

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G.)**

SCHEME OF TEACHING AND EXAMINATION

SEMESTER IV CHEMICAL ENGINEERING

S. No	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory/ Practical				
							ESE	CT	TA		
1	Chemical Engg.	319411(19)	Fluid and Particle Operations	4	1	-	80	20	20	120	5
2	Chemical Engg.	319412(19)	Computer Applications in Chemical Engg.	3	1	-	80	20	20	120	4
3	Chemical Engg.	319413(19)	Process Economics and Management	3	1	-	80	20	20	120	4
4	Chemical Engg.	319414(19)	Material Technology	4	0	-	80	20	20	120	4
5	Chemical Engg.	319415(19)	Fuel Technology	4	0	-	80	20	20	120	4
6	Appl. Chemistry	319416(11)	Organic Chemistry	4	0	-	80	20	20	120	4
7	Chemical Engg.	319421(19)	Fluid and Particle Operations Lab	-	-	3	40	-	20	60	2
8	Chemical Engg.	319422(19)	Computer Applications Lab in Chemical Engg.	-	-	3	40	-	20	60	2
9	Chemical Engg.	319423(19)	Fuel Technology Lab	-	-	3	40	-	20	60	2
10	Appl. Chemistry	319424(11)	Organic Chemistry Lab	-	-	3	40	-	20	60	2
11	Humanities	300425 (46)	Health , Hygiene & Yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1					
Total				22	3	15	640	120	240	1000	34

L- Lecture, T- Tutorial, P- Practical, ESE- End Semester Exam, TA- Teacher's Assessment

Note (1) : Duration of all theory papers will be of **Three Hours**.

Note (2) : Industrial Training of six weeks is mandatory for B.E. Biotech. It is to be completed in two part. The first part will be in summer after IV sem. after which students have to submit a training report which will be evaluated by the college teachers during B.E. V sem.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G.)**

Semester: B.E.Fourth

Subject: Fluid & Particle Operations

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering

Code: 319411(19)

Total Tut Periods: 10

Note: Internal Choice may be given in any three units

UNIT I Solids, characteristics of solid particles, type of standard screen series screening and other separation methods: screen analysis, estimation of particle size, surface area and particle population based on screen analysis, ideal and actual screens, principles of elutriation, flotation, jigging, Cyclone separator, electrostatics, and magnetic separation processes. [No. of classes: 8 + 2]

UNIT II Size reduction and enlargement, crushers, grinders, disintegrates for coarse & intermediate & fine grinding, energy and power requirements, Rittinger's, Kick's and Bond's Law, work index. [No. of classes: 8 + 2]

UNIT III Mixing and agitation: Axial and radial flow impellers, prevention of vortex, -Liquid Liquid, Liquid-solid and Solid- Solid mixing operations and equipments, power consumption in agitated vessels mixing index.

[No. of classes: 8 + 2]

UNIT IV Sedimentation, settling velocity, flocculation, Thickener, Thickener Design, Classifier. Filtration, filter media, filter aids, batch & continuous filtration, filtration equipment, filter press, leaf, cartridge, vacuum filter, rotary drum filters. [No. of classes: 8 + 2]

UNIT V Conveyers: Belt conveyer, Bucket Elevator, Flight conveyer, Apron conveyer, Screw conveyer, pneumatic conveying. [No. of classes: 8 + 2]

Name of Text books:

1 W. L. McCabe, J. C. Smith & Peter Harriott, 'Unit Operations of Chem. Engg.' 5th Ed. McGraw Hill Pub.

2.Hiramath, Kulkarni, Unit Operation I, Everest Publication, Pune.

Name of Reference books:

1 Badger & Banchero, 'Introduction to Chemical Engg.' McGraw Hill

2 Brown et al., 'Unit operations', John Wiley sons.

3 A.S. Froust ET. al. 'Principles of unit operations', John Wiley and Sons

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI (C.G.)**

Semester: B E Fourth

**Subject: Computer Applications in Chemical
Engineering**

Total Theory Periods: 30

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering

Code: 319412(19)

Total Tut Periods: 10

Note: Internal Choice may be given in any three units

Unit -I Characters used in C++. Data Types; Flow chart Arithmetic Operations & Expressions Relation & Logical Operators. Hierarchy of Operations Standard Library Functions, Header Files [No. of classes: 6 + 2]

Unit II If ----Else, For Loop, While Loop Concept of Array, Multi dimensional Array, Inline Function ,Function For Over loading. [No. of classes: 6 + 2]

