

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Diploma in Chemical Engineering

SEMESTER-IV

S No.	Board of study	Subject Code	Subject	Periods per week			Scheme of Examination					Total marks	Credit L+(T+P)/2
							Theory			Practical			
				L	T	P	ESE	CT	TA	ESE	TA		
1	Chemical Engg	219411 (19)	Economics, Management and Entrepreneurship Development	3	-	-	100	20	20	-	-	140	3
2	Chemical Engg	219412 (19)	Mechanical Operations in Chemical Engg.	4	1	-	100	20	20	-	-	140	5
3	Chemical Engg	219413 (19)	Chemical Process Tech – I	4	1	-	100	20	20	-	-	140	5
4	Chemical Engg	219414 (19)	Material Technology	4	1	-	100	20	20	-	-	140	5
5	Chemical Engg	219415 (19)	Plant Maintenance, Safety & Environmental Engg.	3	1	-	100	20	20	-	-	140	4
6	Chemical Engg	219421 (19)	Mechanical Operations in Chemical Engg Lab	-	-	3				50	25	75	2
7	Chemical Engg	219422 (19)	Chemical Process Tech – I Lab	-	-	3				50	25	75	2
8	Chemical Engg	219423 (19)	Material Technology Lab	-		3				50	25	75	2
9	Chemical Engg	219424 (19)	Computer Aided Drawing in Chemical Engg - II	-	-	4				50	25	75	2
Total				18	4	13	500	100	100	200	100	1000	30

L – Lecture
ESE – End Semester Examination

T – Tutorial
CT – Class Test

P – Practical
TA – Teacher's Assessment

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Economics, Management and Entrepreneurship
 Development
 (C) CODE : 219411 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219411(19)	3	-	-	100	20	20	-	-	140	3

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	UNIT – I	9	20
2	2	UNIT – II	9	20
3	3	UNIT – III	10	20
4	4	UNIT – IV	10	20
5	5	UNIT - V	10	20

COURSE CONTENTS :

UNIT – I

Production : Definition, objectives, and factors of production : Land, Labour, capital and organization, characteristics and efficiency of labour, division of labour, types of capital. A general idea about production planning and control system.

UNIT - II

Forms of business organization : formation, main features, advantages and disadvantages of following business organizations.

- (a) Single entrepreneurship
- (b) Partnership
- (c) Joint stock companies
- (d) Co-operatives
- (e) Govt. Ownership
- (f) Cottage industries.

UNIT - III

Economics : Various types of costs, expenses and their interrelationships, costing methods.

Depreciation : definition and types of depreciation Introduction to various terms involved in depreciation i.e. Service life, salvage value, junk value, present value, type of present value method of providing depreciation giving no consideration to interest. Straight line method, declining balance method, sum of the years digits method. Simple problems based on these methods.

Definition of the terms Assets, liabilities, proprietorship and equities, maintaining Accounting Records, Journals ledgers and Balance Sheet.

UNIT - IV

- (A) Distinction between administration, management and organization, factors required to constitute an organization, characteristics of organization, principle of organization, organization chart.
- (B) Introduction to shares and debentures, Break even analysis, Break even chart, simple calculation of Break even point, margin of safety, Angle of incidence contribution, profit.

UNIT - V

- (A) Entrepreneurship development : Large scale and small scale production, advantages and disadvantages, qualification and responsibilities of entrepreneur. Factors involved in starting a small scale industry. Role and scope of small scale industries. Types of Govt. assistance to entrepreneur, outlines of project preparations.
- (B) Financial Institutions : Functions and activities of following financial institutions. Commercial banks, co-operative banks. Industrial development banks, Finance corporations, Industrial development corporations, industrial credit investment corporation, unit trust of India.

TEXT/REFERENCE :

- (1) Engineering Economics by Tarachand.
- (2) Industrial Engineering by O.P. Khanna.
- (3) Plant design and economics for Chemical Engineer by Peters and Timmerhaus.
- (4) Industrial management by K.K. Ahuja.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Mechanical Operation in Chemical Engineering
 (C) CODE : 219412 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219412(19)	4	1	-	100	20	20	-	-	140	5
219421(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	Particulate Solids :	16	20
2	2	Size Reduction :	16	20
3	3	Mechanical separations :	18	20
4	4	Mixing and Agitation :	16	20
5	5	Transportation and handling of solids :	14	20

COURSE CONTENTS :

The above titled paper covers the topics on mechanical separation, conveying, size reduction mixing and storage of solids. Three other papers are to be taught the subsequent year.

