

# CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

## Diploma in Chemical Engineering

### SEMESTER-III

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	219311 (19)	Chemical Process Calculations	4	1	-	100	20	20	-	-	140	5
2	Electrical Engg	219312 (24)	Electrical Engg and Electronics	3	1	-	100	20	20	-	-	140	4
3	Chemical Engg	219313 (19)	Applied Physical and Organic Chemistry	4	1	-	100	20	20	-	-	140	5
4	Mechanical Engg	219314 (37)	Manufacturing Process and Practice	4	1	-	100	20	20	-	-	140	5
5	Mechanical Engg	219315 (37)	Equipment Drawing	3	2	-	100	20	20	-	-	140	4
6	Electrical Engg	219321 (24)	Electrical Engg and Electronics Lab	-	-	3				50	25	75	2
7	Chemical Engg	219322 (19)	Applied Physical and Organic Chemistry Lab	-	-	3				50	25	75	2
8	Mechanical Engg	219323 (37)	Manufacturing Process and Practice Lab	-		3				50	25	75	2
9	Chemical Engg	219324 (19)	Computer Aided Drawing in Chemical Engg. - I	-	-	3				50	25	75	2
Total				18	6	12	500	100	100	200	100	1000	31

L – Lecture

ESE – End Semester Examination

T – Tutorial

CT – Class Test

P – Practical

TA – Teacher's Assessment

## HHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : III  
 (B) SUBJECT TITLE : Chemical Process Calculation  
 (C) CODE (Theory) : 219311 (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		
219311(19)	4	1	-	100	20	20	-	-	140	5

(F) DISTRIBUTION OF MARKS AND HOURS :

S. NO.	CHAPTER NO.	CHAPTER NAME	HOURS / PERIODS THEORY	MARKS
1	1	UNIT – I	14	20
2	2	UNIT – II	16	20
3	3	UNIT – III	18	20
4	4	UNIT – IV	18	20
5	5	UNIT - V	14	20

**COURSE CONTENTS :**

***Unit – I***

Basic and derived Units, Different ways of expressing units of quantities and physical constants.

Molar concept: Inter-relationship between mass and volumetric compositions of mixtures and solutions, and ways of expressing their Compositions Like, eq.wt., Normality, molarity, Molality and PPM etc.

**Unit – II**

**Behaviors of Ideal and real gases** : Boyles law, Charl’s law, Avogadro’s hypothesis, Dalton’s law, Amagats law, vapor pressure, humidity, relative humidity, dew point and use of humidity chart.

***Unit – III***

**Material balance** : Stoichiometric relations governing chemical reactions, concept of limiting and excess reactants, tie and key components percentage conversion and degree of completion, simple recycle, bypass and purging operations, material balance, calculations of some common process.

## **Unit – IV**

### **Energy Balance:**

- (A) Thermophysics : heat capacity of solids, liquids, gases and solutions, simple energy balance for gaseous and gas liquid, liquid-liquid systems.
- (B) Thermochemistry : Heat of formation, heat of reaction and laws of thermochemistry. Energy balance calculations of common chemical processes.

## **Unit – V**

Fuels and combustion, types of fuels, calorific values of fuel, and combustion calculations. Heat of combustion, Air requirement for combustion like theoretical air, excess air, flue gas analysis.

### **Text/Reference**

#### **Books:**

1. Chemical Process Principle by – Hougen and Watson.
2. Stoichiometry by – Bhatt and Vohra.
3. Chemical Process Calculation by – Hemalblau.
4. Chemical Process Calculation by – Chemical Engg. Edu. Development Centre, IIT, Madrass.

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## CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : III  
 (B) SUBJECT TITLE : Electrical Engineering & Electronics  
 (C) CODE (Theory) : 219312 (24)  
 (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		
219312(24)	3	1	-	100	20	20	-	-	140	4
219321(24)	-	-	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	14	20
2	2	UNIT – II	14	20
3	3	UNIT – III	14	20
4	4	UNIT – IV	11	20
5	5	UNIT – V	11	20

**COURSE CONTENTS :**

**Unit – I**

D.C. Circuits and D.C. Machines

- (A) Review of concepts of Electrical Engg. Voltage, current power, resistance, D.C. circuit, Kirchoff's law and Ohm's law.
- (B) Constructional feature of D.C. m/c, Armature winding and E.M.F. equation.
- (C) D.C. Motors and their load characteristics, series, shunt, compound.
- (D) Different types of starters, methods of speed control of D.C. motors.

