UTKALMANI GOPABANDHU INSTITUTE OF ENGINEERING, ROURKELA

LESSON PLAN

DEPARTMENT OF CHEMICAL ENGINEERING

LESSON PLAN

SUBJECT CODE : TH-2

NAME : HEAT TRANSFER

BRANCH : CHEMICAL

SEMESTER :Diploma-IV

CREDIT POINTS : 4

NUMBER OF MODULES : 4

CLASSES REQUIRED : 60

PRE-REQUISITE : The study of heat transfer helps you to understand how to determine the transfer of heat which we use by means of conduction, convection, radiation in the process for manufacturing of products. Heat is generated as wastage at every energy conversation/system.

MODULE-I

CONDUCTION: 1. Heat flow concept in conduction. 2. Steady state and unsteady state heat flow. 3. State Fourier's law of conduction. 4. Heat flow through single material 5. Heat flow through composite walls. 6. Heat flow through cylinder 7. Heat flow through spheres. 8. Heat flow in single and series medium. 9. Thermal insulation and critical radius of insulation 10. Solve simple numerical problems on conduction.

Objectives:

To understand the definitions & basic concepts of Heat Transfer, Conduction and Fourier's law of heat conduction**.** Newton's law of cooling. Identify good conductors of heat. Differentiate between conductors and insulators.

SESSION NO	TOPICS TO BE COVERED	PRIMARY REFERENCE (BOOKS/NOTES)
1	Basic concept of Heat Transfer	T1, R1, R2
2	Heat flow concept in conduction.	T1, R1, R2
3	Steady state and unsteady state heat flow.	T1, R1, R2
4	State Fourier's law of conduction	T1, R1, R2
5	Heat flow through single material	T1, R1, R2
6	Solve simple numerical problems on Heat flow through single material	T1, R1, R2
7	Heat flow through composite walls.	T1, R1, R2
8	Solve simple numerical problems on Heat flow through composite walls.	T1, R1, R2
9	Heat flow through cylinder	T1, R1, R2
10	Solve simple numerical problems on Heat flow through cylinder	T1, R1, R2
11	Heat flow through spheres	T1, R1, R2
12	Solve simple numerical problems on Heat flow through spheres	T1, R1, R2
13	Heat flow in single and series medium	T1, R1, R2
14	Thermal insulation and critical radius of insulation	T1, R1, R2
15	Solve simple numerical problems on conduction	T1, R1, R2

MODULE-II

CONVENCTION and HEAT EXCHANGER: 1. Concept of heat flow by convection 2. Natural and forced convection 3. Individual and overall heat transfer co efficient 4. Application of dimensional analysis in Convention 5. Use Empirical equations for different flow regime 6. Parallels, co current and counter current flow 7. Log mean temperature difference 8. Classify heat exchanger 9. Construction and working of shell and tube heat exchanger 10. Multi pass and single pass heat exchanger 11. Derive energy balance for shell and tube heat exchanger (simple problems) 12. Construction and operation of Finned tube heat exchanger, Plate type heat exchanger, Scrapped surface heat exchanger 13. Heat transfer in agitated vessel 14. Define condensation 15. Drop wise and film type condensation

16. Solve simple numerical problems.

Objectives:

To understand the definitions & basic concepts of Convection. Determine the overall heat transfer coefficient for a heat exchanger. Understand the operation of Heat Exchanger of shell and tube, multi pass and single Pass type. Obtain a relation for the logarithmic mean temperature difference for use in the LMTD method.

SESSION NO	TOPICS TO BE COVERED	PRIMARY REFERENCE (BOOKS/NOTES)
1	Concept of heat flow by convection	T1, R1, R2
2	Natural and forced convection	T1, R1, R2
3	Individual and overall heat transfer co efficient	T1, R1, R2
4	Solve simple numerical problems on Individual and overall heat transfer co efficient	T1, R1, R2
5	Application of dimensional analysis in Convention	T1, R1, R2
6	Use Empirical equations for different flow regime	T1, R1, R2
7	Classify heat exchanger	T1, R1, R2
8	Parallels, co current and counter current flow	T1, R1, R2
9	Log mean temperature difference	T1, R1, R2
10	Solve simple numerical problems on heat exchanger	T1, R1, R2
11	Construction and working of shell and tube heat exchanger	T1, R1, R2
12	Multi pass and single pass heat exchanger	T1, R1, R2

13	Derive energy balance for shell and tube heat exchanger (simple problems)	T1, R1, R2
14	Solve simple numerical problems on heat exchanger	T1, R1, R2
15	Construction and operation of Finned tube heat exchanger	T1, R1, R2
16	Construction and operation of Plate type heat	T1, R1, R2
17	Construction and operation of Scrapped surface heat exchanger	T1, R1, R2
18	Heat transfer in agitated vessel	T1, R1, R2
19	Define condensation, Drop wise and film type condensation	T1, R1, R2
20	Solve simple numerical problems.	T1, R1, R2

MODULE-III

RADIATION: 1. Principle in radiation heat transfer 2. Concept of black body, Gray body and emissivity 3. Mono chromatic emissive power, Derivation of total emissive power 4. State Kirchhoff's Law 5. State Stefan Boltzmann's Law. 6. State Wien's law and Plank's law 7. Estimate heat transfer by radiation.

Objectives:

To understand the definitions & basic concepts of Radiation and Stefan Boltzmann's Law. Determine heat transfer by radiation.

SESSION NO	TOPICS TO BE COVERED	PRIMARY REFERENCE (BOOKS/NOTES)
1	Principle in radiation heat transfer	T1, R1, R2
2	Concept of black body, Gray body	T1, R1, R2
3.	Absorptivity, Reflectivity and Transmissivity	T1, R1, R2
4	Emissive power, Emissivity, Mono chromatic emissive power, Mono chromatic emissivity	T1, R1, R2
5	Derivation of total emissive power	T1, R1, R2
6	State Kirchhoff's Law	T1, R1, R2
7	State Stefan Boltzmann's Law.	T1, R1, R2
8	State Wien's law and Plank's law	T1, R1, R2
9	Estimate heat transfer by radiation	T1, R1, R2
10	Solve simple numerical problems on heat transfer by radiation	T1, R1, R2

MODULE-IV

EVAPORATION: 1 Objective of Evaporation. 2. Performance, capacity, economy of evaporator 3. Differentiate among various types of evaporators 4. Construction and operation of standard basket evaporator, long tube forced circulation type evaporator. 5. Elementary principle of single and multiple effect evaporators 6. Material and energy balance of single effect evaporators 7. Solve simple problems on evaporators 8. Boiling point elevation, Vapour recompression, mechanical recompression and thermal recompression.

Objectives:

To understand the definitions & basic concepts of Evaporation. Capacity & Economy of evaporator.

SESSION NO	TOPICS TO BE COVERED	PRIMARY REFERENCE (BOOKS/NOTES)
1	Objective of Evaporation	T1, R1, R2
2	Performance, capacity, economy of evaporator	T1, R1, R2
3.	Differentiate among various types of evaporators	T1, R1, R2
4	Natural circulation evaporator and Forced Circulation evaporator	T1, R1, R2
5	Construction and operation of standard basket evaporator	T1, R1, R2
6	Construction and operation of long tube forced circulation type evaporator	T1, R1, R2
7	Elementary principle of single and multiple effect evaporators	T1, R1, R2
8	Backward feed and Forward feed evaporation	T1, R1, R2
9	Material and energy balance of single effect evaporators	T1, R1, R2
10	Solve simple problems on evaporators	T1, R1, R2
11	Solve simple problems on evaporators	T1, R1, R2
12	Boiling point elevation,	T1, R1, R2
13	Vapour recompression,	T1, R1, R2
14	Mechanical recompression	T1, R1, R2
15	Thermal recompression.	T1, R1, R2

Course Delivery Plan:

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
MODULE	1	1	1	1 & 2	2	2	2	2	2 & 3	3	3	3 & 4	4	4	4

BOOKS FOR REFERENCE:

TEXT BOOKS

T1: Unit operations II by K Gavane, Nirali Publication

REFERENCE

R1: Unit operation of Chemical Engineering by Mc Cabe & J M Smith, Tata Mc Grawhill.

R2: Introduction to Chemical Engineering by Badgero and Banchero, Tata Mc Grawhil.

	Prepared by	**Approved by**
Signature		
Name	**SUBASINI JENA**	**B.K GANTAYAT**
Designation	**Lecturer**	**HOD, Chemical.**