Unit III Procedure & Object Oriented Language. Class, Object Inheritance, Polymorphism, over loading. [No. of classes: 6 + 2]

Unit IV File Handling, Pointer, Structures. [No. of classes: 6 + 2]

Unit – V Programs Based on Chemical Engineering Problems. [No. of classes: 6 + 2]

Name of Text Books:

1. Robert Laphore, Object oriented programming C++, Gavesh Publication
2. Kanetkar, Let us C++

Name of Reference Books:

1. Venugopal, Programming in C++.
2. Balagurusamy E, Programming in C++
3. RaviChandran, Programming in C++

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI (C.G.)**

Semester: B E Fourth

Subject: Process Economics & Management

Total Theory Periods: 30

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering

Code: 319413(19)

Total Tut Periods: 10

Note: Internal Choice may be given in any three units

- UNIT I** Small and large scale industries, public sector private sector and joint sector undertaking, and Industrial Finance institutions [No. of classes: 6 + 2]
- UNIT II** Industrial administration – Relationship and scientific management, nature of management, functions of managements, control, organizations and structure, out line of time and motion study and work study [No. of classes : 6 + 2]
- UNIT III** Management of production, plant locations Factory locations, production and cost control, personal management – job evaluations and wages payment plans Factory act, minimum wages act, Trade union act, workman compensation acts [No. of classes : 6 + 2]
- UNIT IV** Factory involved in project cost estimation, methods employed for the estimation of the capital investments and cost estimation in chemical plants Depreciation and methods of its calculations, effects of taxes on depreciations [No. of classes : 6 + 2]
- UNIT V** Evaluation of profitability, return on investments, Studies on alternative investments , Replacement cost and asset accounting , Book keeping Factory records and Balance sheet [No. of classes : 6 + 2]

Name of Text Books:

1. Peter and Timmerhauss, Plant design and economics for chemical engineers
2. Tarachand, Engineering Economics

Name of Reference Books:

1. O P Kharbanda, Process plant and equipment costing

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI (C.G.)**

Semester: B E Fourth

Subject : Material Technology

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering

Code: 319414(19)

Total Tut Periods: 00

Note: Internal Choice may be given in any three units

UNIT – I Properties and behavior of materials useful in structure, machines and equipments, atomic arrangements and imperfections elasticity, micro elasticity and phase transformation. Theories of corrosion and methods of corrosion control. [No. of classes : 8]

UNIT – II Theory of alloying, constitutional diagrams, their construction and applications. Cast iron as material of construction with reference to its application in chemical Engg. [No. of classes : 8]

UNIT – III
Materials of construction and their technology with reference to application in chemical industry mild steel, high carbon steel, stainless steel, high silicon steel, molybdenum and tungsten steel. [No. of classes : 8]

UNIT – IV
Nonferrous metals – copper, aluminum, lead, chromium, tin, brass, bronze and monel. [No. of classes : 8]

UNIT – V Non-metals – Glass, Enamels, chemical stone wares, graphite, wood, plastics, rubber, ebonite lining materials. [No. of classes : 8]

Name of Text Books:

1. Russel E*Gackenbach , Materials selection for process plants .
2. Frank Ramford, Chemical Engineering materials .
- 3.Lee Z.Z.,Materials of construction for chemical process Industries.

Name of Reference Books:

1. Agrawal B.K.. Introduction to Engg Materials.
2. Khurmi R.S., Materials Science.
3. Gupta K.M., Material Science& Engg.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI (C.G.)**

Semester: B E Fourth
Subject: Fuel Technology

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 2

Branch: Chemical Engineering

Code: 319415(19)

Total Tut Periods: 00

Note: Internal choice may be given in any three units

Unit – I Solid fuels Classification of coal & Indian coal reserves. Preparation of coal for market & Storage of coal, Forms of sulphur & mineral matter in coal. Principle of Combustion, mechanical stokers, flue gas analysis

[No. of classes: 6 + 2]

Unit –II

Coal Carbonization & bye product recovery, Physical & Chemical Properties of Coke. Pulverized fuel – its combustion & Burner used.

[No. of classes: 6 + 2]

Unit – III Composition of different gaseous fuels & their calorific values. Producer Gas, Coal Gas and its cleaning & recovery of bye products, Water Gas & Carbureted Water Gas, Natural Gas.

[No. of classes: 6 + 2]

Unit – IV Origin of petroleum - Production & Classification of crude. Indian petroleum resources. