

TEACHING AND EXAMINATION SCHEME

Sl. No.	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instruction periods per week			Total Periods per semester	Credits	Continuous internal evaluation			Semester end examination			
			L	T	P			Mid sem. I	Mid sem. II	Internal evaluation	Max. Marks	Min. Marks	Total marks	for passing including
1	18CH 501C	Industrial Management & Entrepreneurship	3	1	0	60	3	20	20	20	40	14	100	35
2	18CH 502C	Thermodynamics and Reaction Engineering	3	1	0	60	3	20	20	20	40	14	100	35
3	18CH 503C	Mass Transfer operations	3	1	0	60	3	20	20	20	40	14	100	35
4	18CH 504E	Program Elective-I	3	1	0	60	3	20	20	20	40	14	100	35
5	18CH 505E	Program Elective-II	3	1	0	60	3	20	20	20	40	14	100	35
6	18CH 506P	Mass Transfer operations Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
7	18CH 507P	Instrumentation Process Control & Reaction Engineering Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
8	18CH 508P	Energy Technology Lab Practice	1	0	2	45	1.5	20	20	20	40	20	100	50
9	18CH 509P	Programming in – C Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
10	18CH-510P	Project Work	1	0	2	45	1.5	20	20	20	40	20	100	50
	Skill up Gradation		0	0	7	105	2.5	0	0	Rubrics				
Total			20	5	17	630	25	200	200	200	400	170	1000	425
Activities: student performance is to be assessed through Rubrics														

***CH-501 is common with Mechanical**

Note: Pass criteria: The minimum marks required for passing in any of courses are given below

1. Cumulative 35% of marks (35 marks) in Mid Sem -1 + Mid Sem -2+ Internal Evaluation +SEE

2. Minimum marks in SEE is 35% (i.e.14marks).
3. If the cumulative of CIE is less than 35% (i.e.21 marks out of 60) then more than 35% of SEE is required to get overall 35%.

Program Elective – I	
18CH-504E(A)	Instrumentation and Process control
18CH-504E(B)	Industrial Safety
Program Elective – II	
18CH-505E(A)	Energy Technology
18CH-505E(B)	Environmental Pollution Control Engineering

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Title : Industrial Management and Entrepreneurship	Course Code : 18CH 501C
Semester : V	Course Group : CORE
Teaching Scheme in Periods (L:T:P:) : 45:15:0	Credits : 3
Methodology : Lecture +Tutorials	Total contact periods : 60
CIE : 60 Marks	SEE : 40 Marks

This course is common for DME & DPT

Prerequisites: Knowledge of Basic Sciences

COURSE OUTCOMES

	At the end of the course the students will have the ability to:
1	Explain the principles and functions of management and Outline organization structure& organizational behavior
2	Describe the Functions of production management
3	Analyse the functions of materials management.
4	Estimate marketing, sales & feasibility study.
5	Make use of ISO 9000 & T.Q.M
6	Outline Industrial legislation & safety and role of entrepreneur and entrepreneurial development

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (Q No)			Remarks
			R	U	A	
1	Principles and functions of management and organisation structure and behaviour	10	4	1	9(a) 13(a)	

2	Production management	10					
3	Materials management	10		2		10 (a)	14 (a)
4	Marketing, sales & feasibility study	10					
5	Introduction to ISO 9000 & T.Q.M	10		3	5 ,6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)
6	Industrial legislation & safety and Entrepreneurial development	10			7 ,8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)

Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

Industrial Management and entrepreneurship

Unit – 1

Duration: 10 Periods (L: 6.0 – T: 4.0)

Principles and functions of management and organisation structure and behaviour

Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Differences of administration and management. Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, public limited company. Industrial Cooperatives, Philosophy, types of Organizations, Line and Staff and functional organisations. Advantages and limitations, departments in a large scale industry. Effective organisation. Motivation, different theories of motivation, leadership, styles.

Unit – 2

Duration: 10 Periods (L: 6.0 – T: 4.0)

Production management

Production, planning and control, relation with other departments, need for planning and its advantages, Routing, scheduling, dispatching, PERT and CPM, simple problems.

Unit – 3

Duration: 10 Periods (L: 6.0 – T: 4.0)

Materials management

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex.

Unit – 4

Duration: 10 Periods (L: 6.0 – T: 4.0)

Marketing, sales & feasibility study

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligopoly, perfect competition. Cost -Elements of Cost, Contribution, Break even analysis, Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports, - different products – Mechanical, Electrical, Electronics, consumer items, Consumer desires etc.

Unit – 5

Duration: 10 Periods (L: 6.0 – T: 4.0)

Introduction to ISO 9000 & T.Q.M

Concept of quality, Definitions of the terms quality policy, quality management, quality systems, quality control and quality assurance. Elements of quality systems: Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser– supplied product, product identification and traceability, process control, Inspection and testing. Definition and Principles of quality assurance. Know the necessity of International standards –ISO- Evolution, Meaning, importance. Various standards under ISO. ISO 9000 series of standards- Features, series, Constituents, Advantages, Draw backs and beneficiaries (Whom does ISO 9000 help). 5-S principles-concept of zero defects. TQM-Meaning, Characteristics.

Unit – 6

Duration: 10 Periods (L: 6.0 – T: 4.0)

Industrial legislation & safety and Entrepreneurial development

Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities. Total Welfare concept, rights and responsibilities and Employers and employees. Salient features of Indian Factories Act, Importance of Safety at work places, Hazards, causes of accidents. Entrepreneur and entrepreneurship -Concept, definition, role, expectation. Entrepreneurship Vs Management, promotion of S.S.I. Self –employment schemes. Product selection, site selection, Institutional support needed, financial assistance programmes.

REFERENCE BOOKS

1. Industrial engineering and management by O.P Khanna
2. Production management by Buffa
3. Engineering Economics and management science by Banga & Sharma
4. Personnel management by Flippo

SUGGESTED LEARNING OUTCOMES

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Principles and functions of management and organisation structure and behaviour

- Define industry, commerce (Trade) and business.
- Know the need for management.
- Understand the evolution of management
- Explain the principles of scientific management.
- Understand functions of Management.
- Differentiate between management and administration.
- Understand types of ownerships
- Differentiate types of ownerships.
- Understand salient features of joint stock companies.
- Understand the philosophy and need of organization structure of an industry.
- Understand the line, staff and Functional organisations.
- List the advantages and limitations of line, staff and functional organizations.
- List different departments in a largescale industry.
- Explain the factors of effective organization.
- Understand organizational behaviour.
- Conduct for analysis.
- State motivation theories.
- State Maslow 's Hierarchy of needs.
- List out different leadership models.
- Explain the trait theory and behaviour theory of leadership.

Production management

- Differentiate and integrate production, planning and control.
- Relate the production department with other departments.
- State the need for planning and its advantages.
- Explain the stages of Production, planning and control.
- Explain routing methods.
- Explain scheduling methods.
- Explain dispatching.
- Draw PERT/CPM networks.
- Identify the critical path

Materials management

- Explain the role of the materials in Industry.
- Derive expression for inventory control.
- Explain ABC analysis.
- Define safety stock.
- Define reorder level.
- Derive an expression for economic ordering quantity.
- Explain stock layout.
- List out stores records.
- Explain the Bin card.
- Describe Cardex method.
- Explain purchasing procedures.
- List out purchase records.
- Describe the stores equipment

Marketing, sales & feasibility study

- Explain marketing functions.
- Explain Sales function.
- List out market conditions.
- Differentiate Sellers and Buyers 'market.
- Differentiate monopoly, oligarchy, and perfect competition.
- Conduct market and demand surveys.
- Differentiate product and production analysis.
- Identify the input materials, i.e. Bill of materials
- Explain the concept of cost.
- List out the elements of cost.
- Explain break-even analysis.
- Decide the location.
- Evaluate Economic and Technical factors.
- Preparation of feasibility study.
- List out different products currently in demand with market or industry.

Introduction to ISO 9000 & T.Q.M

- Understand the concept of quality.
- Know the quality systems and elements of quality systems.
- Know the principles of quality Assurance.
- Know the evolution of ISO standards.
- Discuss ISO standards and ISO 9000 series of quality systems.
- State the constituents of ISO 9000 series of standards for quality systems.
- State the outstanding features and drawbacks of ISO 9000 series of standards.
- List the beneficiaries of ISO 9000.
- Understand 5-S principles and ZERO DEFECT
- Know TQM concept and characteristics.

Industrial legislation & safety and Entrepreneurial development

- Describe employer and employee relations.
- Describe the mechanics of Trade Unions.
- Describe mechanics of settlement of in outs.
- Explain the significance of collective bargain.
- List out Welfare activities.
- Explain the total welfare concept.
- List out the rights and responsibilities of employees and employers.
- List out the salient features of Indian Factories Act.
- Explain the importance of safety at Work place.
- List out the important provisions related to safety.
- Explain hazard and accident.
- Explain the causes of accidents.
- Outline the concepts of Entrepreneurship.
- Define the word entrepreneur.
- Determine the role of Entrepreneurship.
- Describe the profile of an entrepreneur.
- Explain the requirements of an entrepreneur.
- Outline the expectations of Entrepreneurship.
- Determine the role of entrepreneurs in promoting Small Scale Industries.
- Describe the details of self-employment schemes.
- Explain the method of product selection.
- Explain the method of site selection.
- List the financial assistance programmes.
- List out the organisations that help an entrepreneur.

SUGGESTED E RESOURCES/STUDENT ACTIVITIES

1. www.learnengineering.com
2. www.nptel.ac.in
3. www.onlinestudies.com
4. www.classcentral.com
5. Prepare an organisational structure of institution
6. A Case study on principles of management.
7. Make a survey on marketing a product.
8. Prepare a list of ISO 9000 series as well as latest quality standards
9. Prepare sign boards representing safety measures.
10. Role play as an entrepreneur
11. Explore six sigma concepts.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
18CH 501C.1	-	-	-	2	-	3	3	3	2	-	4,6,7,8,9
18CH 501C.2	1	2	2	1	-	3	1	1	1	2	1,2,3,4,6,7,8,9,10
18CH 501C.3	1	2	2	1	-	3	1	1	1	2	1,2,3,4,6,7,8,9,10

18CH 501C.4	2	2	2	1	-	3	1	1	1	2	1,2,3,4,6,7,8,9,10
18CH 501C.5	-	-	-	2	-	3	2	2	3	2	4,6,7,8,9,10
18CH 501C.6	-	-	-	2	-	3	2	2	3	-	4,6,7,8,9

QUESTION PAPER BLUE PRINT FOR CIE (MID I)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
1	Principles and functions of management and organisation structure and behaviour	1 2	5(a) 5(b)	7(a) 7(b)	
2	Production management	3 4	6(a) 6(b)	8(a) 8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID II)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
3	Materials Management	1 2	5(a) 5(b)	7(a) 7(b)	
4	Marketing, Sales & Feasibility study	3 4	6(a) 6(b)	8(a) 8(b)	

State Board of Technical Education, Telangana State
C18-Semester End Examination (SEE)
Model Paper- 18CH 501C
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

TIME : 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8M

*NOTE : 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences*

1. What does CPM stand for?
2. Write the formula to calculate EOQ?
3. Define trade.
4. What is ISO?
5. Define quality.
6. What are zero defects?
7. In which year, Indian factories act formed?
8. List any two safety measure to be followed in industry.

PART – B

*Answer **all** questions . Each question carries **three** marks*

4x 3 M = 12M

9(a) What is Commerce and business?

OR

9(b) Write any three limitations of ISO 9000 series?

10(a) List any three marketing conditions.

OR

10(b) What are the causes of accidents?

11(a) Give any three beneficiaries of ISO.

OR

11(b) What does quality assurance means.

12(a) What is Collective bargaining?

OR

12(b) Name any three Indian entrepreneurs in the field of steel manufacturing.

PART – C

*Answer **all** questions . Each question carries **five** marks*

4x 5 M = 20 M

13(a) Differentiate between Sole proprietorship and partnership.

OR

13 (b) Elaborate the components of quality system.

14 (a) Explain ABC analysis.

.

OR

14 (b) Compare and contrast Management and entrepreneurship.

15(a) State the constituents of ISO 9000 series.

OR

15(b) Explain 5S principles in detail.

16 (a) What are the qualities of an entrepreneur?

OR

16 (b) Explain industrial hazards in detail.

State Board of Technical Education, Telangana State
Model Paper- 18CH 501C
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
Mid -I

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. Define commerce.
2. Write any two qualities of a leader.
3. What do you mean by production?
4. What does PERT stand for?

PART – B

Marks : 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5(a) What is management?

OR

5(b) List out theories of motivation.

6(a) State the advantages of planning.

OR

6(b) What is dispatching?

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

1. Answer **all** questions and each question carries **five** marks.

2. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) What are the functions of management?

OR

7 (b) Draw a neat sketch of line and staff organization.

8 (a) Differentiate between PERT and CPM.

OR

8 (b) A Project has nine activities. The duration of each activity is as follows.

Sno	1	2	3	4	5	6	7	8	9
Activity	1-2	1-3	2-4	3-4	4-6	5-6	3-5	5-7	6-7
Duration(days)	6	8	7	12	3	5	7	11	10

Draw the network and find the project duration.

State Board of Technical Education, Telangana State
Model Paper- 18CH 501C
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
Mid –II (CIE)

Time : 1 hr

Total Marks : 20

PART – A

Marks: 4 X 1 M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. What does EOQ stands for?
2. Give the formula to calculate Contribution.
3. Define Market.
4. List any two elements of cost.

PART – B

Marks : 2 X 3 M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5(a) What is Reorder level?

OR

5(b) Draw a neat sketch of ABC analysis graph.

6(a) Mention any three differences between Sellers's market and Buyer's market.

OR

6 (b) Write a short notes on Monopoly?

PART – C

Marks : 2 X 05 M= 10 M

NOTE :

1) Answer **all** questions and each question carries **five** marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7(a) Describe any two stores equipment.

OR

7 (b) Explain purchasing procedure.

8 (a) Differentiate product and product analysis.

OR

8(b) How to Prepare a feasibility study report.

THERMODYNAMICS AND REACTION ENGINEERING

Course Title :	Thermodynamics and Reaction Engineering	Course Code	18CH-502C
Semester	V	Course Group	Core
Teaching Scheme in Hrs(L:T:P)	3:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Periods :	60Pds
CIE	60 Marks	SEE	40 Marks

Course Objectives:

1. State and apply fundamentals of thermodynamics, laws of thermodynamics
2. Evaluate PVT behavior of substances and their properties.
3. Discuss about Refrigeration
4. Study about reaction Engineering and industrial Reactors.

Course Outcomes

CO1	Summarize state and path functions, work, heat, internal energy and enthalpy. Importance of first law of thermodynamics. solve problems
CO2	Study of PVT behavior for pure fluids and solve related problems
CO3	Apply the concepts of thermodynamic temperature in evaluating Carnot's cycle, understand and apply the principles of second law, Importance of third law of thermodynamics.
CO4	Evaluate thermodynamic properties. study law of mass action for chemical equilibria
CO5	Study and understand the concept and methods of Refrigeration and liquefaction processes.
CO6	Study the basics of Reaction Engineering, and Industrial Reactors.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
1	Introduction and basic concepts.	8	Q4	Q1		Q9(a)	Q13(a)
2	Volumetric properties of pure fluids	12					
3	Second and third law of thermodynamics	15		Q2		Q10(a)	Q14(a)
4	Themodynamic properties of pure fluids & Chemical Equilibria	7					
5	Refrigeration and liquefaction	8		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Introduction to Chemical Reaction Engineering & Industrial reactors	10			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q13(b), Q16(a), Q16(b)
Total		60	8		8	8	

COURSE CONTENTS

UNIT-I: Introduction and Basic concepts

Duration: 8 Periods (L:6-T:2)

Scope and limitations of thermodynamics, system, surroundings, processes, heterogeneous and homogeneous systems, closed and open systems, , intensive and extensive properties, state and path functions, force, pressure and energy, equilibrium state and phase rule, reversible and irreversible process, zero th law of thermodynamics, heat reservoirs and heat engines. General statement of first law of thermodynamics, first law of cyclic process and non flow process, internal energy, heat capacity, enthalpy. Derivation for steady state flow process- simple problems.

UNIT-II: Volumetric properties of pure fluids

Duration: 12Periods (L:7-T:3)

P-V-T behavior of pure fluids, equations of state and ideal gas law, equation of state for real gases: Vander Waals equation, Redlich- Kwong equation of state , generalized compressibility factor- Processes involving ideal gas law: constant pressure, constant temperature, constant volume, and adiabatic processes , equation of state for real gases, different expressions for ΔU , ΔH , Q and W for the above processes connecting PVT properties- Problems on calculation of ΔU , ΔH , Q and W in the above processes.

UNIT-III: Second and third law of Thermodynamics

Duration: 15 Periods (L:10- T:5)hrs.

Limitations of first law of thermodynamics, qualitative differences between heat and work,

Statements of second law – Carnot principle- Clausius statement, thermodynamic temperature scale, Ideal gas as the Carnot engine working substance, process involving ideal gases, entropy and irreversibility, mathematical statement of the second law of thermodynamics. The third law of thermodynamics, Statement -Problems on entropy and adiabatic mixing.