Unit-I

Particulate Solids :

Properties of particulate solids, Evaluation of size, surface and population of particles. Standard screens and screen analysis. Industrial screening equipments, storage of solids.

Unit-II

Size Reduction :

Reduction equipments and their operations. Crushers, grinder and disintegrators, close and open-circuits and dry and wet operations, power requirement in comminution, Laws of comminution . Rittinger's, Kick's and Bond's laws.

Unit - III

Mechanical separations :

Flow of solid particles through fluids, concept of terminal settling velocity, stoke's law. Free settling and hindered settling Settlers, classifiers, jigs. Batch and continuous thickener and calculation of thickener area. Gravity and centrifugal decanters. Cyclones, Electrostatic and Magnetic separators. Elementary principles of constant rate and constant pressure filtration. Filtration equipments, plate and frame (wash and non-wash) filter-press, rotary drum, leaf-filters and centrifugal filters.

Unit – IV

Mixing and Agitation :

Fundamentals of mixing, Mixing equipments for solid-solid, solid-Liquid and liquid-liquid systems. Flow patterns in agitated vessels. Mixer effectiveness and mixing index.

Unit – V

Transportation and handling of solids :

Mechanical and pneumatic conveying devices-belt, chain and screw conveyors, elevators and pneumatic conveyors.

SUBJECT TITLE :- Mechanical Operation in Chemical Engineering Lab

Practical Code: 219421(19)

Total Hours : 48 hrs.

EXPERIMENTS :

1. Screen analysis - to determine the size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter there from.
2. Industrial screening - to evaluate the overall effectiveness of a given screening equipment.
3. Power requirement in size reduction - to evaluate the Rittinger's constant in respect of the laboratory ball mill and jaw crusher.
4. Particle size distribution in comminuted products - to study the particle size distribution in ball mill products when (i) the run time and (ii) the material to void ratio change.
5. Surface creation in comminution - to evaluate the Rittinger's number of a given sample of particulate solid.
6. Mixing of solids - to determine the degree of mixing of a given binary solid system in a tumbler mixer.
7. Energy consideration in ball mill operations - to study the load-power and speed-power relationship in respect of a ball mill.
8. Particle mechanics - motion of particles through fluids - to determine the particle size distribution in a mass of fine solids (belonging to sub-sieve region) by the methods of decantation.

9. Batch settling test - to study the settling characteristics of a given slurry.
10. Constant pressure cake filtration - to find the mean specific cake resistance in cake filtration using a single leaf-filter.

TEXT/REFERENCE BOOKS :

1. Unit operations of Chemical Engineering by McCabe Smith.
2. Introduction to Chemical Engineering by Badger and Benchro.
3. Chemical Engineering Vol. II by Richardson and Coulson.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Chemical Process Tech. I
 (C) CODE : 219413 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219413(19)	4	1	-	100	20	20	-	-	140	5
219422(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	UNIT – I	16	20
2	2	UNIT – II	16	20
3	3	UNIT – III	16	20
4	4	UNIT – IV	16	20
5	5	UNIT - V	16	20

COURSE CONTENTS :

Study of the following industries covering properties and uses of the product, manufacturing process, chemical reactions, flow sheet, main features of the process and the product, major engineering problems and economics.

UNIT – I

- (A) Unit operations and unit processes, schematic representation of various unit operations and unit processes.
- (B) Sulfur Industry : Mining and purification of sulfur, sulfuric acid.
- (C) Glass industries :- Definition of glass, general composition of glass, raw materials, methods of manufacture of glass, manufacture of special glasses – fused silica and high silica glass

UNIT – II

Chloro-Alkali Industries : Soda ash, caustic soda, sodium carbonate, chlorine, Hydrochloric acid and bleaching powder.

UNIT - III

- (A) Nitrogen Industries : Ammonia, Nitric acid, urea and mixed fertilizers.
- (B) Industrial gases : Hydrogen, Oxygen, Producer gas, water gas, carbureted water gas, acetylene gas.

UNIT – IV

Phosphorous Industries : Phosphorous, Phosphoric acid, super phosphate, triple superphosphate.

UNIT – V

Paint and varnishes : Definition and difference between paint, varnish and laquors.
White lead, Titanium dioxide, Zinc oxide, Lithophone, lead chromate, copper sulphate, Iron oxide.

SUBJECT TITLE – Chemical Process Tech. - I Lab

Practical Code: 219422(19)

Total Hours : 48 hrs.

EXPERIMENTS :

1. Purity test of HCL , HNO₃ and H₂SO₄ acids.
2. Elemental analysis of cement.
3. Ignition loss of limestone.
4. Manufacture of paint.
5. Manufacture of bleaching powder.
6. Nitrogran determination of fertilizer by kzeldhal's method.

TEXT/ REFERENCE BOOKS :

1. Chemical process Technology.
Vol. I by Shukla and Pandey.
2. Outlines of chemical Technology edited by Dryden.
3. Chemical process Industries – shreve.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Material Technology
 (C) CODE : 219414 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219414(19)	4	1	-	100	20	20	-	-	140	5
219423(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	UNIT – I	16	20
2	2	UNIT – II	16	20
3	3	UNIT – III	16	20
4	4	UNIT – IV	16	20
5	5	UNIT - V	16	20

COURSE CONTENTS :

UNIT - I

Properties and behavior of materials useful in structures, machines and equipments, cooling curve for pure iron, Iron-Carbon equilibrium diagram, Micro-constituent of steel and cast iron.

UNIT - II

Corrosion : Corrosion, mechanism of corrosion Types of corrosion, factors influencing the corrosion, methods of corrosion control.

UNIT - III

Non ferrous materials and alloys; Aluminum copper, Nickel, plumbum and monal metal.

UNIT - IV

Ferrous materials : Steel, cast iron, stainless steel alloy steel.

UNIT - V

Non-metallic materials : Karbate, wood, Chemical stoneware, Glass, Graphite, plastic, Rubber, Ceramic materials.

SUBJECT TITLE – Material Technology Lab

Practical Code: 219423(19)

Total Hours : 48 hrs.

EXPERIMENTS :

1. Hardness test of metals.
2. Compressive strength test of metals.
3. Tensile strength test of metals.
4. Toughness test of metals.
5. Impact test of metals.
6. Identification of materials.

TEXT/REFERENCE BOOKS:

1. Materials Science by B.S.Narang.
2. Material Science By R. B. Gupta.
3. Material of construction for chemical process industries by Z.Z.Lee.
4. Chemical Engineering Materials by Frante Runford.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Plant Maintenance, Safety and Environmental Engg.
 (C) CODE : 219415 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219415(19)	3	1	-	100	20	20	-	-	140	4

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	Maintenance	13	20
2	2	Fault finding and trouble shooting	13	20
3	3	Pressure & Temperature related safety	13	20
4	4	Fire, Explosion and its prevention	13	20
5	5	Water Pollution and Solid Waste	12	20

COURSE CONTENTS :

UNIT - I

Maintenance : Introduction to the concept of maintenance, objective and importance of maintenance. Types of maintenance; their significance, advantages and disadvantages. organization structure of maintenance department, control and co-ordination of various related functions.

UNIT - II

Fault finding and trouble shooting : various types of problems and their maintenance associated with the following equipments, piping systems, joints, valves, pumps, blowers and compressors, boiler, furnaces and kilns, Double pipe, shell and tube exchangers, pressure vessels, distillation columns and crystallizers.

UNIT - III

Pressure & Temperature related safety

Introduction to Pressure Relief System and related terms, Pressure relief devices: Types of pressure relief devices and their functioning, Criteria for selection of pressure relief devices, Temperature relief devices, Hotspots effect in fired heater, Runaway reactions, Thermal relief devices: Temperature Relief Valve (TRV).

UNIT – IV

Fire, Explosion and its prevention

Fire: Introduction of Fire: Fire triangle and Fire tetrahedron, Classification of Fire: Class A, B, C, D, Terms related to Fire: Flash Point, Fire Point, Auto Ignition Temperature, Lower Flammable Limit, Upper Flammable Limit.

Factors affecting LFL and UFL, Explosion : Introduction, Classification of Explosion: Detonation, Deflagration, Confined explosion, Boiling liquid expanding vapor explosion, Terms related to Explosion: Lower Explosive Limit, Upper Explosive Limit.

Prevention of Fires & Explosion: Different types of Fire Extinguishers and their application, Inerting, Static Electricity, Ventilation, Sprinkler, Deluge and Foam System, Fire and Gas detection system and their upkeep.

UNIT – V

(A) Water Pollution :

Evaluation, classification and characterization of waste water. BOD and COD analysis. General outline of various types of treatment of waste water i. e. preliminary, primary and secondary treatment. Treatment of waste water from typical Chemical Industries. Rayon, Chloroalkali, paper, dyestuffs and Intermediate.

(B) Solid Waste :

Definition of various terms used to describe solid waste, i.e. Refuse, Rubbers, Garbage etc. Classification of solid waste. Method of disposal and treatments. Open dumping. Sanitary land filling,. Incineration, composting.

TEXT/REFERENCE BOOKS :

1. Industrial Engineering and Management by O.P. Khanna.
2. Environmental Engineering by A. Kamala and B.L. Kanta Rao.
3. Safety and accident prevention in chemical operations by Fawcatt and Word.
4. Chem. Tech. -I Edited by Chemical Engineering Education I.I.T. madras.
5. Maintenance Engineering handbook.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : IV
 (B) SUBJECT TITLE : Computer Aided Drawing in Chemical Engg - II
 (C) CODE : 219424 (19)
 (D) BRANCH/DISCIPLINE : Chemical Engineering
 (E) TEACHING AND EXAMINATION SCHEME :

Course Code	Periods / Week (In Hours)			Scheme of Examination						Credit L+(T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219424(19)	-	-	4	-	-	-	50	25	75	2

COURSE CONTENTS :

1. Process Flow Diagrams.

Block Diagrams & Process Flow Diagrams (PFD) - Utility Line Diagrams (ULD) & Utility Block Diagrams (UBD), Engineering Line Diagrams & Piping and Instrumentation Diagram (PID)

2. Plant & Piping Layout

Typical Plant layout and Piping layout

3. Shell and Tube Heat Exchanger

Types of heat exchanger, Flow arrangement, Tubes and Tube sheet layout, Shell & Tube side passes .

4. Tray Towers & Packed Towers

Tray Tower; Fractionating Column : Shell, Head, Support, Tray types, Down comer and weirs, Flow Pattern on tray, Feed systems, Vapor outlet, Bottom outlet, Man hole, Ladder, Platform, Packed Tower: Shell, Manhole, Support, Vapor outlet, Packing materials, Types of packing, Liquid collector, Liquid distributor.

5. Storage Vessels

Storage of liquids, Standard free roof cylindrical tanks, Standard fixed roof storage tanks, Variable volume tanks, Storage of gases - Spherical vessels of Horton spheres.

6. Reaction Vessels

Classification of reaction vessels, Heating and Cooling systems: Jackets, Coils.

7. Supports and Heads

Supports - Bracket or lug support, Skirt support, Saddle support, Heads or Closures - Plain formed head, Flared and dished head, Shallow dished head, Torispherical dished head, Elliptical head, Hemispherical head, Conical head.

Note : All the topics will be taught on computer during practical.

Practical/Term-work - Practical/term-work will consists minimum twenty sketches based on above topics.

Text/Reference Books:

- Jhon W.Gibbs : "Teach Your self Auto CAD Release 13 for Windows"
- M.V.Joshi : "Process Equipment Design", MACMILLAN India Ltd. 1996 ed.
- K.A.Gavhane: "Chemical Engineering Drawing", Nirali Publication.
- By Experts: " Inside Auto CAD Release 13 for Windows and Windows NT", Prentice Hall Publications.
- George Omura : "Mastring Auto CAD 13 for Windows", BPB Publications.
- Krik Othmer: "Encyclopedia of Chemical Technology", Volume _ 19
- Robert E. Treybal : "Mass Transfer Operation", TMH pub., 3rd ed.
- Max S. Peters, Kalus D. Timmerhaus : "Plant Dsign and Economics for Chemical Engineering", McGraw-Hill International Edition
- Richardson and Couluson; "Chemical Eineering".
