenance of PPE  |    |
|     | 3) Review of probability theory                                |    |

**Section B**

- |     |   |    |
|-----|---|----|
| Q.6 | Explain following   |    |
|     | 1) Motivation Hygiene theory  | 05 |
|     | 2) Vertical integration   | 03 |
|     | 3) Changing behaviour   | 02 |
| Q.7 | a) Write down integration of organizational goals & needs of employee | 08 |
|     | b) Describe X & Y theory  | 07 |

- Q.8 a) Write down contribution of Elton Mayo & Skinner to behaviour sciences 08  
b) Explain understanding past behaviour. 07
- Q.9 a) Explain term process management. 08  
b) Discuss customer involvement in process management. 07
- Q.10 Write short note 15  
1) Resource flexibility  
2) Directing behaviour  
3) Job evaluation

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-481**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Elective-I: Biochemical Engineering**  
**[OLD]**

**[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 in each section.
  - 3) Assume suitable data wherever required.

**Section – A**

- |     |   |    |
|-----|---|----|
| Q.1 | a) Write down structure of cells Prokaryotic & Eukaryotic.                | 04 |
|     | b) Define term substrate activation.                                      | 03 |
|     | c) Explain electrophoresis.   | 03 |
| Q.2 | a) Describe Amino acids as building blocks for proteins.                  | 08 |
|     | b) Discuss term introduction to Biochemical Engineering.                  | 07 |
| Q.3 | a) Write down multiple substrate modulation reactions.                    | 08 |
|     | b) Explain simple enzyme kinetics with one & two substrate modifications. | 07 |
| Q.4 | a) Discuss means & various principles of enzyme purification.             | 08 |
|     | b) Write down purpose & methods of enzyme immobilization.                 | 07 |
| Q.5 | Write short note.   | 15 |
|     | a) Regulation of enzyme activity  |    |
|     | b) Precipitation  |    |
|     | c) Structural types of protein  |    |

**Section – B**

- |     |   |    |
|-----|---|----|
| Q.6 | a) Define antibiotics                                     | 04 |
|     | b) Explain growth cycle phase                             | 03 |
|     | c) Sterilization of reactors.                             | 03 |
| Q.7 | a) Write down Design step for Ideal batch reactor.        | 08 |
|     | b) Discuss Monod growth kinetics.                         | 07 |
| Q.8 | a) Write down enzyme catalyzed reactions in CSTR.         | 08 |
|     | b) State term ideal plug flow tabular reactor.            | 07 |
| Q.9 | a) What are various commercial enzymes explain in detail. | 08 |
|     | b) Discuss medium formulation & optimization.             | 07 |



Q.10 Write short note

- a) Organic acid
- b) Streptomycin
- c) Recycle & wall growth

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-482**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Elective-I: Industrial Piping**  
**[OLD]**

**[Time: Three Hours]****[Max.Marks: 80]**

Please check whether you have got the right question paper.

- N.B
1. Q.no.1 and Q.no.6 are compulsory.
  2. Attempt any two questions from the remaining A & B section each.
  3. Assume suitable data if required.

## Section A

- Q.1 Explain the following.
- |                              |    |
|------------------------------|----|
| a) Equivalent length of pipe | 03 |
| b) Bracing system            | 03 |
| c) Siphon                    | 02 |
| d) Blind                     | 02 |
- Q.2 Why are pipe supports necessary? explain different types of pipe supports with neat sketches. 15
- Q.3 What are various types of insulation used in piping system? Explain at least four with examples. 15
- Q.4 Selection of material of construction of pipe is very important in chemical industry” explain with suitable examples. 15
- Q.5 Write notes on 15
- |                             |  |
|-----------------------------|--|
| a) Pipelines in parallel    |  |
| b) Dupits equation          |  |
| c) Organic coating in pipes |  |

## Section – B

- Q.6 Explain the following
- |                    |    |
|--------------------|----|
| a) Cavitation      | 03 |
| b) Hot insulation  | 03 |
| c) Siphon flashing | 02 |
| d) Shoe            | 02 |
- Q.7
- |  |    |
|--|----|
| a) How can vibrations be controlled and presented in pipes.          | 08 |
| b) Differentiate between homogenous piping and heterogeneous piping. | 07 |

- Q.8 Give the design steps for transportation of natural gas by pipes. 15
- Q.9 Three pipes of diameter 100mm, 200mm and 300mm and length of 250m, 300m and 350 m  
respective are connected in series. The difference in water surface levels in two tanks is 18m. 15  
Determine the rate of flow of water if coefficient of friction are 0.0071, 0.0073, 0.0075 respectively.  
a) Considering minor losses  
b) Neglecting minor losses.
- Q.10 Write short notes on 15  
a) Pipeline storage capacity  
b) Pipe color codes  
c) Master plot plan

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-483**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Elective-I: Energy Engineering**  
**[OLD]**

[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 in each section.
  - 3) Assume suitable data wherever required.

**Section A**

- |     |  |    |
|-----|--|----|
| Q.1 | Solve following  |    |
|     | a) What are strategy for energy development in India.                        | 04 |
|     | b) Explain solar photovoltaic cells.   | 03 |
|     | c) Define hydrogen power.  | 03 |
| Q.2 | a) Describe biological mechanism effect of temperature of biogas production. | 08 |
|     | b) Explain basics of Nuclear energy.   | 07 |
| Q.3 | a) Discuss problem & prospects of centralized & decentralized patterns.      | 08 |
|     | b) Write down concept of energy conversion.                                  | 07 |
| Q.4 | a) Write down various steps of design of wind machines                       | 08 |
|     | b) Explain various types of solar devices.                                   | 07 |
| Q.5 | Write short note   | 15 |
|     | a) Wind energy for water pumping   |    |
|     | b) Hydrogen power  |    |
|     | c) Gaseous fuels   |    |

**Section B**

- |     |   |    |
|-----|---|----|
| Q.6 | Solve following   |    |
|     | a) Recuperator  | 04 |
|     | b) Fluidized bed boilers  | 03 |
|     | c) Types of energy Audit  | 03 |
| Q.7 | a) Describe in detail co-generation power plants in sugar industry. | 08 |
|     | b) Write down study of energy recovery systems like heat pumps.     | 07 |
| Q.8 | a) Describe heat exchanger network synthesis                        | 08 |
|     | b) Explain energy efficient process technologies                    | 07 |

- Q.9 a) Write down concept of efficient use of steam condensate. 08  
b) State methodology & steps taken of energy Audit. 07
- Q.10 Write short note 15  
a) Reduction in losses  
b) Steam & gas co-generation  
c) Thermal wheels

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-621**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (CGPA) (Sem-I)**  
**Process Dynamics and Control**

**[Time: Three Hours]****[Max. Marks:80]**

- N.B Please check whether you have got the right question paper.
- Q.No. 01 and 06 are compulsory.
  - Answer any two questions from remaining of each section.
  - Assume suitable data, if required and draw neat sketches whenever needed.

**Section A**

- Q.1 Explain the following terms 10  
 a) Overshoot b) decay ratio c) response time d) Ramp change e) Sinusoidal change
- Q.2 a) Derive overall transfer function for liquid level single tank system. 07  
 b) A first order system is subjected to the step forcing function of magnitude 5. The time constant of the system is 6 second. Sketch the response of the system. 08
- Q.3 a) Derive response equation for first order system when subjected to Sinusoidal input function. 08  
 b) Draw a block diagram for CSTR and explain its different element. 07
- Q.4 a) Obtain transfer function for non interacting system in series. 05  
 b) A thermometer having a time constant of 10 second is placed in temperature bath. After the thermometer reaches steady state temperature of 30°C it is suddenly placed into a hot fluid at 60°C. sketch the response of the thermometer. 10
- Q.5 Write short note on: 15  
 a) Pure capacitive system.  
 b) Transportation lag.  
 c) Servo and regulator control problem.

**Section B**

- Q.6 Explain following terms: 10  
 a) Amplitude ratio b) phase angle c) offset d) phase margin e) gain margin
- Q.7 a) Using Routh's test, determine the value of K for which the system with characteristics equation  $(S + 1)(S + 2)(2S + 1) + 5K = 0$  remains stable. 10  
 b) Obtain the transfer function of pneumatic PI controller. 05

- Q.8 Plot the root locus diagram for the following OLTF and also determine which value of K make the system stable. 15

$$G(S) = \frac{K}{(S+1)(S+2)(S+3)}$$

- Q.9 A proportional controller is used to control two non interacting first order system having time constant 1 and 0.5 minute. Sketch the root locus diagram. Assume unity feedback control system. 15

- Q.10 Write short note on: 15
- Mechanism of PD controller.
  - Pneumatic control valve.
  - Routh-Hurwitz stability criterion.

Total No. of Printed Pages: 02

**SUBJECT CODE NO:- H-629**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Process Equipment Design Drawing- II**  
**[CGPA]**

[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.
4. Make suitable assumption, if necessary.