UNIT IV: Thermodynamic properties of pure fluids & Chemical Equilibria

Duration: 7 Periods (L:5-T:2) Classification of thermodynamic properties, work functions, Gibbs free energy, Gibbs Helmholtz equation fundamental property relation, fugacity, fugacity coefficient-Maxwell's equations- Chemical Equilibrium –and its law. Free energy and its applications– The standard Gibbs energy change and the equilibrium constant – Effect of temperature on the equilibrium constant – Lechatlier's principle -Evaluation of equilibrium constants and standard Gibb's Free energy

UNIT-V : Refrigeration and liquefaction

Duration: 8 Periods (L:7-T:1)

The Carnot refrigerator – Vapor –Compression cycle – Comparison of refrigeration cycles – Refrigerants – Choice of refrigerant –Absorption refrigeration – Heat pump-Liquefaction- Linde liquefaction- Claude liquefaction Process

UNIT-VI : Introduction to Chemical Reaction Engineering & Industrial reactors :

Duration: 10 Periods (L:7-T:3)hrs.

Importance of Chemical kinetics – Classification of reactions –variables affecting the rate of reaction – Reaction rate- Concentration dependent term of a rate equation -Single and multiple reactions, elementary and non elementary reactions – Molecularity and order of a reaction- Rate constant K -representation of a reaction rate –Temperature dependent term of rate equation-

SPECIFIC LEARNING OUTCOMES

1.0 Introduction and First law of thermodynamics.

1.1 Understand the scope of thermodynamics.

1.2 Define internal energy, enthalpy and their units in SI system

1.3 Illustrate the statement for 1st law of thermodynamics.

1.4 Derive an expression of first law of thermodynamics for the following processes:

- a) Closed process
- b) Steady state flow process.

1.5 Differentiate between state and path functions.

1.6 Understand extensive and intensive properties.

1.7 Define heat capacity and specific heat

1.8 Show the relation of constant volume and constant pressure processes

2.0 Volumetric properties of pure fluids

2.1 Know the PVT behavior of pure substances.

2.2 Define ideal gas, know the characteristics of ideal gas.

2.3 Define compressibility factor.

2.4 Define a) Cubic Equation of state (b) Vanderwaal's equation (c) Redlich Kwong's Equation

2.5 Derive $C_p - C_v = R$ for a mole of an ideal gas.

2.6 State and explain about the following processes.

(a) Isochoric (b) Isobaric (c) Isothermal and (d) Adiabatic.

2.7 Derive different expression for ΔU , ΔH , Q and W for (a) Isochoric (b) Isobaric

(c) Isothermal and (d) Adiabatic processes connecting PVT properties.

2.8 Solve problems on calculation of ΔU , ΔH , Q and W in the above processes connecting PVT Properties.

3.0 The Second law and third law of thermodynamics.

3.1 Discuss the statements of second law of thermodynamics.

3.2 Distinguish between heat engine and heat pump.

3.3 Summarize the schematic representation of heat engine and heat pump.

3.4 Define cop in heat engine and heat pump.

3.5 Evaluate the thermodynamic temperature scales

3.6 Illustrate Carnot cycle principle

3.7 State and explain Carnot cycle principle.

3.8 Define entropy and its SI units.

3.9 List out the characteristics of entropy.

- 3.10 Derive the entropy changes of an ideal gas.
- 3.11 Study the mathematical statement of 2nd law of thermodynamics
- 3.12 Solve simple problems on adiabatic mixing.
- 3.13 State third law of thermodynamics.
- 3.14 Name Maxwell's Equations.

4.0 Thermodynamic Properties of Pure fluids & Chemical-Reaction Equilibria

- 4.1 Classification of thermodynamic properties,
- 4.2 Definitions of work functions, Gibbs free energy, Gibbs Helmholtz equation fundamental property relation, fugacity, fugacity coefficient.
- 4.3 List out Maxwell's equations
- 4.4 Study about chemical equilibrium.
- 4.5 Define free energy and know its applications.
- 4.6. Derive the relation between standard Gibbs free energy change (ΔG^0) and the equilibrium constant(K).
- 4.7 Derive an expression for the effect of temperature on equilibrium constant.
- 4.8 State Lechatlier's principle
- 4.9 Solve Simple problems on (a) $\Delta G^0 = -RT \ln K$ (b) $\ln (k_2/k_1) = -(\Delta H^0/R)(1/T_2 - 1/T_1)$

5.0 Refrigeration and Liquefaction.

- 5.1 Define refrigeration.
- 5.2 Explain the cycle of refrigeration.
- 5.3 Study the various methods of refrigeration.
- 5.4 Know about various applications of refrigeration.
- 5.5 Define refrigerant.
- 5.6 Name types of refrigerants (primary and secondary).
- 5.7 Demonstrate the principle of Carnot cycle refrigerator.
- 5.8 Study about choice of refrigerant.
- 5.9 Explain the method of obtaining vapor compression refrigeration.
- 5.10 Explain the method of obtaining vapor absorption refrigeration.
- 5.11 Solve simple problems on refrigeration capacity, COP on refrigeration

- 5.12 Discuss about liquefaction
- 5.13 State various methods of liquefaction
- 5.14 Explain Linde liquefaction process
- 5.15 Explain Claude liquefaction process

6.0 Introduction to Chemical Reaction Engineering, Kinetics of homogeneous Reactions, Interpretation of Batch reactor data & Industrial reactors

- 6.1 Introduction.
- 6.2 Importance of reaction kinetics in chemical industries.
- 6.3 Classify the types of reactions.
- 6.4 Define reaction rate and know its units.
- 6.5 Study the variables that affecting the rate of reaction.
- 6.6 Define single, multiple, elementary and non-elementary reactions.
- 6.7 Study about molecularity and order of reaction.
- 6.8 Define rate constant **k** and know representation of a rate equation.
- 6.9 Discuss about temperature – dependent term of a rate equation.
- 6.10 Determine the order of reaction by Integral method of analysis of data.
- 6.11 Determine the order of reaction by Integral method of analysis of data
- 6.12 Study the types of industrial Reactors

SUGGESTED LIST OF STUDENT ACTIVITIES

Note: The following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
2. Each student should conduct different activity and no repeating should occur.

1	Solve simple problems on force, pressure, internal energy, work done on system and surroundings.
2	Search through proper sources the applications of First and Second law of thermodynamics and submit a report.
	Solve simple problems on heat effects.

3	
4	Summarize with relevant examples the application of Carnot's principle.
5	Collect information from any source on various types of reactors used for particular processes and submit a summary.

References:

1. Chemical Engineering Thermodynamics by K. V.Narayanan
2. Chemical Engineering Thermodynamics by Smith & Vannes.
3. Chemical Reaction Engineering-I by K. A.Gavhane.
4. Chemical Engineer's Handbook By Robert HPerry.
5. Chemical Reaction Engineering second edition by OctaveLevenspiel

6. e-links:

<https://www.youtube.com/watch?v=-gSL6cc9HLg>
<https://www.youtube.com/watch?v=kJlmRT4E6R0>
<https://www.youtube.com/watch?v=lbPEaaKiCww>
<https://www.youtube.com/watch?v=iNPUCmkKiE4>
<https://www.youtube.com/watch?v=G3vISXYom1o>
<https://www.youtube.com/watch?v=y6pGifi8FZw>

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Summarize State and path functions, work, heat, internal energy and enthalpy. Importance of first law of thermodynamics. solve problems	R/U/A	1,2,3,9,10	8
CO2	Study of PVT behavior for pure fluids and solve related problems.	R/U/A	1,2,3,9,10	12
CO3	Apply the concepts of thermodynamic temperature in evaluating Carnot's cycle,	R/U/A	1,2,3,9,10	15

	understand and apply the principles of second law, Importance of third law of thermodynamics.			
CO4	Evaluate thermodynamic properties. Study the law of mass action for chemical equilibria.	R/U/A	1,2,3,9,10	7
CO5	Refrigeration and liquefaction	R/U/A	1,2,3,9,10	8
CO6	Study the basics of Reaction engineering and types of industrial reactors	R/U/A	1,2,3,9,10	10
				60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	

2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed $\frac{1}{4}$ of a page, 1 page and 2 pages respectively.

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

1

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE
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	R		U	A	
I	Q4	Q1		Q9(a)	Q9(a)
II					
III		Q2		Q10(a)	Q10(a)
IV					
V		Q3	Q9(b), Q11(a), Q11(b)	Q9(b), Q11(a), Q11(b)	
VI			Q10(b), Q12(a), Q12(b)	Q10(b), Q12(a), Q12(b)	
Total Questions	8		8	8	

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V Semester Mid Semester-I Examination

Corse Code: 18CH-502C

Duration:1 hour

Course Name: Thermodynamics and Reaction Engg

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

- 1) What is enthalphy? Write its units.
- 2) What is an extensive property? give examples.
- 3)** What is an isothermal process?
- 4) What is cubic equation of state?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Differentiate between state function and path functions

(or)

5(b) Write the importance of Thermodynamics in process industries.

6(a) Derive $C_p - C_v = R$ for a mole of an ideal gas.

(or)

6(b) What is an ideal gas? Give its characteristics.

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Derive an expression for first law of thermodynamics of steady state flow process.

(or)

7(b) A system consisting of some fluid is stirred in a tank. The work done on the system by the stirrer is of the

order of 2 H.P. Heat generated because of stirring is dissipated through surroundings. If the heat transfer

is 835 Kcal/hr. Determine the change in I.E.

8(a). Show that $P_1 V_1^\gamma = P_2 V_2^\gamma = P V^\gamma = \text{constant}$ for adiabatic process.

(or)

8(b). Derive the equations for PVT relationships. ΔU , ΔH , Q and W for one mole of an ideal gas undergoing

the following changes. a) Isobaric process b) Adiabatic process.

Model Question paper

DCHE V semester Mid Semester-II Examination

Corse Code: 18CH-502C

Duration:1 hour

Course Name: Thermodynamics and Reaction Engineering

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

- 1) Define entropy
- 2) What is a thermal reservoir?
- 3) Define Gibbs free energy.
- 4) What is law of mass action?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Discuss qualitative differences between heat and work

(or)

5(b) Write the statements of second law of thermodynamics.

6(a). What is Gibbs free energy and its applications.

(or)

6 (b). What factor favors the forward reaction in the following reaction at 300⁰K?



PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Calculate the entropy changes for the processes involving ideal gases.

(or)

7(b) A Reversible engine operating between heat source at normal boiling point of water and a heat sink at triple point of water absorbs 240 Kcal of heat. Compute, work obtained and heat rejected

8(a) Explain the effect of temperature on the equilibrium constant

(or)

8(b) Derive the relation between Gibb's free energy and equilibrium constant

**MODEL QUESTION PAPER
BOARD DIPLOMA SEMESTER END EXAMINATIONS (C-18)
D.C.H.E – V - SEMESTER EXAMINATION
18CH-502C Thermodynamics and Reaction Engineering**

TIME: TWO HOURS

MAXIMUM MARKS: 40

PART –A

MARKS: 8 X 1 = 8M

NOTE: Answer all questions.

1. What is triple point?
2. Define equilibrium.
3. Define rate of reaction

4. What is refrigerant?
5. Write different methods of refrigeration?
6. What is liquefaction process?
7. Define rate of reaction.
8. Write the units of K for 2nd order reactions.

PART –B

MARKS:4 X3 =

12

Answer FOUR questions. Each question carries three marks.

9(a). Compute the work done when 10kg of water evaporated at atmosphere pressure until a volume of

1.25m³ is occupied.

(or)

9(b) Write about the choice of refrigerant

10(a). Write the relation between equilibrium constant and composition.

(or)

10(b). Write the difference between elementary and non-elementary reactions with examples.

11(a) .Write the classification of refrigerant with examples

(or)

11(b). Write applications of liquefaction process

12(a).What is the importance of chemical kinetics in chemical industries?

(or)

12(b).What is the difference between order and molecularity of a reaction?

PART –C

MARKS:4 X5 = 20

Answer FOUR questions. Each question carries five marks.

13(a). Write the different expression for ΔU and ΔH and W for isobaric, isochoric, Isothermal and adiabatic processes connecting PVT properties

(or)

13 (b). Explain the method of obtaining vapor compression refrigeration cycle

14 (a) A steel casting weighing 30kg and a temp of 500°C is quenched in 150 kg of oil at 30°C .if there are no heat losses, what is the change in entropy of i) the casting, ii) the oil iii) both considered together.

Cp of steel casting = $0.52 \text{ kJ/kg}^{\circ}\text{K}$ Cp of oil = $2.4 \text{ kJ/kg}^{\circ}\text{K}$

(or)

14 (b) Describe the method of evaluating order by differential analysis

15(a) Explain Linde liquefaction process with a neat sketch

(or)

15(b) Explain vapor absorption refrigeration cycle with a neat sketch.

16(a) Describe the construction and operation of Plug flow reactor.

(or)

16(b) Describe the construction and operation of fluidized bed reactor

MASS TRANSFER OPERATIONS

Course Title: MASS TRANSFER OPERATIONS	Course Code : 18CH-503C
Semester : V	Core / Elective : Core
Teaching Scheme in Periods (L:T:P) : 45:15:0	Credits : 3Credits
Type of course : Lectures, Self Study & Activities	Total Contact Periods : 60
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Knowledge of basic mathematics science, physical ,organic and inorganic chemistry, fundamentals of unit operations and processes, fluid mechanics.

CourseOutcomes

On successful completion of the course, the students will be able to attain below Course Outcomes(CO):

Course outcomes	
CO1	Explain the principles of diffusion mass transfer & illustrate various mass transfer operations
CO2	Discuss Inter phase mass transfer, two resistance theory. Illustrate the concept of ideal stages, Multistage, batch and continuous contact mass transfer operations. Illustrate the principles of humidification operations. Explanation the use of humidity chart .
CO3	Summarize binary and multi component systems, state and apply Raoult's law, prediction of vapour liquid equilibrium, Demonstrate types of distillation. Illustrate McCabe Thiele method for finding out number of theoretical stages
CO4	Summarize the principles of absorption operation, illustrate the construction and operation of packed towers. Identify the industrial applications of adsorption & adsorbents, study characteristics of adsorbents.
CO5	Explain the principles and identify the fields of application of liquid extraction, choose a suitable solvent for the given duty, appreciate the use of triangular charts and classify & illustrate the operation of various extraction equipments. Summarize the principles, identify the industrial applications of leaching & sketch & demonstrate the working of various leaching equipments. .
CO6	Illustrate drying characteristics, explain the mechanism of drying , illustrate with sketches the construction and operations of various dryers, Analyse rate of drying curve. Illustrate the principles and mechanism of crystallization, classify the crystallizers, Construct neat sketches of various crystallizers and summarize their operational details.

Course Content and Blue Print of Marks for SEE

No							
			R		U	A	
1	Introduction of mass transfer and Diffusion	8	Q4	Q1	Q9(a)	Q13(a)	
2	Interphase mass transfer and Humidification	9					
3	Distillation	14		Q2	Q10(a)	Q14(a)	
4	Absorption and Adsorption	9					
5	Extraction and Leaching	10		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Drying & Crystallization	12			Q7,Q8	Q10(b), Q12(a), Q12(b)	Q13(b), Q16(a), Q16(b)
Total		60	8		8	8	

COURSE CONTENT:

UNIT – I :- INTRODUCTION OF MASS TRANSFER AND DIFFUSION

Duration: 08 Periods (L:6– T:2)

Mass transfer operations – unit process – unit operation – classification of mass transfer operations – terms and symbols involved – distinguish various mass transfer operations – Diffusion - understand equilibrium between phases -Principles of diffusion – molecular diffusion – Fick’s first law – eddy diffusion – Distinguish between molecular and eddy diffusions – operations that depend on diffusion – various fluxes – diffusion in gases – Equimolal diffusion – diffusion of “A” through non – diffusing “B” – problems.

UNIT- II: INTERPHASE MASS TRANSFER & HUMIDIFICATION

Duration: 08 Periods (L:6 –T:2)

Interphase mass transfer – various mass transfer coefficients – relation between individual

and overall mass transfer coefficients – two resistance theory – Phase rule —

Humidification – various terms involved – adiabatic saturation temperature – wet bulb

temperature – dry bulb temperature – humidity – psychrometric chart –humidification

equipment – cooling tower.

UNIT- III: DISTILLATION

Duration: 14 Periods (L:9 – T:5)

Vapor liquid equilibrium at constant pressure and temperature - Raoult's law – Application of phase rule to distillation – Henry's law – ideal solution – relative volatility – its significance – equilibrium and boiling point diagrams – equilibrium distillation – Batch distillation – continuous distillation – Rayleigh's equation – Steam distillation – Continuous distillation with rectification and stripping – feed conditions reflux ratio – minimum reflux and optimum reflux ratio – Mc Cabe and Thiele assumptions – Mc. Cabe & Thiele method – Graphical procedure to determine the number of theoretical trays-location of feed plate-q-line and operating line stage efficiency – overall efficiency — bubble cap and sieve tray columns – flooding-channeling

UNIT- IV : ABSORPTION AND ADSORPTION Duration:10 Periods (L:7 – T:3)

Gas absorption principles – Equilibrium solubility of gases – Ideal and non ideal liquid solution – Henry's law choice of solvent for absorption –Gas and liquid velocities – limitations – Tray towers and packed towers for absorption – Packed towers construction and operation – Regular and random packing – Characteristics of packing – Packing supports — Entrainment separator – Flooding & Loading of packed towers.

Definition – Principles - Physical adsorption – Chemisorption - Examples – Nature of adsorbents – Adsorption equilibrium – industrial adsorbers - uses – types

UNIT – V: EXTRACTION AND LEACHING Duration: 10Periods (L:8– T:2)

Liquid–liquid extraction –Liquid equilibrium – Triangular charts and their use — Choice of solvent for extraction equipments . Co-current, Cross–current and Counter- current extraction (principles only) description of liquid–liquid extraction equipments. Principles of leaching – Equipments for leaching – Tray thickener - Ballman extractor – Rotocel extractor.

UNIT-VI : DRYING & CRYSTALLIZATION Duration: 12 Periods (L:8 – T:4)

Principles–Equilibrium–Definition of terms–Wet basis moisture content–Dry basis moisture content–Equilibrium moisture–Bound moisture–Unbound moisture and free moisture–Batch drying – Drying characteristics - Constant rate drying – Falling rate drying - Time of drying – Drying equipments–Batch driers–Tray drier–Rotary drier–Drum drier– Spray drier–Fluidized bed and vacuum drier- Principles of Crystallization – Mechanism of crystallization – Crystal growth – methods for super saturation – caking of crystals – prevention of caking – critical humidity – classification of crystallizers – Crystallization equipment - Tank crystallizer- Agitated batch crystallizer – Swenson – Walker crystallizer – Vacuum crystallizer – Krystal crystallizer-Evaporative crystallizer - Description and operation of the above equipments- Problems.

SPECIFIC LEARNING OUTCOMES

Know about mass transfer operations and diffusion

- 1.1 Define the mass transfer operation
- 1.2 Illustrate about the unit process, unit operation with examples.
- 1.3 Classify the mass transfer operations
- 1.4 Distinguish various mass transfer operations.
- 1.5 Understand the process of diffusion
- 1.6 Define Fick's first Law of diffusion
- 1.7 Explain the process of molecular diffusion with example
- 1.8 Explain eddy diffusion.
- 1.9 Distinguish molecular diffusion and eddy diffusion
- 1.10 Identify the unit operations that depend on diffusion.
- 1.11 List out various fluxes and their units with examples.

1.12 Diffusion in gases for the cases (i) equimolar counter diffusion and (ii) diffusion of A through non diffusion B.

1.13 Solve Simple problems on molecular gas phase diffusion for the above two cases.

2.0 Understand Interphase mass transfer and humidification

2.1 Understand Interphase mass transfer

2.2 Define mass transfer coefficient

2.3 summarize the two resistance theory.

2.4 Write the relations between individual and overall mass transfer coefficient

2.5 Define phase rule

2.6 Definitions of stage, cascade.

2.7 Study the concept of ideal stages, multistage, batch and continuous contact operations.

2.8 Define various terms involved in humidification operations

2.9 Discuss adiabatic saturation temperature.

2.10 Explain the wet bulb and dry bulb temperatures

2.11 Determine the humidity of a gas system

2.12 Understand the reading of psychometric chart.

2.13 Describe the humidification equipment – cooling towers.

2.14 Discuss about air conditioning.

3.0 Understand Distillation

3.1 Define distillation

3.2 Apply phase rule to distillation.

3.3 Define Raoult's law, Henry's law and ideal solution.

3.4 Define relative volatility and its significance.

- 3.5 Analyse equilibrium and boiling point diagrams.
- 3.6 Define and explain equilibrium distillation.
- 3.7 Distinguish between batch distillation and continuous distillation.
- 3.8 State Rayleigh's equation.
- 3.9 Understand steam distillation.
- 3.10 Explain the process of continuous distillation with rectification and stripping.
- 3.11 Discuss Bubble cap and sieve tray columns.
- 3.12 Analyze the effect of feed conditions and feed plate location.
- 3.13 Define reflux ratio
- 3.14 State Mc.Cabe Thiele assumptions.
- 3.15 Determine the no. of stages for a binary mixture using Mc.Cabe – Thiele method.
- 3.16 Solve problems in distillation and calculation of no. of ideal stages using Mc.Cabe Thiele method.
- 3.17 Define and explain stage efficiency, overall plate efficiency and factors influencing them.
- 3.18 Explain the azeotropic distillation and its applications.

4.0 Understand Absorption and Adsorption:

- 4.1 Explain absorption and stripping operation with examples.
- 4.2 Describe absorption towers and tower packings.
- 4.3 Apply material balances for absorption tower.
- 4.4 Understand minimum liquid to gas flow rate ratio.
- 4.5 Understand the concept of number of transfer units and HTU
- 4.6 Discuss about channeling, loading and flooding velocity

- 4.7 Demonstrate about packed towers
- 4.8 Distinguish between plate tower and packed tower.
- 4.9 Define adsorption with examples
- 4.10 Write about types of adsorption
- 4.11 Illustrate about the nature of adsorbents and various adsorbents with examples.

5.0 Understand Extraction and Leaching

- 5.1 Define extraction and leaching operations with examples.
- 5.2 Equilibrium relation (Binodal curve) for complete immiscible system.
- 5.3 Distinguish the processes of extraction and leaching.
- 5.4 Notation used in equilibrium diagram of extraction operation.
- 5.5 Select the choice of solvent for extraction operation
- 5.6 Describe single stage and multistage equipment used for extraction
- 5.7 Explain mixer – settler with a neat sketch.
- 5.8 Infer the notation used in leaching operation
- 5.9 Explain the working principle of an agitated vessel with a neat sketch

6.0 Understand Drying and Crystallization

- 6.1 Demonstrate about drying operation with examples.
- 6.2 Study the equilibrium relationship in drying operation
- 6.3 Define various terms involved in drying operation.
- 6.4 Explain batch-drying process under constant drying condition
- 6.5 Explain the rate of drying curves and the factors influencing

- 6.6 Calculate rate of drying and time of drying for batch drying process
- 6.7 Classification of driers.
- 6.8 Demonstrate the working of various types of driers
- 6.9 Define crystallization.
- 6.10 Summarize the principles of crystallization.
- 6.11 Define Crystal geometry, nucleation and crystal growth
- 6.12 Describe the classification of crystallizers.
- 6.13 Explain the working principles of tank crystallizers, agitated tank crystallizers
- 6.14 Explain the working principles of Swensen-Walker crystallizer, Vacuum crystallizer
- 6.15 Explain caking of crystals
- 6.16 Problems on calculation of time drying

Suggested Student Activities:

- 1. Prepare a report on diffusion mass transfer.
- 2. Write a report about humidifying and dehumidifying equipments.
- 3. Write a report on vapour liquid equilibrium at constant temperature & pressure.
- 4. Prepare a study report on construction and working of various distillation towers.
- 5. Prepare a report on types of absorption columns.
- 6. Write a report about extraction equipments.
- 7. Write a report on leaching applications and search for suitable possible solvents for each application.
- 8. Prepare a study report on construction and working of various adsorption equipments.

REFERENCE TEXT BOOKS:

- 1 Unit operations of chemical Engg by W.L.McCabe J.C.Smith McGraw Hillbookco.

- 2 Introduction to chemical Engg by W.L.Badger & J.T.Banchero.
- 3 Mass transfer operation by R.E.Treybal.
- 4 Mass transfer-I&II by K.A.Gavhane.

E Learning -links:

2. <https://www.youtube.com/watch?v=xxNfJLMNS4E>
3. <https://www.youtube.com/watch?v=e9Wfz8l2T4E>
4. https://www.youtube.com/watch?v=ex_hScKbYhM
5. <https://www.youtube.com/watch?v=jWiuGRnFVcM>
6. <https://www.youtube.com/watch?v=ObEm84ZacIY>
7. <https://www.youtube.com/watch?v=RSiNRwiR1iU>
8. <https://www.youtube.com/watch?v=OWd4HeV9RUw>
9. https://www.youtube.com/watch?v=vscX_zawdOw

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Explain the principles of diffusion mass transfer & illustrate various mass transfer operations	R/U/A	1,2,3,4,9,10	8
CO2	Discuss Inter phase mass transfer, two resistance theory, Illustrate the concept of ideal stages, Multistage, batch and continuous contact mass transfer operations. Illustrate the principles of humidification operations. Explanation about construction of cooling towers and use of humidity chart .	R/U/A	1,2,3,4,9,10	8
CO3	Summarize binary and multi component systems, state and apply Raoult's law, prediction of vapour liquid equilibrium, Demonstrate types of distillation. Illustrate McCabe Thiele method for finding out number of theoretical stages	R/U/A	1,2,3,4,9,10	14

CO4	Summarize the principles of absorption operation, illustrate the construction and operation of packed towers. Identify the industrial applications of adsorption & adsorbents, study characteristics of adsorbents.	R/U/A	1,2,3,4,9,10	8
CO5	Explain the principles and identify the fields of application of liquid extraction, appreciate the use of triangular charts and classify & illustrate the operation of various extraction equipments. Summarize the principles, identify the industrial applications of leaching & sketch & demonstrate the working of various leaching equipments. .	R/U/A	1,2,3,4,9,10	10
CO6	Illustrate drying characteristics, explain the mechanism of drying , illustrate with sketches the construction and operations of various dryers, Analyse rate of drying curve. Illustrate the principles and mechanism of crystallization, classify the crystallizers, Construct neat sketches of various crystallizers and summarize their operational details.	R/U/A	1,2,3,4,9,10	12
				60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
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1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	
MID SEM –II EXAM					
S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE			Remarks
		R	U	A	

1	I	4	1		9(a)	13(a)	
2	II		2		10(a)	14(a)	
3	III		3	5, 6	9(b)	13(b)	
4	IV				11(a)	15(a)	
5	V			11(b)	15(b)		
6	VI			7,8	10(b)	14(b)	

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V Semester Mid Semester-I Examination

Corse Code: 18CH-503C

Duration: 1Hour

Course Name: MASS TRANSFER OPERATIONS

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

- 5) What is mass transfer?
- 6) List out various mass transfer operations.
- 7) What is mass transfer coefficient?
- 8) Define the term Humidity.

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Define Fick's First Law of diffusion and explain the terms in it.

(or)

5(b) Distinguish molecular diffusion and eddy diffusion

6(a) What are co-current, counter-current and cross-current operations?

(or)

6(b) Write the uses of psychometric chart.

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Ammonia gas (A) diffuses through a non-diffusing nitrogen gas (B) under steady state conditions. The partial pressure of A at location 1 is 1.5×10^4 Pa and that at location 2 is 5×10^3 Pa. The locations 1 and 2 are 0.15 m apart. The total pressure is 1.103×10^5 Pa and temperature is 298°K . Calculate the flux of diffusion of ammonia. The diffusivity of ammonia at the prevailing condition is $2.3 \times 10^{-5} \text{ m}^2/\text{s}$.

(or)

7(b) Methane diffuses at steady state through a tube containing Helium. At point 1 the partial pressure of methane is 55 kPa and at point 2 it is 15 kPa. The points 1 and 2 are 30 mm apart. The total pressure is 101.3 kPa and temperature is 298K. Calculate the flux of CH_4 at steady state for equimolar counter diffusion. The diffusivity of methane at the prevailing conditions is $6.75 \times 10^{-5} \text{ m}^2/\text{s}$.

8(a). Explain in brief two resistance theory of mass transfer
(or)

8(b). Explain the principle of humidification and discuss the working of cooling tower.

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V Semester Mid Semester-II Examination

Corse Code:18CH-503C

Duration:1Hour

Course Name: MASS TRANSFER OPERATIONS

Max.Marks:20

PART-A

Answer **all** questions, Each Question carries one mark

4x1 = 4 Marks

- 1) Write Rayleigh's equation.

- 2) Define relative volatility?
- 3) What is absorption?
- 4) What are the commonly used adsorbents?

PART-B

Answer **two** questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Draw a neat sketch of fractionating column.

(or)

5(b) When is steam distillation recommended?

6(a) List the desirable characteristics of packing.

(or)

6(b) What do you mean by channeling? How can it be minimized?

PART-C

Answer **two** questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Explain the process of continuous distillation with a neat sketch

(or)

7(b) A mixture of Benzene and toluene containing 60 mole% benzene is to be separated to give a product of 98 mole% benzene and bottom product containing 10 mole% benzene. The feed enters column at its bubble point. It is proposed to operate the column at a reflux ratio of 2.5. Find the number of theoretical plates and position of the feed plate.

The VLE data is

X	0	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Y	0	0.13	0.21	0.375	0.5	0.6	0.7	0.77	0.83	0.9	0.95	1.0

8(a). Explain the construction and operation of packed column with the help of a neat sketch.

Give its applications.

(or)

8(b). What is an Adsorbent ? Write various types of adsorbents with examples with their characteristics.

MODEL QUESTION PAPER
BOARD DIPLOMA SEMESTER END EXAMINATIONS (C-18)
D.C.H.E – V - SEMESTER EXAMINATION
18CH-503C – MASS TRANSFER OPERATIONS

TIME: Two HOURS

MAXIMUM MARKS: 40

PART –A

MARKS: 8 X 1 = 8M

NOTE: Answer all questions.

1. Write the classifications of mass transfer operations
2. Define Stage efficiency.
3. Draw a neat sketch of tray dryer.
4. Define leaching
5. What is extraction? Give examples.
6. What are the notations used in leaching operation
7. Define the term Bound moisture
8. Define the crystallization.

PART –B

MARKS:4 X3 = 12

Answer FOUR questions. Each question carries three marks.

- 9 (a). Define molecule diffusion and write its applications

(or)

- 9(b) . Write the applications of leaching.

- 10 (a). Draw the feed lines for the following feed conditions on a graph of mole fraction of more volatile component in liquid and in vapors.

- (a) Cold feed
- (b) Saturated liquid
- (c) Saturated vapor.

(or)

- 10 (b). Name the various methods of generating super- saturation.

- 11(a). What are the choices required for the selection of solvent in extraction operation

(or)

- 11 (b). Explain briefly about binodal curve.

12 (a) Explain in brief the rate of drying curve.

(or)

12 (b) Draw the neat diagram of Krystal crystallizer indicating various parts.

PART –C

MARKS:4 X5 = 20

Answer FOUR questions. Each question carries five marks.

13 (a). Methane diffuses at steady state through the tube containing helium. At point 1, the partial pressure of methane is 55 kPa and at point 2, it is 15 kPa. The points 1 and 2 are 30mm apart. The total pressure is 101.3 kPa and temperature is 298 K (25⁰ C). Calculate the flux of CH₄ at steady state for equimolar counter diffusion .
Take the value diffusivity as $6.075 \times 10^{-5} \text{ m}^2/\text{s}$.

(or)

13 (b). Write the construction and working of a batch operated mixer – settler with a neat sketch.

14 (a) A Continuous fractionating column is to be designed to separate 1400 gm moles/hr of a mixture of 45% A and 65% of B. The overhead product contains 95% of A and bottom product contains 6% of A. These percentages are mole percentages. The feed is 30% liquid and 70% vapor and the vapor leaving the column is condensed completely. Calculate the Moles of overhead and bottom product.

(or)

14 (b) A wet solid is to be dried from 67% to 25% moisture under constant drying conditions in 3 hours. If the equilibrium moisture content is 1% and the critical moisture content is 40%, how long it will take to dry solids to 4% moisture under the same conditions.

15(a) Explain in brief about Agitated Vessel.

(or)

15 (b) Write the differences between extraction and leaching with examples.

16(a) Explain briefly about Tray drier with a neat sketch.

(or)

16(b). Explain the working principle of Swenson – walker crystallizer with a sketch

INSTRUMENTATION AND PROCESS CONTROL

Pre requisites			
Course Title :	INSTRUMENTATION AND PROCESS CONTROL	Course Code	18CH-504E(A)
Semester	V	Course Group	Elective
Teaching Scheme in Hrs(L:T:P)	3:1:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	45/60Pds
CIE	60 Marks	SEE	40 Marks

Knowledge of fundamentals of science, heat transfer, mass transfer, momentum transfer and thermodynamics.

On completion of the course, the student will be able to :

Course Outcomes

CO1	Interpret the qualities required for measurement and illustrate the operation of temperature measurement in chemical Process industries.
CO2	Illustrate the pressure and vacuum measuring instruments and operate them in the chemical process industries
CO3	Explain and Illustrate the operation of various liquid level measuring instruments, viscosity and vacuum measuring equipment applicable in various Industrial operations
CO4	Explain and Illustrate the different types of instruments used for measuring composition of various solids, liquids and gases.
CO5	Summarize the principle and working of different types of instruments and Illustrate the instrumentation diagrams and explain
CO6	Illustrate the principles of automatic process control, and different modes of control systems. Explain the principle, construction and working of the pneumatic, hydraulic systems instruments.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Period s	Questions to be set for SEE				
			R		U	A	
1	Qualities of measurement and Measurement of Temperature	15	Q4	Q1	Q9(a)	Q13(a)	
2	Measurement of pressure and Vacuum	06					
3	Measurement of Liquid level, Density and Viscosity:	8		Q2	Q10(a)	Q14(a)	
4	Measurement of composition	10					
5	Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations	10		Q 3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Principles of automatic process control and modes available for process control.	11					
Total		60	8		8	8	

Course Content

Unit-1: Qualities of measurement and Measurement of Temperature.

Duration: 15 Periods (L:12,T:3)

Meaning of measurement - Different elements of an instrument – Static and Dynamic characteristics of an instrument - First order system and Second order system with physical examples —Principle, working of expansion thermometers like Mercury in glass thermometer, Bi-metallic thermometer and Pressure spring thermometer - Vapor actuated thermometer- Thermo-electricity and thermo-electric circuit or Thermocouple - Accessories of an industrial thermocouple - Milli-voltmeter and its application - Null Potentiometer circuit and its application - Resistance thermometer elements - Wheat stone bridge circuit and Modified wheat stone bridge circuit -Radiation temperature measurement - Radiation receiving elements - construction and working - Optical pyrometer and Radiation pyrometer.

Unit-2: Measurement of pressure and Vacuum:

Duration: 06 Periods (L:5,T:1)

Basic concepts of pressure measurement - manometers - pressure spring gauge, Bellow pressure element, Diaphragm element, Differential pressure indicating manometer, Bell differential pressure gauge-- Mechanical indicating elements, Principle, working and construction of Pressure tight shaft and torque tube

shaft--Principle construction and working of different types of vacuum gauges like Mc-leod vacuum gauge, Pirani vacuum gauge, Thermocouple vacuum gauge.

Unit-3: Measurement of Liquid level, Density and Viscosity: Duration: 08 Periods (L:6,T:2)

Basic concepts for measuring density--Principle construction and working of displacement meter for measuring density by republic flow-meter -Principle construction and working of hydrometer for density measurement--Principle construction and working of liquid level method of measuring density--Direct methods of liquid level measurement, Float and tape liquid level system, Hydraulic remote transmission of liquid level system-Principle construction and working of bubbler system for measurement of liquid level-Level measurement in pressure vessels, Principle construction and working of differential pressure manometer for measuring liquid level in pressure vessels- Principle construction and working of displacement float liquid level system-Principle construction and working of pneumatic balance displacement float liquid level system--Basic concepts of viscosity measurement- Principle construction and working of viscosity measurement by Viscosity meter-Brabender Corporation-Principle construction and working of viscosity measurement by Continuous Viscosity meter.

Unit-4: Measurement of Composition: **Duration: 10 Periods (L:8,T:2)**

Gas analysis by thermal conductivity method--Determination of moisture content in gases by Psychrometer--Determination of moisture in Paper and Lumber--Determination of pH of a solution by pH cell (Measuring cell & Calomel cell) method--Spectroscopic analysis methods, Absorption spectroscopy, Emission spectroscopy, Mass spectroscopy

Unit-5: Process Instrumentation & Instrumentation diagrams for Chemical Engineering processes and operations: **Duration: 10 Periods (L:8,T:2)**

Recording instruments used for process instrumentation, Circular recording chart and concentric indicating scale, Strip recording chart and linear indicating scale, Indicating and signaling instruments, Eccentric scale indicator, Concentric indicating scale--Control center--Instrumentation diagrams--Instrumentation diagram for heat exchangers, distillation column, evaporator, reactor and extractor.

Unit-6: Principles of automatic process control and modes available for process control.

Duration: 11 Periods (L:8,T:3)

Simple automatic process control system--Components of a control system, measuring element, Controller, Final control element, Types of control systems, Feedback control system or closed loop control system - Feed forward control system (Open loop control system)--Basic nomenclature associated with a control system, load, controlled variable, set point, error, measured variable, manipulated variable, offset -- Control actions, Proportional control action, Integral control action, Derivative control action, Proportional-Integral control action, Proportional-Derivative control action, ON-OFF Control action, Proportional-Integral-Derivative control action--Expressions for the transfer function for the Proportional control, Proportional-Derivative, Proportional-Integral, Proportional-Integral-Derivative control actions-- Know about the components of a hydraulic system--Construction, working of a hydraulic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-

Derivative control action--Components of a pneumatic system, Construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action--Control valve, its components, working and characteristics.

SPECIFIC LEARNING OUTCOMES

1.0 Qualities of measurement and Measurement of Temperature.

- 1.1 What is the meaning of measurement?.
- 1.2 What is the difference between direct and in-direct measurement?.
- 1.3 Name the different elements of an instrument.
- 1.4 List and explain the Static characteristics and Dynamic characteristics of an instrument.
- 1.5 Distinguish a First order system and Second order system with physical examples.
- 1.6 What are the parameters that characterize a first order system and a second order system.
- 1.7 Explain the Principle, construction and working of expansion thermometers.
- 1.8 Discuss about Vapor actuated thermometer.
- 1.9 Name the different types of industrial thermocouples.
- 1.10 Discuss about the accessories of an industrial thermocouple.
- 1.11 Discuss the mechanical properties of thermal well materials.
- 1.12 Illustrate the effect of location of reference junction and lead wires for a thermocouple.
- 1.13 Explain the principle, construction, working of Milli-voltmeter and its application.
- 1.14 Explain the principle, construction, working of Null Potentiometer circuit .
- 1.15 Name and explain resistance thermometer elements.
- 1.16 Explain the requirement of thermal wells and lead wires for resistance thermometers.
- 1.17 Illustrate and explain the indicating elements of industrial resistance thermometers like Wheat stone bridge circuit and Modified wheat stone bridge circuit also known as “Callender Griffith circuit”.
- 1.18 What is radiation temperature measurement.
- 1.19 Explain about radiation receiving elements.
- 1.20 Name the types of radiation pyrometers.
- 1.21 Illustrate an Optical pyrometer and explain its principle, construction and working.

2.0 : Measurement of Pressure and Vacuum:

- 2.1 What are the basic concepts of pressure measurement.
- 2.2 Name the different types of pressures.
- 2.3 Name the different types of liquid column manometer and explain their principle construction and working.
- 2.4 Name and explain the different types of pressure measuring elements.
- 2.5 Name and explain the mechanical indicating elements.
- 2.6 Name and explain about different types of vacuum gauges.

3.0: Measurement of Liquid level, Density and Viscosity.

- 3.1 What are the basic concepts for measuring density.

- 3.2 Illustrate and explain the principle construction and working of displacement-meter for measuring density by republic flow-meter Company.
- 3.3 Illustrate and explain the principle construction and working of hydrometer for density measurement.
- 3.4 Illustrate and explain the principle construction and working of liquid level method of measuring density.
- 3.5 What are the direct methods of liquid level measurement.
- 3.6 Illustrate and explain the principle construction and working of bubbler system for measurement of liquid level.
- 3.7 How is the level measurement done in pressure vessels.
- 3.8 Illustrate and explain the principle construction and working of displacement float liquid level system.
- 3.9 Illustrate and explain the principle construction and working of pneumatic balance displacement float liquid level system.
- 3.10 What is the basic concept of viscosity measurement.
- 3.11 Illustrate and explain the principle construction and working of viscosity measurement by Viscosity meter-Brabender Corporation.
- 3.12 Illustrate and explain the principle construction and working of viscosity measurement by Continuous Viscosity meter.

4.0 : Measurement of composition.

- 4.1 Illustrate and explain gas analysis by thermal conductivity method.
- 4.2 Illustrate and explain the determination of moisture content in gases by Psychrometer.
- 4.3 Illustrate and explain the determination of moisture in Paper and Lumber.
- 4.4 Illustrate and explain the determination of PH of a solution by PH cell (Measuring cell & Calomel cell) method.
- 4.5 What are the different Spectroscopic methods of analysis

5.0: Process Instrumentation & Instrumentation diagrams for Chemical Engineering

processes and operations:

- 5.1 Name and explain about recording instruments used for process instrumentation.
- 5.2 Name and explain about indicating and signaling instruments.
- 5.3 What is a control center/
- 5.4 Developmental theory of instrumentation diagrams.
- 5.5 Develop the instrumentation diagram for a distillation column.
- 5.6 Develop the instrumentation diagram for an evaporator.
- 5.7 Develop the instrumentation diagram for a reactor.
- 5.8 Develop the instrumentation diagram for extractor

6.0: Principles of automatic process control and modes available for process control.

- 6.1 What is a simple automatic process control.
- 6.2 Name the components of a control system.
- 6.3 Name the different types of control systems.
- 6.4 Name the different control actions.
- 6.5 What are the components of a hydraulic system?

- 6.6 Explain and illustrate the construction, working of a hydraulic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.
- 6.7 List the components of a pneumatic system.
- 6.8 Explain and illustrate the construction, working of a Pneumatic system incorporated with Proportional, Proportional-Integral, Proportional-Derivative and Proportional-Integral-Derivative control action.

Suggested Student Activities

- 1 A student will be asked to recall and to summarise the different types of instruments used for measuring different process variables.(Summary includes instruments used in industries other than that mentioned in the syllabus.).
2. A student will be given a task to list out any five pressure measuring devices available in market with specifications and current market price.
3. Visit a nearby industry and develop an instrumentation diagram of a distillation column, evaporator, reactor with specifications required for chemical engineering processes.
4. Prepare a list of different types of latest equipment which has replaced the old equipment (such as a digital thermometer which replaced the mercury in glass thermometer) being used in the industries.
5. Write a summary of recent applications of various Spectrometers, Chromatographic instruments in various fields
6. Prepare models / charts for any instrument.
7. Group discussion/Quiz
8. Surprise tests.

REFERENCE BOOKS:

1. Industrial Instrumentation by Donald P. Eckmann
2. Industrial Instrumentation & Control by S K Singh.
3. Process systems analysis & Control by Donald R. Coughanowr.
4. Chemical Process Control by George Stephanopoulos.
5. Process Control by Peter Harriot.
6. Instrumentation & Process Measurements by W Bolton.

e-Learning links:

1. <http://nptel.ac.in>
2. www.flowmaster.com
3. www.vlab.co.in

e-links :

1. <https://www.youtube.com/watch?v=HHFdJ6dyeDA>
2. <http://www.explainthatstuff.com/how-pyrometers-work.html>
3. <https://www.youtube.com/watch?v=o0GZA-vU3MY>
4. <https://www.youtube.com/watch?v=-9IfpNAESIM>

5. <https://www.youtube.com/watch?v=DCzu4e9Q80k>
6. <https://www.youtube.com/watch?v=xWWg8J60r3A>

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
Total Marks						20 Marks

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed $\frac{1}{4}$ of a page, 1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
Total Marks						40 Marks

Unit No	Questions to be set for SEE				
	R		U		A
I	Q4	Q1		Q9(a)	Q13(a)
II					
III		Q2		Q10(a)	Q14(a)
IV					
V		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q13(b), Q15(a), Q15(b)
VI					
Total Questions	8		8	8	

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V-Semester Mid Semester-I Examination

Course Code: 18CH-504E(A)

Duration: 1 hour

Course Name: Instrumentation and Process Control

Max.Marks : 20

PART-A

Answer all questions, Each Question carries one mark

4x1 = 4 Marks

1. What is First Order and Second Order Instrument?
2. Name the different elements of the Instruments.
3. Name the indicating elements.
4. What are the different types of vacuum gauges?

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a) List the Static and dynamic characteristics of an Instrument. Explain fidelity.

(or)

5(b). With the neat diagram describe the Bimetallic thermometer.

(or)

6(a) Name the pressure measuring elements and with a diagram explain any one element.

(or)

6(b) Explain any one type of Vacuum gauge.

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) With a neat diagram explain the principle, construction and working of a mercury in glass thermometer.

(or)

7(b) Explain with a neat sketch the principle, construction and working of Optical pyrometer.

8 (a) Explain the construction and working of Mcleod gauge with a neat diagram

(or)

8(b). Name the different types of liquid column manometer and explain their principle construction and working of any one manometer.

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE V-Semester Mid Semester-II Examination

Course Code: 18CH-504E(A)

Duration: 1 hour

Course Name: Instrumentation and Process Control

Max.Marks : 20

PART-A

Answer all questions, Each Question carries one mark

4x1 = 4 Marks

1. List the different methods for measuring densities.
2. List the different direct methods of liquid level measuring instruments.
3. Name the different spectroscopic analysis methods.
4. What is absorption spectroscopy?

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Construct a neat diagram of a float and tape liquid level system and explain.

(or)

5(b) Explain the principle of working of hydrometer

6(a) What are the applications of composition analysis in the manufacturing industries

(or)

6(b) Explain briefly the principle of XRD analysis.

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Explain with a neat sketch the principle construction and working of viscosity measurement by Viscosity meter- Brabender Corporation.

(or)

7(b). Explain the principle construction and working of bubbler system for measurement of liquid level.

8(a) Determine moisture in paper and write the construction and working with a neat sketch

(or)

8(b).Determine the moisture in gases by Psychrometer with a neat sketch.

State Board of Technical Education and Training, Telangana
Model Question paper
DCHE V-Semester Semester End Examination

Course Code: 18CH-504E(A)

Duration: 2 hours

Course Name: Instrumentation and Process Control

Max.Marks : 40

PART-A

Answer all questions

8x1 =8 Marks

1. Name the different elements of an Instrument?
2. List the different methods for measuring densities.
3. Name the different Recording instruments
4. What is First Order and Second Order Instrument?
5. Name the different signalling instruments
6. Write about Indicating instruments.
7. What is pneumatic control?
8. Name the different types of automatic control

PART-B

Answer four questions

4 x 3 = 12 Marks

9(a). Explain with a neat sketch the construction and working of Bimetallic thermometer.

(or)

9(b). With neat diagrams explain the recording instruments .

10(a).With a neat sketch determine the moisture content in lumber

(or)

10(b) Name the different types of control systems and explain.

11(a) Write about Indicating instruments.

(or)

11(b) Explain a strip chart recorder with a diagram.

12(a) Draw the pneumatic control circuit for proportional control

(or)

12(b). Name the components of a control system. Explain their function.

PART-C

Answer four questions

4 x 5 = 20 Marks

13(a). List and explain Static and dynamic characteristics of an Instrument.

(or)

13(b) Explain and analyse the parameters of a distillation column with instrumentation diagram

14(a) Explain with a neat sketch the principle, construction and working of Pressure spring thermometer.

(or)

14(b). Explain the pneumatic control circuit for proportional derivative control with a neat sketch

15(a) With a help of a neat diagram explain and analyse the parameters of an extractor.

(or)

15(b) With a help of a neat diagram explain and analyse the parameters of an evaporator.

16(a) Explain with a neat sketch the Pneumatic nozzle- flapper

(or)

16(b) Draw the hydraulic system incorporated with Proportional control circuit and explain.

QUESTION BANK

18CH-504E(A) – INSTRUMENTATION AND PROCESS CONTROL

PART –A

List the various pressure measuring instruments.

What is direct and indirect measurement.

List the four commonly used thermo couples.

What is First Order and Second Order Instrument? give examples

What is Direct and Indirect measurement Give examples

List the names of the different types of manometers

What are the different types of vacuum gages

Construct a neat diagram of a float and tape liquid level system and Label it

List out the various static and dynamic characteristics of instruments.

Name the different spectroscopic methods.

Write about Indicating instruments

Explain briefly a recording instrument

Name the types of control system.

List the types of automatic control actions.

Name the different elements of the Instruments.

Explain briefly about the diaphragm gage.

List the different methods for measuring densities.

Determine the moisture measurement in Lumber.

Explain briefly about control system.

List the names of the pressure measuring elements.

What are the different methods for direct measurement of liquid level.

Construct a neat diagram of Displacement float liquid level system and Label it

Explain briefly the principle of XRD analysis.

Explain briefly a strip chart recorder.

Name the four elements of an instrument give examples

What are the applications of composition analysis in the manufacturing industries

Explain briefly about Signalling Instruments

Explain briefly about ON- OFF control action.

Explain with a neat diagram a Pressure Tight Shaft.

Name the essential elements of the Control system.

Draw a neat diagram to determine the moisture in lumber and Label it.

Name the components of a control system.

Name the commonly used thermocouples

PART -B

34. Explain a float and tape liquid level system with a neat diagram .

35. Name the different spectroscopic methods and write short note on any two .

36. Name the different types of manometers and explain.

37. Explain about Indicating instruments with the help of diagrams.

38. Explain with a neat sketch the construction and working of Bimetallic thermometer.

39. Explain a recording instrument with the help of a diagram.

40. Explain any one pressure measuring element with a neat diagram.

41. List the different method for measuring densities and explain one method.

42. Determine the moisture in lumber with a neat diagram .

43. Explain with the help of diagram the Recording instruments .

44. Explain the signaling instruments with the help of diagram

45. Explain the Displacement float liquid level system with a neat diagram.

46. State the applications of composition analysis in the manufacturing industries

- 47.Explain the principle of XRD analysis .
48. Explain a strip chart recorder with a diagram.
- 49.. Explain with the help of a neat diagram the pressure tight shaft .
- 50.Explain with a neat sketch the construction and working of Bellow gage.

PART –C

51. List and explain Static and dynamic characteristics of an Instrument.
- 52 Explain with a neat sketch the principle, construction and working of Pressure spring thermometer.
53. Explain With the neat diagram describe the principle, construction and working of Mercury in glass thermometer
54. Explain with a neat sketch the principle, construction and working of Bimetallic thermometer.
55. Explain the construction and working of Pirani gage with a neat sketch.
- 56.Explain the construction and working of Mcleod gage with a neat diagram.
- 57.Explain with a neat sketch the method of liquid level measurement using Bubbler system.
- 58.Determine the moisture in gases by psychrometer with a neat sketch.
59. Explain with a help of a neat diagram evaporator and analyse the parameters.
- 60.Explain with the help of a neat diagram explain about the pneumatic relay
- 61..Explain with a neat sketch the principle, construction and working of optical pyrometer.
- 62.Explain with a neat sketch write the principle construction and working of a viscosity meter.
- 63.Determine moisture in paper and write the construction and working with a neat sketch .
- 64.Explain with a neat sketch the principle construction and working of viscosity measurement By Viscosity meter- Brabender Corporation.
- 65.Draw the instrumentation diagram of a extractor and analyse the various parameters.
- 66.Draw the pneumatic control circuit for proportional control and explain.
- 67.Explain with a neat sketch the principle construction and working of a continuous Viscometer.
- 68.Explain with a neat sketch the Pneumatic nozzle- flapper.