**Unit-II**

- (A) A.C. Circuits : Alternating current wave forms, Rms, average value, form factor, power factor, R,L, and C in A.C. circuit, 3 phase A.C. star and delta connections, different types of A.C. supply used in common industrial application i.e. 1 phase, 3 phase-3 wire and 3 phase – 4 wire.
- (B) Transformers : Principle of operation of emf equation, transformation ratio, construction detail.

**Unit-III**

3 phase A.C. Machines : Construction features of induction motors, cage type and slipping type : Principles of operation of 3 phase induction motor, slip and slip frequency, application of induction motor. Working principle of single phase induction motor. Synchronous motor and alternator : Construction feature, principle and application.

#### **Unit-IV**

Electrical measuring instruments : main feature, circuit connections and uses of Ammeter, Voltmeter, Wattmeter and Multimeter, Working principles of M.I. and M.C. type instruments.

#### **Unit-V**

Electronics : Semiconductor devices, diode, transistor SCR, Rectifier circuit, H.W. and F.W., filters in power supply circuits, Amplifier action of transistor.

### **SUBJECT TITLE – Electrical Engineering & Electronics Lab**

**Practical Code: 219321(24)**

**Total Hours : 48 hrs.**

#### **Experiments :**

1. Study of D.C. m/c.
2. Speed control of D.C. Motors.
3. Study of D.C. motor starters.
4. Performance of RLC series and parallel circuits.
5. Star and delta connection – verification of phase and line voltage and current.
6. Determination of transformation ratio.
7. Determination of efficiency of a single phase transformer by C.C. and S.C. tests.
8. Study and operation of 3 phase squirrel cage and slop ring induction motors.
9. Study and operation of starters for induction motors.
10. Study and operation of single phase induction motors.
11. Study and mode of connection of different types of measuring instruments.
12. Measurement of power and energy in a single phase circuit.
13. Measurement of power and energy in a 3 phase circuit by 2 wattmeter method.
14. Study of various electronic devices such as diodes, transistors, FET, SCR etc.
15. Study of rectifiers and observation of wave form of CRC.
16. Study of battery charging circuits.

#### **Text/Reference Books:**

1. Electrical Engg. & Electronics by B.L. Theraja.
2. Electrical Measurements by J.B. Gupta – (Dhanpat Rai and Sons Pub.)
3. Elementary Electrical Engg. By H. Partab – (Dhanpat Rai and Sons Pub.)
4. Electrical Engg. By S.I. Uppal – (Khanna Pub.)

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## CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : III  
 (B) SUBJECT TITLE : Applied Physical and Organic Chemistry  
 (C) CODE : 219313 (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		
219313(19)	4	1	-	100	20	20	-	-	140	5
219322(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	17	20
5	5	UNIT – V	15	20

**COURSE CONTENTS :**

**Unit-I**

- (A) Phase Rule : Statement and explanation, Derivation, one component system- water, Two component system-KI Water and Silver-Lead.  
 (B) Distribution Law : Nernst's Distribution law : its explanation and limitations, Henry's law, extraction and multistep extraction, Numerical problems on distribution law and extraction.

**Unit-II**

- (A) Electrochemistry : Conductance of electrolytes and its measurement, classification of electrolytes transport number, Kohlrausch's law and its applications conductometric and potentiometric titrations. Galvanic cells, reversible and irreversible cells, polarization and decomposition potential and over voltage.  
 (B) Ionic equilibria : Ostwald's Distribution law and its limitations. Debye Heich theory of strong electrolytes and degree of ionization, common ion effect and solubility product : their applications numerical on solubility product.

**Unit-III**

- (A) Adsorption : Introduction, Physical and chemi-sorption, their comparisons, freudleich and langmuir Adsorption Isotherms, Application of Adsorption, Ion- exchange Adsorption.
- (B) Crystal Chemistry : Introduction, crystal gnisatropy space lattice, lattice sites and co-ordination number, types of crystal, Defects in crystals, polymorphism and Isomorphism.

#### **Unit-IV**

The concept of hydrocarbon, valance of carbon atom, unsaturation in carbon compounds, Empirical, molecular and structural formula, classification of organic compounds Homologous series IPLIAC system of nomenclature, Isomerism, chain, functional and positional isomerism, types of organic reactions.

#### **Unit-V**

Lab preparation, properties and uses of the following organic compounds, Chloroform, Carbon tetrachloride, Grignard reagent, Oxalic acid, Acetone, Benzene, Ethylamine, Diazonium salt, and phenol.

### **SUBJECT TITLE – Applied Physical and Organic Chemistry Lab**

**Practical Code: 219322(19)**

**Periods: 48 hrs.**

#### **Experiments :**

1. To verify adsorption isotherm.
2. To determine partition coefficient.
3. To find the equilibrium constant for the reaction  $KI + I_2 - KI_3$
4. Furification of common salt.
5. Conductiometric titration.
6. Potentiometric Titration.
7. Estimation of Nitrogen, Sulphur and Halogen organic compound .
8. Identification of halogen, nitro, amino carboxylic, aldehyde and ketonic group in orgnic compounds.
9. Laboratory Preparation of orgnic compounds appeared in unit V.

#### **Text/Reference Books :**

1. Essentials of physical chemistry by B. S. Bahl and G. D. Tuli.
2. Physical chemistry by N. Kkundu and S. K. Jain.
3. Chapters in physical chemistry by B. N. Phadke.
4. A Text book of physical chemistry by K. K. Sharma and L. K. Sharma.
5. Physics & Chemistry – Dr. S. K. Vadhaya.
6. Physical chemistry - Dr. G. L. Agrawal & Other.
7. Organic Chemistry by Bahl and G. D. Tuli.

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**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI**

- (A) SEMESTER : III  
 (B) SUBJECT TITLE : Manufacturing Process and Practice  
 (C) CODE : 219314 (37)  
 (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		
219314(37)	4	1	-	100	20	20	-	-	140	5
219323(37) -	-		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	18	20
2	2	UNIT – II	16	20
3	3	UNIT – III	16	20
4	4	UNIT – IV	16	20
5	5	UNIT – V	14	20

**COURSE CONTENTS :**

**Unit-I**

Metal Casting :

Pattern making : different types of pattern material, types, allowances, cores and core prints, moulding, moulding sand and its composition : types and properties, different moulding processes like green sand moulding, dry sand moulding etc. special moulding processes.

Casting Processes : Pouring equipment, metal casting defects.

**Unit-II**

Metal working : Hot working and cold working recrystallization temp. types of hot and cold processes i.e. rolling, spinning, extraction, forging, drawing etc. simple press units and its parts, press working operations.

**Unit-III**

Metal machining : fundamentals of different machining processes, Lathe machine : general descriptions and operations like turning, threading, grooving, boring etc. Drilling machines : different parts, types and operations like drilling, reaming etc.

#### **Unit-IV**

Metal joining : types of welding processes plastic welding, fusion welding, resistance welding, arc welding, gas welding, welding equipments and tools, types of weld, types of electrode, weldability of metals, other joining techniques, soldering and brazing.

#### **Unit-V**

Powder metallurgy : Introduction, scope, powder making, compaction, sintering, limitations.

### **SUBJECT TITLE – Manufacturing Processes and practice Lab**

**Practical Code: 219323(37)**

**Total Hours : 48 hrs.**

#### **Experiments :**

1. To prepare a solid pattern.
2. To prepare a core box.
3. Practice of making green sand moulding.
4. Pairing of the mould with suitable material e.g. cast iron, aluminum etc. press and searching for different defects.
5. Practice of making a washer on fly press.
6. Practice of making a chisel in smithy shop.
7. Practice of making corner joint and T joint in a welding shop.
8. Practice of spot welding on sheets.
9. Practice of gas welding, making a butt joint.
10. Practice of brazing.
11. Practice of plain turning, step turning, grooving and boring.
12. Practice of knurling and threading.
13. Practice of making drill on flat pieces.
14. Shaping of rectangular job.
15. Practice of sawing, filling and fitting of small rectangular pieces, preparation of edges for welding.
16. Practice of piercing, notching, and circle cutting with the help of a metal master, machine.

#### **Text/Reference Books :**

1. Workshop Technology Vol. I & II by – Hazra Choudhary.
2. Workshop Technology Vol I & II by – Raghuvanshi
3. Manufacturing Science and Technology Vol. I & II by – Suresh Balela.
4. Welding Technology Vol. I by Hazra Choudhary.
5. Foundry Practice, Asia Publication.
6. Workshop technology Vol I & II by Chapman.
7. Mechanical Technology by Charnote.
8. Forging and Forming by Russi and Noff.

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## CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

(A) SEMESTER : III  
 (B) SUBJECT TITLE : Equipment Drawing  
 (C) CODE : 219315 (37)  
 (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		
219315(37)	3	2	-	100	20	20	-	-	140	4

**(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***

Review of orthographic projections, multiview drawing principles and selection of view to describe object, simple problems.

***Unit-II***

Sectional views : Necessity of sectioning, representation types of sectional views such as half and full sectional view problems on sectioning.

***Unit-III***

Pipes and pipe joints : Types and symbols of pipe fittings such as elbow, tee bend, union, crosses nipples, flange plug etc. as per I.S. code requirements pipe joints.

***Unit-IV***

Fastening : Nuts, Bolts, keys, Rivets and Riveted joint, welded joints, cotter joint, pin joint, knuckle joint.

***Unit-V***

Assembly drawing : Glands, stuffing box and flange coupling.

**Text/reference :**

**Books :**

1. Machine Drawing, by N. D. Bhatt.
2. Machine Drawing : N Sidheswar and Shastry.

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## CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : III  
 (B) SUBJECT TITLE : Computer Aided Drawing in Chemical Engg. - I  
 (C) CODE (Practical) : 219324 (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		
219324(19)	-	-	3	-	-	-	50	25	75	2

### COURSE CONTENTS :

#### 1. Introduction To Auto CAD and its Applications

Hardware and software of Auto CAD, Features of Auto CAD, Input Devices, Creating a new drawing, prototype creation, Opening and saving of drawing, Use of menu systems; pull down menu, cursor menu, floating/docked pallets with fly outs, side screen menu, Use of Key board input, Setting of units and limits of a drawing.

#### 2. Drawing Commands

Understanding Co-ordinate Systems; Absolute Co-ordinates, Relative Co-ordinates, Polar Co-ordinates, Creation of lines and polylines, ARC command, Creating Circles and Ellipse, Drawing of uniformly shaped polygon.

#### 3. Editing Commands

Selection of geometry with various options, Creation of groups, Cleaning up a drawing : ERASE, UNDO, REDO, Commands for positioning objects : MOVE, ROTATE, STRETCH, SCALE, Commands for changing an entity's length; TRIM, EXTEND, LENGTHEN, BREAK, Construction editing commands; COPY, MIRROR, OFFSET, ARRAY, FILLET, CHEMFER, Setting of object creation modes, Modifying an entity by DDMODIFY command.

#### 4. Precision Input Commands, Annotating the Drawing and Plotting.

Precision Input Commands ; Controlling the Environment with Drawing Aids dialogue box;, Blips, Highlighting selected objects, Solid fill display, Grid reference, Snap to reference grid, Ortho tool, Transparent commands: ZOOM, PAN, REDRAW, Object Snaps and Running object snap, Creating complex object with BLOCK and WBLOCK, Annotating the Drawing - Dimensioning the object;, Setting the Dimension style, Linear Dimension, Aligned Dimension, Radial Dimension, Angular Dimension, Ordinate Dimension, Baseline Dimension, Continue Dimension, Leader Dimension, Cross-Hatching, Writing Text with - TEXT, DTEXT, MTEXT, Use of layer to organize the drawing; Creating and controlling the layers with DDLMODES, plotting the AutoCAD drawing.

#### 5. Introduction to 3 D drawing

3D drawing using Isometric grid, 3D drawing using Solids and surfaces preparation of 3D solids using commands; extrusion, revolve, etc.

#### 6. Introduction to Pro-Engineer Software

Pro/draw- Define multiple drawing views, Create geometry with user friendly mouse and keyboard interface, Modify geometry easily using a comprehensive set of tools, fully annotate drawing

adhering to industrial standards, Solid modeling with Pro/engineer, (Pro/part) - Feature based, associative and parametric solid modeling, The screen layout, pull down menu, toolbars, display area, message area, Types of sketched feature; Protrusion cut and slot, Use of base feature and datum plane, Extrude, sweep, blend, and Revolve, Duplication; copy, mirror, and pattern.

#### **7. Introduction to Auto LISP**

Understanding the Auto LISP interpreter, Auto LISP Expressions, Variables and Data Types, functions used in AutoLISP: Setq, car, cdr, get point, get corner, Introduction to function for obtaining user input, like getting, get real, get point get string, get angle, An Auto LISP programme to crate BOX.

**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 Enineering".

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