**Section A**

- Q.1 A chemical solution is to be concentrate having flow rate  $2 \times 10^4$  kg/min at  $40^\circ\text{C}$  and 10 % solvent (solid) present in it to product containing 50 % solvent (solid) steam is available at pressure  $200 \text{ KN/m}^2$ . In last effect of triple effect evaporator with equal heat transfer surface is operated at  $15 \text{ KN/m}^2$  pressure specific heat of all solutions  $4.18 \times 10^3 \text{ J/KgK}$ . Calculate the steam consumption and heat transfer area required for above task in each effect.

The overall (coefficient) heat transfer is 3.4, 1.4 &  $0.71 \text{ Kw/m}^2$  in I<sup>st</sup>, II<sup>nd</sup> & III<sup>rd</sup> effect respectively.

Triangular pitch 28 mm, in side diameter of tub = 16mm, outside diameter of tube = 20mm. Length of tube of suitable material is 2.5 m with usual notations.

- Q.2 A shell & tube heat exchanger is to design for following duty, to cool condensate from  $95^\circ\text{C}$  to  $40^\circ\text{C}$  flow rate of methanol is  $10 \times 10^4$  kg/hr water is used as cooling medium available at temperature  $25^\circ\text{C}$  permissible rise in temperature of water is  $40^\circ\text{C}$ .

Heat capacity of methanol  $= 2.84 \text{ KJ/Kg } ^\circ\text{C}$

Heat capacity of water  $= 4.2 \text{ KJ/Kg } ^\circ\text{C}$

Overall coefficient to start calculation is  $560 \text{ W/m}^2 ^\circ\text{C}$ ,

$K_1=0.249$ ,  $n_1=2.207$

Density of water  $995 \text{ kg / m}^3$ ,

Viscosity of water  $0.8 \text{ MN. s/m}^2$

Thermal conductivity of material of construction of tube is  $0.59 \text{ W/m}^\circ\text{C}$   $j_h=3.9 \times 10^{-3}$ .

Density of methanol  $750 \text{ kg/m}^3$

Viscosity of methanol  $0.34 \text{ mN s/m}^2$

Heat capacity of methanol  $2.84 \text{ KJ/Kg } ^\circ\text{C}$

Thermal conductivity of methanol  $0.19 \text{ w/m}^\circ\text{C}$ .

$j_h=3.3 \times 10^{-3}$

$j_f=4.3 \times 10^{-3}$  for tube side

$j_f= 4 \times 10^{-2}$  for shell side



## Section B

- Q.3 Explain in detail: 20
- 1) External coil vessel.
  - 2) Baffle selection methods.
  - 3) Piping for gases & slurry.
  - 4) Significance of scaling in tubes during design.
- Q.4 Design steps & its significance of: 20
- 1) Tray column.
  - 2) Continuous dryer.
- Q.5 Design steps with necessary equations and significance of these equation with selection for double pipe heat exchanger. 20

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-636**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Transport Phenomena**  
**[CGPA]**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

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

**SECTION 'A'**

- |     |  |    |
|-----|--|----|
| Q.1 | a) Describe classification of fluids.  | 05 |
|     | b) Compute steady state momentum flux $C_{yx}$ when the lower plate velocity is 0.1 m/s in the +ve direction. The distance between the plates is 0.005 m and the fluid viscosity is $1.77 \times 10^{-3}$ kg/ms.         | 05 |
| Q.2 | a) Discuss theory of thermal conductivity of liquids.  | 07 |
|     | b) Explain molecular theory of viscosity of gases and derive its equation at low density.  | 08 |
| Q.3 | Derive velocity profile for flow of a falling film.  | 15 |
| Q.4 | Derive temperature profile for a heat conduction through a cooling fin.  | 15 |
| Q.5 | a) The density of liquid $C_6H_6$ at $20^\circ C$ and 1 atm is $1.595 \text{ g/cm}^3$ and the isothermal compressibility is $90.7 \times 10^{-6} \text{ atm}^{-1}$ . What is its thermal conductivity?                   | 08 |
|     | b) For a falling film of thickness 2.5 mm vertical wall find mass flow rate of liquid if a liquid has a kinematic viscosity of $2 \times 10^{-4} \text{ m}^2/\text{s}$ and a density of $0.8 \times 10^3 \text{ kg/m}^3$ | 07 |