- 69.Explain with a neat sketch the construction and working of Callender Griffith circuit .
- 70.Explain and analyse the parameters of a reactor with a help of a neat diagram
- 71.Explain and analyse the parameters of a distillation column with instrumentation diagram
- 72.Explain the pneumatic control circuit for proportional control with a neat sketch
- 73.Explain the principle Construction and working of a lens type and Mirror type Pyrometer.
- 74.Explain the principle Construction and working of a Millivoltmeter.
- 75.Explain the principle Construction and working of a Null potentiometer circuit.

INDUSTRIAL SAFETY

Course Objectives: Create awareness about industrial hygiene and toxicity of hazardous chemicals in

Course Title :	INDUSTRIAL SAFETY	Course Code	18CH-504E(B)
Semester	V	Course Group	Elective
Teaching Scheme in Periods(L:T:P)	45:15:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Hours :	45/60Pds
CIE	60 Marks	SEE	40 Marks

the workplace. Prioritize the importance of safety, safety practices, occupational diseases, first aid operations and detection of fire through automatic alarms.

Pre requisites

Knowledge of basic science, fundamentals of unit operations and processes, fluid mechanics, heat transfer, mass transfer & thermodynamics

On completion of the course, the student will be able to be aware of :

Course Outcomes

CO1	Importance of Industrial hygiene - Recognition of chemical hazards -Industrial evaluation and monitoring of hazard- controlling techniques of hazards - Toxicity of hazardous chemicals in the work place - Physical classification of chemicals- industrial process /operations that produce health hazards.
CO2	Importance of safety - economic aspects- Direct and indirect costs of hazards - Safety in the storage of hazardous chemicals - Guidelines for the storage of chemicals - General recommendations for storage of chemicals in an industry- Industrial hazards and fire hazards processing the hazardous gases, acids, alkalis, corrosive substances, flammable substances
CO3	Develop safety practices - safety in maintenance works like vessel entry, welding operations. Types of personal protection equipment , applications- selection of protective equipment for different chemical substances- equipment protection : guards, rupture discs, safety valves
CO4	Analyse the causes of fire - safety triangle - detection of fire – classification of fires - portable and fixed fire extinguishers- dust explosion..
CO5	Create awareness about occupational diseases- Health hazards due to lead, mercury, chromium, arsenic, manganese, Benzene First aid operations- precautions taken in toxic atmospheres- steps to be taken in case of chemical contact, spilling of hazardous solids, liquids, and gases - electric shocks and burns and first aid given in shocks & burns.
CO6	Explain the risks associated with industrial activity - hazardous chemical processes - hazards in chemical reactors and chemical reactions such as nitration, halogenations, polymerization, oxidation - operational deviations in pressure, temperature & flow - Technical report of a chemical plant for chemical process safety - material safety data sheet(MSDS).

Course Content:

1.0 Industrial Hygiene:

Duration: 11 Periods (L:8-T:3)

Industrial hygiene - Recognition of chemical hazards -Industrial evaluation and monitoring of hazard- controlling techniques of hazards - Toxicity of hazardous chemicals in the work place - Physical classification of chemicals- industrial process /operations that produce health hazards..

2.0 Industrial Hazards and fire Hazard

Duration: 10 Periods (L:8-T:2)

Importance of safety - economic aspects- Direct and indirect costs of hazards - Safety in the storage of hazardous chemicals - Guidelines for the storage of chemicals Ammonia, Chlorine, LPG - Storage inspections - General recommendations for storage of chemicals in an industry- Industrial hazards and fire hazards processing the Hazardous gases, acids, alkalis, Corrosive substances, flammable substances /explosives safety instructions.

3.0 : Personal Protection & Equipment Protection

Duration: 12 Periods (L:8-T:4)

Safety practices - Safety in maintenance works like Vessel entry, Welding operations - Types of personal protection equipment, applications- selection of protective equipment for different chemical substances- equipment protection: guards, rupture discs, safety valves.

4.0 : Fire prevention and extinguishing

Duration: 7 Periods (L:6-T:1)

Causes of fire - safety triangle - detection of fire through automatic fire alarms – classification of fires - portable and fixed fire extinguishers - dust explosion.

5.0: Occupational diseases and first aid

Duration: 8 Periods (L:6-T:2)

Occupational diseases - diseases notified in factories act 1987 - pneumoconiosis, silicosis, Bagassosis - Health hazards due to lead, mercury, chromium, arsenic, manganese, benzene
First aid operations- precautions taken in toxic atmospheres- steps to be taken in case of Chemical Contact, Spilling of hazardous solids, Liquids, and gases - electric shocks and burns and first aid given in shocks & burns.

6.0 : Chemical process safety

Duration: 12 Periods (L:8-T:4)

Risks associated with industrial activity - hazardous chemical processes - hazards in chemical reactors- Hazards in chemical reactions such as nitration, halogenations, polymerization, oxidation - operational deviations in pressure, Temperature & flow -Technical report of a chemical plant for chemical process safety - material safety data sheet(MSDS).

SPECIFIC LEARNING OUTCOMES

1.0 Industrial Hygiene:-

- 1.1 Define and understand industrial hygiene.
- 1.2 Explain the recognition of chemical hazards
- 1.3 Explain the Industrial evaluation and monitoring of hazards.
- 1.4 Explain the controlling techniques of hazards.
- 1.5 Explain the toxicity of hazardous chemicals in the work plan.
- 1.6 Show the physical classification of chemicals.
- 1.7 Explain the industrial process /operations that may produce health hazards.

2.0 Industrial Hazards and fire Hazard

- 2.1 What is the importance of safety in work plan.

- 2.2 Explain the economic aspects and direct and indirect costs of hazards.
- 2.3 Explain the safety in the storage of hazardous chemicals
- 2.4 Outline the specific guidelines for the storage of chemicals such as ammonia, chlorine, LPG.
- 2.5 Compile the storage inspections.
- 2.6 Outline the general recommendations for storage of chemicals in an industry.
- 2.7 List out various industrial hazards and fire hazards while processing the following:
 - a) Hazardous gases
 - b) Acids
 - c) Alkalies
 - d) Corrosive substances
 - e) Flammable substances /explosives

3.0 : Personal Protection & Equipment Protection

- 3.1 What are the safety practices
- 3.2 Explain the safety in steps of maintenance works.
 - a) Vessel entry
 - b) Welding operations
- 3.3 What are the types of personal protection equipment and their applications
- 3.4 Select the protective equipment for the handling of different chemical substances.
- 3.5 Discuss the equipment protection with the following items:
 - a) guards
 - b) rupture discs
 - c) safety valves.

4.0 : Fire prevention and extinguishing

- 4.1 Analyse the causes of fire.
- 4.2 Discuss about the fire safety triangle.
- 4.3 Discuss about the detection of fire through automatic fire alarms
- 4.4 Explain the classification of fires.
- 4.5. Discuss about portable and fixed fire extinguishers.
- 4.6 Illustrate dust explosion.

5.0: Occupational diseases and first aid

- 5.1 Name the occupational diseases
- 5.2 List the diseases notified in factories act 1987.
- 5.3 Discuss about the diseases namely pneumoconiosis, silicosis, Bagassosis.
- 5.4 Discuss the health hazards due to lead, mercury, chromium, arsenic, manganese, benzene.
- 5.5 Explain first aid operations
- 5.6 Explain the precautions to be taken in toxic atmospheres.
- 5.7 Explain the steps to be taken in case of
 - a) Chemical Contact
 - b) Spilling of hazardous solids, Liquids, and gases.
- 5.8 Discuss about electric shocks and burns and first aid given in shocks & burns.

6.0 : Chemical process safety

- 6.1 Analyse the risks associated with industrial activity.
- 6.2 Explain the hazardous chemical processes.
- 6.3 Analyse the hazards in chemical reactors.
- 6.4 Explain the hazards in certain chemical reactions such as nitration, halogenations, polymerization, oxidation
- 6.5 Discuss the operational deviations such as pressure, Temperature & flow.
- 6.6 Explain the technical report of a chemical plant for chemical process safety.
- 6.7 Explain the material safety data sheet (MSDS).

Suggested Student Activities

1. Visit an industry and prepare a report on the toxicity of hazardous chemicals in the work place .
2. Write a report about industrial hazards and remedies.
3. Write a report on storage of chemicals in an industry.
4. Prepare a study report on effluent treatment of any chemical industry.
- 5 Visit an industry and prepare a report on Personal Protection & Equipment Protection
6. Quiz and Group discussion
7. Surprise test

Recommended Books

Text Book: 1. Industrial hygiene & Chemical safety By M.H.Fulekar , I.K.International

2. Industrial health and safety management by A.M. Sarma, Himalaya publishing House

Reference ::

1. Industrial Accident prevention – Heinrich HW
2. Injury Prevention and Control – Geetam Mohan and Tiwari
3. Fire and Explosion Protection Handbook – Denis P Nolan
4. Loss Prevention in process industries-Lees FP
5. Environmental pollution & control in chemical process industries, S C Bhatia
6. Chemical process industry safety, KSN Raju
7. Environmental Pollution control Engg. By C.S. Rao
8. Safety and hazard management in Chemical industries
9. Safety and hazard management by M.N. Vyas
10. Engineering Chemistry by S.K. Jain

e-Learning links:

- 1.<http://www.wisegeek.com/what-is-plant-maintenance.htm#>
- 2.<https://www.youtube.com/watch?v=xJ0ifFS4fU>
- 3.<https://www.youtube.com/watch?v=bSirBWBNCBI>

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	Industrial hygiene - Recognition of chemical hazards - Industrial evaluation and monitoring of hazard- controlling techniques of hazards - Toxicity of hazardous chemicals in the work place - Physical classification of chemicals-industrial process /operations that produce health hazards.	R/U/A	1,2,3,4,5,6,8,9,10	11
CO2	Importance of safety - economic aspects- Direct and indirect costs of hazards - Safety in the storage of hazardous chemicals - Guidelines for the storage of chemicals Ammonia, Chlorine, LPG.- Storage	R/U/A	1,2,3,4,5,6,8,9,10	10

	inspections - General recommendations for storage of chemicals in an industry- Industrial hazards and fire hazards processing the Hazardous gases, acids, alkalies, Corrosive substances, flammable substances /explosives safety instructions.			
CO3	Safety practices - safety in maintenance works like Vessel entry, Welding operations Types of personal protection equipment , applications- selection of protective equipment for different chemical substances- equipment protection : guards, rupture discs, safety valves	R/U/A	1,2,3,4,5,6,8, 9,10	12
CO4	Causes of fire - safety triangle - detection of fire through automatic fire alarms – classification of fires - portable and fixed fire extinguishers- dust explosion..	R/U	1,2,3,4,5,6,8, 9,10	07
CO5	Occupational diseases - diseases notified in factories act 1987 - pneumoconiosis, silicosis, Bagassosis - Health hazards due to lead, mercury, chromium, arsenic, manganese, Benzene First aid operations- precautions taken in toxic atmospheres- steps to be taken in case of Chemical Contact, Spilling of hazardous solids, Liquids, and gases - electric shocks and burns and first aid given in shocks & burns.	R/U/A	1,2,3,4,5,6,8, 9, 10	8
CO6	Risks associated with industrial activity - hazardous chemical processes - hazards in chemical reactors- Hazards in chemical reactions such as nitration, halogenations, polymerization, oxidation - operational deviations in pressure, Temperature & flow -Technical report of a chemical plant for chemical process safety - material safety data sheet(MSDS)	R/U/A	1,2,3,4,5,6,8, 9,10	12
				60

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	
MID SEM –II EXAM					
S.No	Unit Name	R	U	A	Remarks

1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks	
		R		U	A		
1	I	4	1		9(a)	13(a)	
2	II						
3	III		2		10(a)	14(a)	
4	IV						
5	V		3	5, 6	9(b)	13(b)	
					11(a)	15(a)	
		11(b)		15(b)			
6	VI		7,8	10(b)	14(b)		
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8		

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

ENERGY TECHNOLOGY

Course Title :	ENERGY TECHNOLOGY	Course Code	18CH-505E(A)
Semester	V	Course Group	Elective
Teaching Scheme in Periods(L:T:P)	45:15:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Periods :	60Pds
CIE	60 Marks	SEE	40 Marks

Pre requisites: This course requires the basic knowledge of sources of energy and various types of energy.

On completion of the course, the student will be able to :

Course Outcomes

CO1	To understand the general energy scenario & various provisions of the Energy conservation act, 2001.
CO2	To perform and prepare basic effective energy audit report and study about solid fuels.
CO3	Study about liquid and gaseous fuels and their properties
CO4	To judiciously select equipments from energy efficiency perspectives.
CO5	Know the combustion principles and study about refractories and furnaces.
CO6	To identify the application of non-conventional& renewable energy

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE				
			R		U	A	
1	Introduction to energy Sources	5	Q4	Q1	Q9(a)	Q13(a)	
2	Solid fuels	12					
3	Liquid and gaseous fuels.	12		Q2	Q10(a)	Q14(a)	
4	Energy conservation.	6					
5	Combustion principles, Furnaces and Refractories.	13		Q3	Q5,Q6	Q9(b), Q11(a), Q11(b)	Q14(b), Q15(a), Q15(b)
6	Non-conventional Energy sources.	12					
Total		60	8		8	8	

COURSE CONTENTS

UNIT-I: Introduction to Energy Sources

Duration: 5 Periods (L:4-T:1)

Introduction: Energy crisis and management – classification of energy sources conventional energy – Non conventional energy sources- Solar energy, Nuclear energy , Bio energy , Wind, hydal, Tidal, Energy and Geothermal energies.

UNIT-II: Solid fuels

Duration: 12 Periods (L:8-T:4)

Coal – origin – constituents of coal- manufacture of coke. & Byproducts recovery – selection of coal for different uses.

UNIT-III: Liquid& Gaseous fuels

Duration: 12 Periods (L:8- T-4)

Classification of chemical energy systems –Crude Petroleum refining operations – CDU, FCC, Catalytic Reforming – mono propellant – Bipropellant- Hydrazine production- Abel's apparatus, Octane number, Diesel index, Cetane number, Knocking tendency- Viscosity using Red wood

viscometer- Classification of gaseous fuels.

UNIT-IV: Energy conservation

Duration: 6 Periods (L:6-T:0)

Impact of flue gas on boiler efficiency – Factors effecting fuel Economy in furnace, fuel conservation by efficient steam utilization- Energy conservation with reference to thermal insulation- Energy conservation in selected industries like Iron and Steel industries

UNIT V: Combustion Principles, Furnaces & Refractories

Duration: 13Periods (L:10-T:3)

Combustion Principles: Solid fuels calorific value by bomb calorimeter, solid fuel firing by stokers. Liquid and gaseous fuel firing by burners.

Furnaces: Classification on various factors – General features of a furnace – Furnaces used in Iron & Steel Industry- Glass making, kiln in cement Industry & other Inorganic chemical Industries – Fuel economy of furnace.

Refractories: Classification of refractories – properties of refractory – manufacture of refractory – Fire

clay/silica, chrome magnasite, dolomite refractories- causes for failure of refractory – application of refractories.

UNIT-VI: Non Conventional energy sources

Duration: 12 Periods (L:8-T:4)

Nuclear energy – nuclear fuels – fission fusion – Classification of Nuclear reactors, Basic components of Nuclear reactor – Radioactive radiation hazards

Solar Energy: Collection, storage and application.

Wind energy: Technology & Applications

Bio Energy: Bio Gas technology, Applications.

Geothermal: Sources: Geothermal Applications

Hydal, tidal, ocean, wave energy: Tidal energy conversion – wave energy conversion – hydal energy conversion.

SPECIFIC LEARNING OUTCOMES

Introduction to Energy Sources

- 1.1 Define Energy crisis and management
- 1.2 Classify energy sources
- 1.3 Name Conventional energy sources viz solid, liquid & gaseous fuels
- 1.4 Classify Non conventional energy sources viz nuclear fuel, biomass fuel, wind energy, solar energy, hydal, tidal, ocean wave energy & Geo thermal energy.

2.0 Solid fuels

- 2.1 List constituents of coal
- 2.2 Manufacture of coke by High Temperature carbonization of coal includes by product recovery.
- 2.3 Selection of coal for different applications
- 2.4 Explain about Energy systems for air- space vehicles such as rockets.
- 2.5 Classification of chemical energy systems
- 2.6 Explain Monopropellant, Bipropellant
- 2.7 Explain Solid propellant of double base and composite type.
- 2.8 Understand rank of coal and classification of coal by rank.
- 2.9 Understand proximate analysis of coal
- 2.10 Understand Ultimate analysis of coal.

3.0 Liquid and Gaseous fuels.

- 3.1 Know about occurrence of crude petroleum and exploration of crude petroleum.
- 3.1 Know about occurrence of crude petroleum and exploration of crude petroleum.

- 3.2 Understand Crude petroleum refinery operations-CDU.
- 3.3 Compare the conversion processes like cracking, reforming.
- 3.4 Understand Fluid catalytic cracking
- 3.5. Understand catalytic reforming
- 3.6 Explain the process of manufacture of liquid propellants, monopropellant, bi-propellant.
- 3.7 Explain Hydrazine production by ammonia – sodium hypo chlorite process.
- 3.8 Explain analysis of liquid fuels to determine flash point, fire point by Abel's apparatus , Pensky-Martin apparatus
- 3.9 Illustrate Octane number, Diesel index, Cetane number and Knocking tendency.
- 3.10 Explain the procedure of determination of the viscosity of an oil using Redwood viscometer.
- 3.11 Classify the gaseous fuels
- 3.12 Define about (a). Natural gas (b). Coke Oven gas (c). BF gas (d).Water gas (e). Producer gas (f). LPG

4.0 Energy Conservation

- 4.1 Study the impact of flue gas on boiler efficiency
- 4.2 Analyse the factors affecting fuel economy in furnace
- 4.3 Explain the fuel conservation by efficient steam utilization
- 4.4 Study the energy conservation with reference to thermal insulation
- 4.5 Demonstrate the energy conservation in iron and steel plants

5.0 Combustion Principles, Furnaces and Refractories.

- 5.1 Combustion Principles of solid fuels.
- 5.2 Determination of calorific value of solid fuel (coal) by Bomb calorimeter.
- 5.3 Determination of gas's calorific value by Junker's gas calorimeter.
- 5.4 Function of stoker and comparison between hand firing & mechanical firing devices.
- 5.5 Function of chain grate stoker, sprinkler stoker and under feed stoker.
- 5.6 Discuss the firing of liquid fuel by vaporizing, mechanical atomizing and pressure atomising burners.
- 5.7 Explain the firing of gaseous fuels by atmospheric gas burner
- 5.8 List out the classification of furnaces on various factors
- 5.9 Discuss the general features of the furnace.

- 5.10 Explain the furnaces used in Iron and Steel industry viz. Blast furnace, steel making furnace (LD converter)
- 5.11 Demonstrate the furnace used in glass making, cement manufacture
- 5.12 State the factors for fuel economy of a furnace
- 5.13 Classify Refractories
- 5.14 Elaborate the Properties of refractories
- 5.15 Analyse the causes for failure of refractories
- 5.16 Apprehend the applications of refractories
- 5.17 Explain Manufacture of refractory – fire clay, silica, chrome - magnesite and dolomite

6.0 Non conventional energy sources

- 6.1 Define the nuclear energy
- 6.2 Name nuclear raw materials
- 6.3 Differentiate the nuclear fission – nuclear fusion
- 6.4 Classify nuclear reactors
- 6.5 List the basic components of nuclear Reactor
- 6.6 Apprehend radioactive radiation hazards
- 6.7 Understand the solar energy – collection, storage and application
- 6.8 State the Solar energy collectors
- 6.9 Explain Storage and Application of Solar Energy
- 6.10 Illustrate the wind energy – Technology and application
- 6.11 Explain the Bio energy – Bio gas production and application
- 6.12 Explain geothermal energy – sources – energy application
- 6.13 Compare the Hydal – tidal – ocean wave energy
- 6.14 Discuss about Tidel energy conversion
- 6.15 Study about wave energy conversion

6.16 Explain Hydal energy conversion.

SUGGESTED LIST OF STUDENT ACTIVITIES

3. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.
4. Each student should conduct different activity and no repeating should occur.
 - (i). To Prepare preliminary audit report for any organization considering following points.
 - Energy Consumption in the Organization.
 - Scope of Saving.
 - Identify the mostly and the easiest areas of attention.
 - Identify immediate improvements/ saving etc.
 - (ii). To collect information for detailed audit report such as.
 - Energy consumption by department, type of Energy.
 - Energy Cost and Tariff data.
 - Process and Material flow diagram.
 - Sources of Energy supply.
 - Material balance data.
 - Capacity utilisation etc.
5. To Prepare detailed Energy audit report for any organization.
6. Report presentation with case studies on any one topic in Energy management.
7. Visit to any industrial sector where energy management policy is implemented.
6. To collect information about Energy management policy of any 2 companies using web source.
- 7) Report presentation with case studies on any one topic in Energy management.

References:

1. Elements of fuels furnaces & Refractories – O.P.Gupta, Khanna Publishers, New Delhi.
2. Fuel Combustion and Energy Technology, S.N.Saha, Dhanpatrai Publishing Co.,New Delhi.
3. Drydens Outlines of Chemical Technology, 3rd edition, M.Gopal Rao, Marshall Sittig, East West Press Pvt. Ltd., New Delhi
4. Shreves Chemical process Industries, 5th edition, George T Austin, Mc.Graw-Hill.

e-Learning links:

Web Source

- (i) www.bp.com/centres/energy.
- (ii) www.epa.org
- (iii) www.calculator.org/properties.html

- (iv) www.eeca.govt.nz
(v) www.energyusernews.com/
(vi) www.bce-india.nic.in

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	
MID SEM –II EXAM					
S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	

2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks	
		R		U	A		
1	I	4	1		9(a)	13(a)	
2	II						
3	III		2		10(a)	14(a)	
4	IV						
5	V		3	5, 6	9(b)	13(b)	
					11(a)	15(a)	
				11(b)	15(b)		
6	VI		7,8	10(b)	14(b)		
				12(a)	16(a)		
				12(b)	16(b)		
Total Questions		8		8	8		

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

CO-PO MATRIX

COURSE OUT COME		CL	Linked PO	Teaching Hrs
CO1	To understand the general energy scenario & various provisions of the Energy Conservation Act, 2001..	R/U	1,2,3	5
CO2	Perform basic effective energy audit report.	R/U/A	1,2	12
CO3	To perform and prepare basic effective energy audit report and study about solid fuels.	R/U	1,2	12
CO4	To judiciously select equipments from energy efficiency perspectives.	R/U/A	1,2,10	06
CO5	Know the combustion principles, and study about refractories and furnaces.	R/U/A	1,2,5,6	13

CO6	To identify the application of non-conventional & renewable energy	R/U/A	1,2,5,6,10	12
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State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V semester Mid Semester-I Examination

Course Code: 18CH- 505E(A)

Duration:1 hour

Course Name: ENERGY TECHNOLOGY

Max.Marks:20

PART-A

Answer all questions, Each Question carries one mark 4x1 = 4 Marks

1. Name some non- conventional energy sources.
2. What is energy crisis ?
3. What is a propellant?
- 4). What is rank of coal?

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a). What do you understand by energy management?

(or)

5(b). Write the differences between conventional and non- conventional energy sources?

6(a) How is the coal analyzed?

(or)

6(b) What are the uses of coke?

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Write about conventional energy sources

(or)

7(b) Write the Classification of energy sources

8(a) How coke is manufactured from coal?

(or)

8(b). Explain about energy systems for air space vehicles.

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V semester Mid Semester-II Examination

Course Code:18CH- 505E(A)

Duration:1 hour

Course Name: ENERGY TECHNOLOGY

Max.Marks:20

PART-A

Answer all questions, Each Question carries one mark

4x1 = 4 Marks

- 1) What is the composition of petroleum?
- 2) Define flash point.
- 3) What are factors that reduce the fuel gas consumption?
4. What is thermal insulation?

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Explain about occurrence of crude petroleum?

(or)

5(b) Write about cloud point & pour point of an oil with examples.

6(a). Write short notes on waste heat boiler.

(or)

6(b) Write short notes on energy recovery from converter hood cooling?

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) What are gaseous fuels? Write its applications.

(or)

7(b) Explain the procedure of determination of the viscosity of an oil using Redwood viscometer.

8(a) Explain about energy conservation with thermal insulation.

(or)

8(b).Discuss the factors that majorly contribute to energy management.

MODEL QUESTION PAPER

BOARD DIPLOMA SEMESTER END EXAMINATIONS (C-18)

D.CH.E – V - SEMESTER EXAMINATION

18CH-505E(A) – ENERGY TECHNOLOGY

TIME: TWO HOURS

MAXIMUM MARKS: 40

PART –A

MARKS: 8 X 1 = 8M

NOTE: Answer all questions.

1. What is Coke?
2. Define Flash point of an oil.
3. What is natural gas?
4. What is primary air?
5. What is stoker?
6. What is combustion?
7. Define solar energy.
8. Name the raw materials required in a nuclear reactor?

PART –B

MARKS: 4 X 3 = 12

Answer FOUR questions. Each question carries three marks.

9 (a). What is proximate analysis and ultimate analysis? Give examples.

(or)

9(b) Differentiate between vaporization and atomization?

10 (a). What is a propellant? Write its classification with examples.

(or)

10 (b). What are the advantages of mechanical stoker over hand firing?

11(a) Give advantages and disadvantages of liquid fuels

(or)

11 (b). What is calorific value? Name instruments used to find out calorific value.

12 (a) Write the applications of Solar energy.

(or)

12 (b) What is the basic principle of tidal power?

PART –C

MARKS:4 X5 = 20

Answer FOUR questions. Each question carries five marks.

13 (a). Write the production of making coke by Otto-Hoffman Byproduct coke oven process

(or)

13 (b). Explain the process of determining the flash point of oil by Pensky-martins apparatus.

14 (a). Explain about fuel conservation by efficient steam utilization.

(or)

14 (b) How do you determine the calorific value of solid fuel using Junkers gas calorimeter.

15(a) Write the procedure for the combustion of liquid fuel.

(or)

15 (b) Describe the manufacturing process of fire clay refractory.

16(a) Explain about various components of a nuclear reactor?

(or)

16. (b). Explain the various sources and applications of Geo-thermal energy

ENVIRONMENTAL POLLUTION CONTROL ENGINEERING

Pre-requisites: This course requires the knowledge of fundamentals of environmental studies, chemical

Course Title :	ENVIRONMENTAL POLLUTION CONTROL ENGINEERING	Course Code	18CH-505E(B)
Semester	V	Course Group	Elective
Teaching Scheme in Periods(L:T:P)	45:15:0	Credits	3
Methodology	Lecture + Assignments	Total Contact Periods :	60Pds
CIE	60 Marks	SEE	40 Marks

technology and unit operations of chemical Engg.

Course Outcomes

CO1	State the importance of different natural resources, their conservation and problems due to over exploitation and comprehend various types of pollution
CO2	Identify different pollutants in waste water and appreciate various methods of waste water treatment.
CO3	Analyse the sources of air pollutants and their effects , Select suitable methods for air pollution control
CO4	Appraise the various legal aspects involved in pollution control and aware important acts and laws in respect of environment
CO5	Classify solid waste, summarize the effect of solid waste and comprehend various solid waste disposal methods.
CO6	Analyse the sources and characteristics of wastes from important chemical industries and comprehend various treatment methods of wastes

Course Content

UNIT-1 : Environmental studies

Duration: 09 Periods (L:7-T:2)

Scope and importance of environmental studies - Environmental pollution - types of pollution - types of pollutants and their effect - green house effect- ozone layer depletion - acid rain - land resources, land degradation, soil erosion – desertification – water conservation, rain water harvesting and watershed management - pollution case studies and natural disasters - HIV/ AIDS

UNIT 2 - Water pollution

Duration: 11 Periods (L:8-T:3)

Water pollution - origin of waste water - industrial waste waters - Characteristics of waste water - BOD and COD - Treatment of waste water- primary treatment, secondary treatment- Activated sludge process, Trickling filter, Lagoons and tertiary treatment - - disposal of sludge

UNIT 3 - Air pollution

Duration: 10 Periods(L:7-T:3)

Air pollution - classification – properties - sources of air pollutants and their effects - air pollution control methods - Particulate emission control –Gravity settling chamber, cyclone separator, fabric filter, electrostatic precipitator and wet scrubber - Gaseous emission control-Absorption by liquids, adsorption by solids.

UNIT 4 - Legal aspects of pollution

Duration: 08 Periods (L:6-T:2)

Legal aspects- Air act - Water act - environmental protection act - functions of state pollution control board, central pollution control board

UNIT 5 - Solid waste management

Duration: 10 Periods (L:7-T:3)

Solid waste - classification – sources - characteristics - effect on public health - collection of solid waste, Transfer station, Disposal methods – open dumping, land composting, sanitary land filling, incineration and pyrolysis – Hazardous waste management- Recycling and reuse

UNIT 6 - Pollution control in process industries :

Duration: 12 Periods (L:9-T:3)

Characteristics and sources of wastes from pulp and paper, fertilizer, petroleum refinery and sugar industries - treatment methods of wastes from pulp and paper , fertilizer, petroleum refinery, and sugar industries.

SPECIFIC LEARNING OUTCOMES

1.0 Environmental studies

- 1.1 Define environment and environmental studies.
- 1.2 Explain scope and importance of environmental studies.
- 1.3 Describe the impact of human being on environment and effect of environment on human being.
- 1.4 Classify the different types of pollution.
- 1.5 Describe the effect of pollutants on environment and human being
- 1.6 Explain the green house effect- ozone layer depletion and acid rain
- 1.7 Describe Importance of land resources
- 1.8 Illustrate land degradation, soil erosion and desertification.
- 1.8 Explain water conservation, rain water harvesting and watershed management.
- 1.9 Appraise the pollution case studies and natural disasters.
- 1.10 Demonstrate about HIV / AIDS

2.0 Water pollution

- 2.1 Define water pollution.
- 2.2 Explain the origin of waste water.
- 2.3 List and classify various pollutants in industrial waste waters.
- 2.4 Explain the characteristics of waste water like oxygen demanding wastes, disease causing agents, and synthetic organic compounds.
- 2.5 Define BOD and COD and their significance.
- 2.6 Describe the methods of treatment of waste water

- 2.7 Illustrate the primary treatment processes of waste water
- 2.8 Describe secondary treatment methods
 - (a) Activated Sludge process (b) Trickling Filter (c) Lagoons
- 2.9 Describe Tertiary treatment/ Advanced treatment methods of waste water.
- 2.10 Describe the methods of disposal of sludge

3.0 Air Pollution

- 3.1 Classify air pollutants and explain properties of air pollutants.
- 3.2 Identify the sources of air pollutants and explain their effects.
- 3.3 Explain different air pollution control methods.
- 3.4 Describe the working particulate emission control equipments – Gravity settling chamber, cyclone separator, fabric filter, electrostatic precipitator & wet scrubber
- 3.5 Describe the gaseous emission control- Illustrate the Absorption process of gaseous pollutants into a liquid medium, and absorption of gaseous pollutants by solids.

4.0 Legal aspects of pollution

- 4.1 Appraise the various legal aspects involved in pollution control.
- 4.2 Explain the salient features of Air Act, Water Act and Environmental protection Act.
- 4.3 State the functions of State pollution control board and Central pollution control board.

5.0 Solid waste management

- 5.1 Define solid waste and classify solid waste
- 5.2 Analyse the sources of solid wastes and the characteristics of solid wastes.
- 5.3 Describe the effect of solid waste on public health.
Explain the methods of collection of solid waste
- 5.4 Illustrate the transport of solid waste -Transfer station
- 5.5 Describe Potential methods of disposal of solid waste
 - a) Open dumping b) Sanitary Land filling c) Land composting d) Incineration
- 5.6 Illustrate Hazardous Waste management
- 5.7 Identify the materials for recycling and reuse and explain methods of recycle.

6.0 Pollution control in process industries

- 6.1 Analyze the sources and characteristics of wastes from
 - (a). Pulp and paper industries (b). Fertilizer industry (c).Petroleum industry (d). Sugar industry
- 6.2 Describe the treatment methods of wastes from
 - (a). Pulp and paper industries (b). Fertilizer industry (c).Petroleum industry (d). Sugar industry

SUGGESTED LIST OF STUDENT ACTIVITIES

Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned Teacher and HOD.