**SECTION 'B'**

- |     |  |    |
|-----|--|----|
| Q.6 | a) Explain Fick's law for multi component mixture.   | 03 |
|     | b) What is creeping flow around the sphere?  | 03 |
|     | c) Write shell mass balance with boundary conditions.  | 04 |
| Q.7 | a) Explain theory of diffusion in gases at low density.  | 08 |
|     | b) Write analogy between momentum-heat-mass transport.   | 07 |
| Q.8 | Derive an expression for average concentration of component 'A' in case of diffusion with homogeneous chemical reaction. | 15 |

- Q.9 Derive concentration profile equation for diffusion and chemical reaction inside a porous catalyst. 15
- Q.10 Estimate  $D_{AB}$  for a mixture of 80 mole % of methane and 20 mole % of ethane at 2000 psi and  $104^{\circ}\text{F}$  (136 atm and 313 K). The experimental value of  $(PD_{AB})$  at 293 K is  $0.163 \text{ atm} \cdot \text{cm}^2/\text{sec}$ . 15

Data :

Methane	$T_c = 190.7 \text{ K}$
	$P_c = 45.8 \text{ atm}$
Ethane	$T_c = 305.4 \text{ K}$
	$P_c = 48.2 \text{ atm}$
$\frac{PD_{AB}}{(PD_{AB})^0} = 0.73$	

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-643**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Industrial Safety and Management**  
**[CGPA]**

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

N.B.

- 1) Q.1 and Q.6 are compulsory
- 2) Solve any two from remaining in each section
- 3) Draw neat sketches wherever required.

**Section – A**

- |     |  |    |
|-----|--|----|
| Q.1 | Solve following  |    |
|     | 1) Safety organization   | 03 |
|     | 2) Gas cylinder Rules  | 03 |
|     | 3) TLV   | 02 |
|     | 4) Mist  | 02 |
| Q.2 | a) What are different provisions of workmen compensation Act     | 08 |
|     | b) Write down rules & regulating of Petroleum Act                | 07 |
| Q.3 | a) Write down typical toxins & their Biological effects          | 08 |
|     | b) Explain Risk assessment & analysis & Minimization of Hazards. | 07 |
| Q.4 | a) Write down Role of government in promoting industrial safety  | 08 |
|     | b) Describe types of Accidents & damages                         | 07 |
| Q.5 | Write short note   | 15 |
|     | a) Safety training   |    |
|     | b) Toxicology parameters   |    |
|     | c) ESI   |    |

**Section – B**

- |     |   |    |
|-----|---|----|
| Q.6 | Solve following   |    |
|     | a) Ergonomics   | 02 |
|     | b) Fire triangle  | 02 |
|     | c) Review of Probability theory                                     | 03 |
|     | d) Static Electricity   | 03 |
| Q.7 | a) Explain safety house keeping & Industrial lighting.              | 08 |
|     | b) What are various hand tools & portable tools. Draw neat sketches | 07 |
| Q.8 | a) Differentiate between fire & explosion                           | 07 |
|     |   | 08 |

- b) Describe storage & handling of flammable & toxic materials

Q.9

- a) Describe in detail Chernobyl nuclear disaster  
b) Write down HAZAN studies in detail

08

07

Q.10 Write short note

- a) Process hazard check list  
b) Storage materials  
c) Minimum oxygen concentration

15

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-668**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (Chemical) (Sem-I)**  
**Elective-I Industrial Piping**  
**[CGPA]**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- 1) Q.No.1 and Q.No.6 are compulsory.
- 2) Solve any two questions from remaining question in each section.
- 3) Draw neat sketches wherever required
- 4) Assume suitable data wherever required

**Section A**

- |     |   |    |
|-----|---|----|
| Q.1 | Define the following terms<br>a) Schedule number<br>b) plug<br>c) Newtonian fluid<br>d) valve<br>e) Blind | 10 |
| Q.2 | Differentiate between<br>a) Pipes and tube<br>b) Turbulent flow and laminar flow.                         | 15 |
| Q.3 | Explain different types of pipe fittings with neat sketches   | 15 |
| Q.4 | What are various types of material used for piping in crude oil industry                                  | 15 |
| Q.5 | Write notes on<br>a) Color codes for piping<br>b) Restraining<br>c) Expansion joints                      | 15 |

**Section B**

- |     |  |    |
|-----|--|----|
| Q.6 | Define the following terms:<br>a) Buckling pressure<br>b) Water hammer<br>c) Corrosion<br>d) Steam trap<br>e) Insulation | 10 |
| Q.7 | Differentiate between<br>a) Pipelines in series and parallel<br>b) Cervices corrosion and cavitation's corrosion         | 15 |

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