1	Each student will give an activity to prepare a tabulated summary for types of treatments available for industrial waste waters and domestic waste waters
2	Students visit any chemical industry to analyse the effluents and their treatment methods.
3	Each student will be given an activity for analyzing the sources and characteristics and treatment methods wastes from chemical industries other than specified in the syllabus
4	Each student should analyse various solid wastes collected from houses and identify the materials for recycle
5	Visit to any NGO/Public Health Department dealing with the environmental health program
5	Prepare an excel sheet on sources of solid waste in a village/ town in teams.
6	Group Discussion, Quiz and Seminars

Recommended Books

1. Environmental pollution control engineering by C.S.Rao, Wiley eastern Ltd., New age international Ltd.
2. Pollution control in process industries by S P Mahajan, T.M.H Publications.
3. Environmental chemistry & pollution control by S.S.Dhara, S.Chand. Company Ltd.
4. Environmental Engineering by G.N.Pandey, G.C.Carney: T.M.H Publishers.

e-Learning links:

9. <http://nptel.ac.in>

CO-PO Mapping Matrix

Course Outcome		CL	Linked PO	Teaching periods
CO1	State the importance of various natural resources, their conservation and problems due to over exploitation and comprehend various types of pollution	R/U	1,2,5,6,7,10	09
CO2	Identify different pollutants in waste water and appreciate various methods of waste water treatment.	R/U/A	1,2,3,5,6,10	11

CO3	Analyse the sources of air pollutants and their effects , Select suitable methods for air pollution control	R/U/A	1,2,3,5,6,7,8,10	10
CO4	Appraise the various legal aspects involved in pollution control	R/U	1,3,5,6,7,10	08
CO5	Classify solid waste, summarize the effect of solid waste and comprehend various solid waste disposal methods.	R/U/A	1,2,3,5,6,7,8,10	10
CO6	Analyse the sources and characteristics of wastes from important chemical industries and comprehend various treatment methods of wastes	R/U/A	1,2,3,4,5,6,10	12
				60

QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	4	1	Nil	4 Marks
02	Part-B	Understanding(U)	4	3	2	6 Marks
03	Part-C	Application(A)	4	5	2	10 Marks
	Total Marks	20 Marks				

MID SEM-I EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-I	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-II	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

MID SEM-II EXAM

S.No	Unit No	R	U	A	Remarks
1	Unit-III	1,2	5(a)	7(a)	
			5(b)	7(b)	
2	Unit-IV	3,4	6(a)	8(a)	
			6(b)	8(b)	
Total Questions		4	4	4	

The length of answer for each question framed in respect of Part-A, B&C shall not exceed $\frac{1}{4}$ of a page, 1 page and 2 pages respectively

QUESTION PAPER PATTERN FOR SEMESTER END EXAM

Sl.No	Description	Level	No of Questions	Marks for each question	Choice	Total Marks
01	Part-A	Remembering(R)	8	1	Nil	8 Marks
02	Part-B	Understanding(U)	8	3	4	12 Marks
03	Part-C	Application(A)	8	5	4	20 Marks
	Total Marks	40 Marks				

Unit No	Unit Name	Periods	Questions to be set for SEE			
			R		U	A
1	Environmental studies	11	Q4	Q1	Q9(a)	Q13(a)
2	Water pollution	10				
3	Air pollution	12		Q2	Q10(a)	Q14(a)
4	Legal Aspects of Pollution	7				
5	Solid waste management	8	Q3	Q5,Q6	Q9(b),Q11(a), Q11(b)	Q13(b),Q15(a), Q15(b)
6	Pollution control in process industries	12		Q7,Q8	Q10(b),Q12(a), Q12(b)	Q14(b),Q16(a), Q16(b)

State Board of Technical Education and Training, Telangana
Model Question

paper

DCHE V semester Mid Semester-I Examination

Course Code: 18CH- 505E(B)

Duration: 1 hour

Course Name: Environmental Pollution control Engineering

Max.Marks : 20

PART-A

Answer all questions, Each Question carries one mark

4x1 = 4 Marks

1. Define the term pollution.
2. Define Watershed.
3. What are the oxygen demanding wastes?
4. Define BOD

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Discuss about Land degradation.

(or)

5(b) Explain the scope and importance of environmental studies.

6(a) Explain the process of waste water treatment by sedimentation with a neat sketch

(or)

6 (b) Classify different types of pollution and write their effects.

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Explain about Water conservation and Rain water harvesting

(or)

7(b) Explain the uses of forests. What are the causes and consequences of deforestation?

8(a). Discuss about waste water treatment by using Trickling filter with a neat sketch and what are its advantages over activated sludge process

(or)

8(b). Explain in brief about Reverse osmosis and ion exchange process for the treatment of waste water.

PART-A

Answer all questions, Each Question carries one mark

4x1 = 4 Marks

1. What are the different sources of air pollutants?
2. Name the devices used for Particulate emission control.
3. What is environmental protection act?
4. List different types of pollution.

PART-B

Answer two questions. Each question carries three marks

2x 3 = 6 Marks

5(a) Explain about Photochemical smog.

(or)

5(b) Write about the classification and properties of air pollutants.

6(a) Discuss the salient features of Air Act.

(or)

6 (b) Write the salient features of Water Act 1974.

PART-C

Answer two questions. Each question carries five marks

2x 5 = 10 Marks

7(a) Discuss about Adsorption by solids for control of air pollution.

(or)

7(b) Explain the construction and working of cyclone separator with a neat sketch.

8(a). Explain the functions of Central pollution control board?

(or)

8(b). Write the functions of State pollution control board?

State Board of Technical Education and Training, Telangana

Model Question paper

DCHE V Semester End Examination

Course Code: 18CH-505E(B)

Duration: 2 hours

Course Name: Environmental Pollution control Engineering

Max.Marks : 40

PART-A

Answer all questions

8x1 =8 Marks

1. Define environmental pollution.
2. What are the different sources of air pollutants?
3. Define solid waste.
4. List different types of pollution.
5. Classify Solid waste. .
6. Name some materials that can be recycled from solid waste.
7. List the wastes from sugar industry.
8. Name some methods of treatment used for treating industrial waste.

PART-B

Answer four questions

4 x 3 = 12 Marks

9(a). Explain about Watershed.

(or)

9(b). Explain about hazardous waste management.

10(a). What are the duties of Central pollution control board?

(or)

10(b). What are the sources and characteristics of wastes from fertilizer industry?

11(a) What is a transfer station? Explain with a line sketch.

(or)

11(b) Explain the methods of collection of solid waste?

12(a) What are the sources and characteristics of wastes from petroleum industry?

(or)

12(b) Write about the characteristics and sources of wastes from Sugar Industry.

PART-C

Answer four questions

4 x 5 = 20 Marks

13(a). Explain about secondary treatment of waste water by activated sludge process and give its advantages.

(or)

13(b) Explain in detail about Recycle and reuse.

14 (a) Discuss about Particulate emission control methods to control air pollution.

(or)

14 (b). Discuss about the treatment methods of wastes from Paper and pulp Industries.

15(a) Discuss the process of Composting of solid waste.

(or)

15(b) What are the various methods of disposal of solid waste? Explain in brief about Sanitary land fill.

16(a) Write the different methods of treatment of wastes from Petroleum industry

(or)

16(b) Explain the methods of treatment of wastes from Fertilizer Industry.

18CH-506P :: MASS TRANSFER LAB PRACTICE

Course Title:	Mass Transfer Lab Practice	Course Code	18CH 506P
Semester	V	Course Group	Core
Teaching Scheme in Periods(L: T:P)	15:0:30	Credits	1.5
Methodology	Lecture + Practical	Total Contact Periods:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

Learning concepts of Basic and Knowledge of Mass transfer

COURSE OBJECTIVE

1. Apply the principles of mass transfer operations, to evaluate the rate, efficiency, characteristics, equilibrium relationships so that they can rectify some problems normally occurring in industries.
2. To study the different equipments used in mass transfer operations with its advantages, limitations & applications.

COURSE OUTCOMES

On successful completion of the course, the students will be able to attain CO:

Course Outcome		CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Draw the standard plots between mole fraction of CCl ₄ vs Refractive index & specific gravity of the mixture	U/A	1,2	2,3,4,8.9,10	06
CO2	Appraise the mechanism of batch distillation and verify Rayleigh's equation	U/A	3,10,	2,3,4,8.9,10	06
CO3	Evaluating the principles of steam distillation	U/A	3,4	2,3,4,8.9,10	06
CO4	Estimate rate of drying and interpret drying characteristics	U/A	6,8	2,3,4,8.9,10	06
CO5	Evaluate the Binodal curve for a given ternary liquid equilibria.	U/A	7	2,3,4,8.9,10	06

CO6	Determine the efficiencies of mass transfer in leaching operation	U/A	9	2,3,4,8.9,10	09
CO₇	Evaluate the rate of diffusional constant temperature.	U/A	5	2,3,4,8.9,10	06
					45

COURSE OBJECTIVE

On the completion of this subject the students should be able to understand, demonstrate the difference between laminar and turbulent flow, losses due to friction and evaluate the performance of flow meters, pumps, and fluidized beds

LIST OF GRADED PRACTICAL EXERCISES

COURSE OUTCOMES

The practical learning outcomes in affective domain and psychomotor domain, so that students are able to acquire the necessary skills. Following is the list of experiments to be carried out.

Students who had completed the course will be able to

Exe rcis e No.	Course outcome		Linked Exercise	CL (R/U/A)	Linked Practical	Approx. Hrs. Required	Teaching periods
	CO1	Distinguish laminar and turbulent flow	1,10	U,A	1,2,3,8,10		6
		Identify different heads and					
PART A. PERFORMING EXPERIMENTS			2	U,A	1,2,3,8,10		6
1	To draw a graph of specific gravity Vs mole fraction of a given binary system.					03	6
2	To determine the frictional index Vs mole fraction of a given binary system	3	U,A	1,2,3,6,8,10	03		
	Apply the knowledge of principle for determination of						12
3	Verify Rayleigh's equation for simple distillation					03	
5	CO4 metres	4,5,6	U, A	1,2,3,4,6,8,10	03		
	Determination of the Diffusivity co-efficient						
6	CO5 Calculate the pressure drop for flow through packed bed and fluidized bed	7	U,A	1,2,3,8,9,10	06		6
7	CO6 Evaluate the characteristics of pumps	8	U,A	1,2,3,8,9,10	06		9
8	To determine the rate of evaporation at regular intervals of time					03	
9	Estimate the leaching efficiencies in single and multistage operations					06	
PART B. OPEN ENDED EXPERIMENTS							
10	Estimation of vapor liquid equilibrium data of a given binary system.					03	
11	To determine the no. of trays required using Mc.Cabe Thiele method					03	
						45	

Course Delivery:

The course will be delivered through lectures, classroom interaction, group discussion, demonstration and practicals.

Reference :

1. Unit operations of chemical Engg by W.L. McCabe J.C. Smith Mc Graw Hill bookco.
2. Introduction to chemical Engg by W.L. Badger & J.T. Banchero.

Suggested Learning Outcomes

Upon completion of the course, the student will have ability to

1. Draw the standard plots between mole fraction of CCl_4 vs Refractive index and specific gravity of the mixture
2. Identify different Mass transfer equipments
3. Determine the Diffusivity coefficient.
4. Apply the knowledge of principle of distillation
5. Analyse rate of drying in driers
6. Demonstrate different types of driers and mass transfer operations.

SUGGESTED STUDENT ACTIVITY

1. Each student should submit any one of the following type activity or any other similar activity related to the course and before take up get it approved from concerned teacher and HOD.
2. Each student should conduct different activity and no repetition should occur

1	Collect/ download product catalogues with specification of various types of mass transfer equipments and details .
2	Identify and list at least 10 equipments/devices which are used in mass transfer operations in industries. Also state the specific applications of those.
3	At least one visit of any power plant/ industry where various items like distillation columns, absorption towers, extractors ,gas-liquid separators., Various types dryers, cooling tower, condenser etc. can be shown to students.
4	Group discussions & Quiz

Suggested E-Learning references

10. <http://nptel.ac.in>

State Board of Technical Education and Training, Telangana

Semester End Examination Model Question paper

DCHE V Semester practical Examination

Corse Code: 18CH-506P

Duration:3 hours

Course Name: MASS TRANSFER Lab Practice

Max.Marks:40

Instructions to the Candidate:

(i)Answer any One of the following Questions.

(ii)Record the results on a graph sheet if required , and conclude your observation of the experiment

1. Draw a graph of specific gravity Vs mole fraction of a given binary system.
2. Draw a graph of refractive index Vs mole fraction of a given binary system.
3. Verify the Rayleigh's equation for simple distillation.
4. Determine the vaporization and thermal efficiencies in steam distillation
5. Determine the Diffusivity Co-efficient.
6. Calculate time of drying of a given material and to draw the rate of drying curve.
7. Determine the equilibrium relationship between three component system.
8. Determine the rate of evaporation at regular intervals of time
9. Estimate the vapor liquid equilibrium data of a given binary system.
10. Determine the no. of trays required using Mc.Cabe Thiele method .
11. Estimate the leaching efficiencies in single and multistage operations

INSTRUMENTATION PROCESS CONTROL & REACTION ENGG LAB PRACTICE

Course Title:	INSTRUMENTATION PROCESS CONTROL AND REACTION ENGG LAB PRACTICE	Course Code	18CH 507P
Semester	V	Course Group	Core
Teaching Scheme in Periods(L: T:P)	15:0:30	Credits	1.5
Methodology	Lecture + Practical	Total Contact Periods:	45Pds
CIE	60 Marks	SEE	40 Marks

PRE-REQUISITE

1. Basic knowledge of instrumentation and process control, reaction engineering and fluid mechanics.
2. Basic knowledge of unit processes in chemical industry and an idea about the different types of reactors and its design.

COURSE OBJECTIVE

On the completion of this subject the students should be able to calibrate the different thermocouples, resistance thermometers, pressure gauges, should be able to determine the response and time constant, at the same time understand, discuss about control valve, demonstrate on - off control system and also understand the Chemical treatment step of a process, basic principles of kinetics which are required in developing new products, operation of chemical reactors.

COURSE OUTCOMES

Students who had completed the course will be able to

Course outcome		CL (R/U/A)	Linked PO	Teaching periods
CO1	1. Calibrate a Thermocouple 2. Measure the temperature using a Resistance thermometer. 3. Calibrate a Pressure gauge	U,A	1,2,3,4,5,6,7, 8,9,10	6
CO2	Determine the time constant and response in 1. Two tank interacting system. 2. Two tank non-interacting system. 3. Single tank system.	U,A	1,2,3,4,5,6,7, 8,9,10	6
CO3	Discuss the Control Valve characteristics	U, A	1,2,3,4,5,6,7, 8,9,10	6

CO4	Demonstrate the response of On-off control system.	U, A	1,2,3,4,6,8,10	12
CO5	Experiment with the batch reactor and calculate the Volume required for constant volume batch reactor	U,A	1,2,3,8,9,10	6
CO6	Experiment with the mixed flow reactor and plug flow reactor and calculate the 1. Volume required for constant volume steady state mixed flow reactor 2. Volume required for constant volume steady state plug flow reactor	U,A	1,2,3,8,9,10	9

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Perform the experiment to calibrate the following thermocouples. (a) Iron- constantan (b) Copper- constantan (c) Chromel- Alumel	3
2	Measure the temperature using resistance thermometer.	6
3	Calibrate an unknown pressure gauge using dead weight piston gauge..	6
4	Determine the time constant and response in two tank interacting system by conducting experiment.	6
5	Determine time constant and response in two tank non-interacting system by performing experiment.	3
6	Determine the time constant and response in single tank system by conducting experiment	3
7	Perform an experiment to study the Control valve characteristics.	6
8	Perform an experiment to study the response. of “on-off” control system.	3
9	Perform an experiment to calculate the volume required for constant volume batch reactor.	3
10	Perform an experiment to calculate the volume required for constant volume steady state mixed flow reactor	3
11	Perform an experiment to calculate the volume required for constant volume steady state plug flow reactor	3

Suggested Student Activities

1. A student will be asked to assemble a thermocouple other than that in the curriculum and calibrate it.
2. A student will be given a task to list out any five pressure gauges available in market with specifications and current market price.
3. Visit a nearby industry learn and analyse the reaction in a batch reactor,

- mixed reactor and plug flow reactor required for chemical engineering processes.
4. Prepare a list of different types of latest equipment being used in the industries. which have replaced the old equipment

Reference :

1. Unit Operations of Chemical Engineering, McCabe and W.L Smith V Edn., McGraw Hill.
2. Industrial instrumentation by – Donala P Eckman weley eastern Ltd, 1984.
3. Instrumental methods of chemical analysis by – B.K Sharma Yrel Pub :- House.
4. Instrumentation & process control by R P Vyas.
5. Instrumentation & process control by S K Singh
6. Perry's Chemical Engineers' Handbook, McGraw Hill
7. Unit Operations of Chemical Engineering, McCabe and W.L Smith V Edn., McGraw Hill.

Suggested E-Learning references

e-links :

7. <https://www.youtube.com/watch?v=HHFdJ6dyeDA>
 8. www.supercoolsliderule.com
 9. <http://www.explainthatstuff.com/how-pyrometers-work.html>
 10. <https://www.youtube.com/watch?v=o0GZA-vU3MY>
 11. <https://www.youtube.com/watch?v=-9IfpNAESIM>
 12. <https://www.youtube.com/watch?v=DCzu4e9Q80k>
 13. <https://www.youtube.com/watch?v=xWWg8J60r3A>
 14. <https://www.youtube.com/watch?v=jNVePBvI2ps>
 15. <https://www.youtube.com/watch?v=CRI-Un3FY8M>
 16. <http://instrupedia.blogspot.in/2012/02/bubbler-level-measurement-system.html>
 17. <https://www.youtube.com/watch?v=vwY-xWMam7o>
-
11. <http://nptel.ac.in>
 12. www.flowmaster.com
 13. www.vlab.co.in
 14. Pipeflow.co.uk

ENERGY TECHNOLOGY LAB PRACTICE

Course Title:	Energy Technology Lab Practice	Course Code	18CH 508P
Semester	V	Course Group	Core
Teaching Scheme in Periods(L: T:P)	1:0:2	Credits	1.5
Methodology	Lecture + Practical	Total Contact Hours:	45Pds
CIE	60 Marks	SEE	40 Marks

COURSE OBJECTIVE

On the completion of this subject the students should be able to measure the parameters of importance of temperature Air & Gas flow /Liquid flow/ revolutions per minute noise& vibration /dust concentration etc

COURSE OUTCOMES

Students who had completed the course will be able to

Course outcome		Linked Exercise	CL (R/U/A)	Linked PO	Teaching periods
CO1	Determine the proximate analysis of coal	1,2	U,A	2,3,4,5,8,10	6
CO2	Determine the ultimate analysis of coal.	3	U,A	1,2,3,4, 8,9,10	3
CO3	Determination of calorific value of solid fuel by Bomb Calorimeter	4	U, A	2,3,5,6,8,10	9
CO4	Determination of flash point and fire point by Pensky Martins Apparatus. & Abels closed cup Apparatus.	5,6	U, A	1,2,3,8,10	9
CO5	Determination of viscosity of an oil by Redwood viscometer.	7,8	U,A	1,2,3,8,10	9
CO6	Determination of CO, CO ₂ and O ₂ content present in the flue gas using Orsat apparatus	9	U,A	1,2,3,	9

COURSE CONTENTS

S. No	Name of the Exercise	Periods
1	Determine the moisture content, Volatile matter in a given a sample of Coal	6
2	Determine the fixed carbon and ash content given sample of coal.	3
3	Determination of carbon and hydrogen in coal by ultimate analysis.	3
4	Determination of the Calorific value of solid fuel by using Bomb calorimeter.	6
5	Determination the flash and fire point of a given sample of oil using Abels closed cup apparatus	6
6	Determination of flash and fire point of a given sample of oil using Pensky martins apparatus	3
7	Determination of viscosity of a lubricating oil by Red wood viscometer-I	3
8	Determination of viscosity of lubricating oil by Red wood viscometer-II.	6
9	Determination of CO, CO ₂ and O ₂ content present in the flue gas using Orsat apparatus.	6
10	Determination the Smoke point of Kerosene.	3

Specific Learning Outcomes

Upon completion of the course, the student will have ability to

7. Analyse the properties of coal.
8. Demonstrate and operate Bomb calorimeter.
9. Evaluate the flash point and fire point of liquid fuel.
10. Identify and analyse viscosity of lubricant oil.
- 5 Determine the content of CO, CO₂ and O₂ present in the flue gas using Orsat apparatus.
11. Illustrate smoke point of kerosene.

Suggested Student Activities

Carry out processes other than mentioned in lab and submit a report

Identify the instruments /Equipments used for proximate analysis and ultimate analysis.
Acquire a Knowledge of Orsat analysis.

Reference :

1. Fuels ,Furnces and Refractories by O.P Gupta.

Suggested E-Learning references

- (vii) www.bp.com/centres/energy.
- (viii) www.epa.org
- (ix) www.calculator.org/properties.html
- (x) www.eeca.govt.nz
- (xi) www.energyusernews.com/
- (xii) www.bce-india.nic.in

State Board of Technical Education and Training, Telangana

Semester End Examination Model Question paper

DCHE V Semester practical Examination

Corse Code: 18CH-508P

Duration: 3 hours

Course Name: ENERGY TECHNOLOGY Lab Practice

Max.Marks:40

to the Candidate:

(i) Answer any One of the following Questions.

(ii) Record the results on a graph sheet if required, and conclude your observation of the experiment

(iii) Draw the diagram for illustration, choose appropriate values when not mentioned in the question

1. Determine the moisture content, volatile matter in a given a sample of coal.
2. Determine the fixed carbon and ash content given sample of coal.
3. Determine Carbon and Hydrogen in Coal by ultimate analysis.
4. Determine the Calorific value of solid Fuel by using Bomb Calorimeter.
5. Determine the flash and fire point of a given sample of oil using Pensky martins apparatus
6. Determine the viscosity of a lubricating oil by Red wood viscometer-I
7. Determine the viscosity of lubricating oil by Red wood viscometer-II.
8. Determination of CO, CO₂ and O₂ content present in the flue gas using Orsat apparatus.
9. Determine the smoke point of Kerosene.

PROGRAMMING IN C LAB PRACTICE

Course Title :	Programming in C lab practice	Course Code	18CH-509P
Semester		Course Group	Practical
Teaching Scheme in Periods(L:T:P)	15:00:30	Credits	1.5
Methodology	Lecture + Practical	Total Contact periods :	45Pds
CIE	60 Marks	SEE	40 Marks

Pre requisites

Basic knowledge of Computer Operation.

Course outcomes

Course Outcome	
CO1	Write programs using input/output statements, variables and operators
CO2	Work on Constants, Variables, Data Types, Operators and Expressions in C
CO3	Construct programs on Decision making and Looping statements.
CO4	Develop programs using arrays and structures

Course Content

1. Programming Methodology and Introduction to C Language

Duration: 5 Periods

Program - Define High level language and low level language-history of C language - importance of C language – Define & Differentiate Compiler, Assembler - structure of C language - programming style of C language - steps involved in executing the C program

2. Understand Constants, Variables and Data Types in C and Understand Operators and Expressions in C

Duration: 15 Periods

Character set - C Tokens - Keywords and Identifiers- Constants and Variables - data types and classification - declaration of a variable - Assigning values to variables - Define an operator - Define an expression -Classify operators - List and explain various arithmetic operators with examples -Illustrate the concept of relational operators - List logical operators - various assignment operators - Increment and decrement operators - Conditional operator - List

bitwise operators -List various special operators- Arithmetic expressions- precedence and associativity of operators- Evaluation of expressions - formatted input and output.

3. Decision making and Looping statements

Duration: 10 Periods

Simple if statement with sample program – if else statement – else if statement – switch statement - Classification of various loop statements- while statement – do-while statement - for loop statement - break and continue statements.

4. Arrays and Structures

Duration: 15 Periods

Arrays -declaration and initialization of One Dimensional -Accessing elements in the Array - Declaration and initialization of two Dimensional Arrays - sample programs on matrix addition and matrix multiplication–Declaration of a Structure – Structure members – Array of structures.

Course Outcome		CL	Linked PO	Teaching Hours
CO1	Write programs using input/output statements, variables and operators	R, U, A	1,2,3,4,8,9,10	5
CO2	Work on Constants, Variables, Data Types, Operators and Expressions in C	R, U, A	1,2,3,4,8,9,10	15
CO3	Construct programs on Decision making and Looping statements.	R,U, A	1,2,3,4,8,9,10	10
CO4	Develop programs using arrays and structures	U, A	1,2,3,4,8,9,10	15
			Total Sessions	45

REFERENCE BOOKS

1. Let Us C -- Yeshwanth Kanetkar BPB Publications
2. Programming in ANSI C -- E. Balaguruswamy Tata McGrawHill
3. Programming with C -- Gottfried Schaum's outline
4. C The complete Reference -- Schildt Tata McGraw Hill

List of Experiments

1. Exercise on structure of C program
2. Exercise on Keywords and identifiers
3. Exercise on constants and variables
4. Execution of simple C program
5. Exercise on operators and expressions

6. Exercise on special operators
7. Exercise on input and output of characters
8. Exercise on formatted input and output
9. Exercise on simple if statement
10. Exercise on ifelse statement
11. Exercise on elseif ladder statement
12. Exercise on switch statement
13. Exercise on conditional operator
14. Exercise on while statement
15. Exercise on for statement
16. Exercise on do...while statement
17. Exercise on one dimensional arrays
18. Exercise on two dimensional arrays
19. Exercise on structure
20. Exercise on array of structures

Department of Technical education
State Board of Technical education & Training (TS)
18CH510P- PROJECT

Course title:	Project			Course Code:	18CH-510P
				Course group:	Practical
Semester:	V			Credits:	1.5
Teaching scheme in periods (L:T:P):	0:0:45			Total contact periods :	45
Methodology: Lecturer+ Assignment:					
CIE:	60 Marks			SEE:	40 Marks

Course out comes:

The student should be able to

1. Applying the principles and knowledge of Chemical Engineering , to design chemical engineering equipment, innovative ideas to solve engineering, and societal problems
2. Demonstrate the knowledge to assess safety, legal issues and consequent responsibilities
3. To function effectively as an individual and as a member in a team
4. To communicate effectively
5. To engage in lifelong learning in the context of technological changes

SCHEME OF INSTRUCTIONS AND EXAMINATION

S. No	Subject	Items	Max Marks	Remarks
1	Major Project	1.Major project I spell (Abstract submission)	100	RUBRICS 1
		2. Major project II spell (Final submission)	100	RUBRICS 2
		3.a)Maintenance of Log Book	60	
		b)Record work	60	
		4.a) Seminar	40	
		b) Viva Voce	40	
			400	

The Major Project shall carry 400 marks and pass marks are 50% a candidate failing to secure the minimum marks.

Course content:

A list of topics suggested for project work

1. Basic design and cost estimating of the following equipment based on the problems suggested by teachers on topics;
 - a) Heat exchangers and condensers
 - b) Distillation units
 - c) Pumping installation
 - d) Absorption system
 - e) Extraction system
 - f) Water purification system
 - g) Evaporator system
 - h) Dryers
2. Prepare a process report on industrially important chemicals.
3. Design and fabricate small prototype chemical engineering equipments useful for doing experiments in the laboratory.
4. To conduct a survey of a chemical industry and produce a report on
 - a) Various safety methods being followed
 - b) Various pollution control methods being carried out.
 - c) Production, planning and control systems
 - d) Process instrumentation of the plant
 - e) Maintenance schedule of chemical engineering equipment
 - f) Material transportation and storage of chemicals
5. Identification and selection of a product with an aim to setup a small scale industry.
6. Conduct of detailed market survey
7. Exploration of the various financial arrangements to start the manufacturing of the product under technocrat scheme in small scale industrial sector.
8. Detailed survey of requirements of the department of industry, municipal, health, Inspectorate of factories, electrical inspectorate, banks, other financial agencies etc., for starting an industry.
9. Planning for type of organisation.
10. Selection of site.

Suggested learning outcomes

Upon completion of the course the student shall be able to

- **Prepare technical project report**
- Prepare a project report with details of materials, processes etc.
- Develop a proto type/model of the product with the facilities available in polytechnic.
- **Conduct survey to establish a small scale unit**
- Identify and select a product with an aim to set up a small scale industry.
- Conduct a detailed market survey.
- List the raw materials, equipment and tools needed for the manufacture of a specified quantity.
- Explore the various financial arrangements to start the manufacture of a product under technocrat scheme in small scale industrial sector.
- Make a survey of requirements of the department of industries, municipal, health, inspectorate of factories for starting an industry.
- Plan for a type of organisation.
- Select a site.
- Prepare a techno feasibility report consisting of drawings, plant layouts, building requirements, machinery and equipment requirements, raw material, labour, production and administrative staff requirements, working capital, material flow sheet, cash flow sheet, financial analysis etc.
- Develop working models to show scientific and engineering principles studied in the curriculum and repair, up gradation and maintenance of equipment which are existing.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
1	3	3	2	2	1	2	1	3	2	2	all
2	3	3	1		3	3			1		1,2,3,5,6,9
3	3	3	1					3	1		1,2,3,8,9
4	3	3							3	2	1,2,9,10
5	3	3	3	3	1	1	1		3	3	1,2,3,4,5,6,7,9,10

RUBRICS 1: level of achievement

	GOOD	AVERAGE	ACCEPTABLE	UNACCEPTABLE
Identification of problem	Good explanation of the purpose and need of the project	average explanation of the purpose and need of the project	Moderate explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
Study the existing systems	Collects a great deal of information and good study of the existing systems	Collects some basic information	Limited information	Incomplete information
Objectives and methodology	Good justification to the objectives	Incomplete justification to the objectives	Only some objectives of the proposed	Objectives of the proposed work are either not identified or not well

1. Identification of problem and explanation of the purpose and need of the project (30 Marks)
2. Detailed study of the existing systems and feasibility of project proposal (30 Marks)
3. Methodology and Abstract submission (40 Marks)

RUBRICS2:

	GOOD	AVERAGE	ACCEPTABLE	UNACCEPTABLE
Incorporation of suggestions	Changes are made as per modification	All major changes are made as per modification	Few changes are made	Suggestions are not incorporated
Project demonstration	All defined objectives are achieved	All modules are achieved	Some of the defined objectives are achieved	Defined objectives are not achieved
Demonstration and presentation	Objectives achieved as per time frame	Objectives achieved as per time frame	Objectives achieved as per time frame	No Objectives achieved as per time frame

1. Changes are made as per modifications suggested and new innovations added (30 Marks)
2. Complete explanation of the key concepts strong description of the technical requirements of the project (30 Marks)
3. Objectives achieved as per time frame (40 Marks)

Skill Upgradation activities V-semester

1. Search through proper sources the applications of First and Second law of thermodynamics and submit a report.
2. Summarize with relevant examples the application of Carnot's principle.
3. Collect information from any source on various types of reactors used for particular processes and submit as summary
4. A student will be asked to recall and to summarise the different types of Instruments used for measuring different process variables.(Summary includes instruments used in industries other than that mentioned in the syllabus.).
5. Visit a nearby industry and develop an instrumentation diagram of a distillation column, evaporator, reactor or an extractor with specifications
6. Prepare a list of different types of latest equipment which has replaced the old equipment (such as a digital thermometer which replaced the mercury in glass thermometer) being used in the industries.
7. Write a summary of recent applications of various Spectrometers, Chromatographic instruments in various fields
8. Prepare models / charts for any instrument.
9. Prepare a report with illustrations of the equipment to explain different types of polymerization techniques by visiting a nearby polymer industry.
10. Write a report on the properties and applications of condensation polymers
11. Prepare models / charts for any manufacturing process.
12. To prepare preliminary audit report for any organization considering following points.
Energy Consumption in the Organization, scope of saving.
13. Report Presentation with case studies on any one topic in Energy management.
14. Drawing and analysing the instrumentation diagrams
15. Constructing process flow sheets for chemicals other than prescribed in syllabus
16. Visit a nearby industry learn and analyse the reaction in a batch reactor, mixed reactor and plug flow reactor required for chemical engineering processes.
17. Prepare a list of different types of latest equipment being used in the industries which have replaced the old equipment
18. Establish and follow a selection process to determine the most appropriate reactor type for a specific process
19. List out any five reactors available in market with its specifications and current market price.
20. Collect information from any source on various types of reactors used for particular processes and submit a summary.
21. Each student should visit library to refer to manuals/Journals of Chemical Engineering
22. Visit to any NGO/Public Health Department dealing with the environmental health program
23. Prepare an excel sheet on sources of solid waste in a village/ town in teams.
24. Visit an industry and prepare a report on the toxicity of hazardous chemicals in the work place
25. Write a report about industrial hazards and remedies.

26. Write a report on storage of chemicals in an industry.
27. Prepare a study report on effluent treatment of any chemical industry.
28. Visit an industry and prepare a report on Personal Protection & Equipment Protection
29. Prepare models/ charts for potential methods of disposal of solid waste- a) Open dumping
b) Sanitary Land filling c) Land composting d) Incineration e) Pyrolysis
30. Seminars on Hazardous Waste management
31. Seminars on recycling and reuse.
32. Quiz and Group discussion

1. Information Search and Data collection:

Information search can be done through manufacturer's catalogue, websites, magazines; books etc. Following topics are suggested.

Products of Petroleum refinery and their additives.

Distillation columns

Heat exchangers

Coolants and additives.

Condensers

Industrial pumps

Filtration equipments

Different industrial dryers

Types of Reaction vessels.

Boilers

Cooling towers.

Crystallizers

Composite materials

Applications of Nanotechnology in Chemical Engg.

Evaporators and accessories

Advanced process control systems

Latest developments in saline water treatment

Industrial hazards

Plant maintenance

Industrial safety

Industrial accidents

Fire fighting

Industrial Effluent treatment

Low cost automation

Method for conducting Graded activities

The student should individually select the topic, and search the information related to topic.

The report is strictly hand written document to have knowledge of precise writing and report making based on data collection, Carry out class room presentation.

Group Discussion : Various topics

Pollution control in process industries

Environmental pollution & control.

Effluent treatment.

Fire Fighting / Safety Precautions and First aids.

Computer Networking and Security.

Career opportunities,

Yoga Meditation,

Aids awareness and health awareness.
Use of plastics in automobiles.
Nonferrous Metals and alloys for engineering applications
Surface treatment processes like electroplating, powder coating etc.
Computer aided drafting.
Industrial hygiene.
Composite materials.
Heat treatment processes.
Ceramics
Safety Engineering and waste elimination
Interview techniques.
Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen
Personality development
Exhaust gas analysis.
Process control systems
Analytical instruments.
Industrial utilities.
Biotechnology
Nanotechnology
Recent advancements in refinery processes.
Solid waste management
Packaging technology
Polymer applications
Water purifiers
Saline water treatment

The students shall discuss in group of six students .Some of the suggested topics are

Polythene bags must be banned!
Do we really need smart cities?
E – Books or Printed books – what's your choice?
Is Face book for the attention – seeking and lazy people?
Global warming is caused more by developed countries
Rain forests help in maintaining the earth's ecosystem
NGOs - Do they serve people's interests?
Managers are born, not trained
Managerial skills learnt in the classroom
India's growth rate is bridging gap between rich and poor.
Nuclear power is a safe source of energy
Electronic media vs. print media
Multinational corporations: Are they devils in disguise?
Advertising is a waste of resources.
Technology Creates Income Disparities
Rising petrol prices - Govt. can control?
Smaller businesses and start-ups have more scope
Business and Ethics do not go together
Depreciation of Indian Rupee has only negative impact on the economy
Gold: Best investment or a bursting bubble?
Freedom of press should exist
Computer viruses are good
Food Bill - Is it really something India needs?
Quality is a myth in India.
Indian villages - our strength or our weakness?

Mobile phones - requirement of the day.

Education is a progressive way of discovering your ignorance.

If you are not a part of the solution, you are part of the problem

A room without books is like a body without soul.

E-Learning is good for the education system and society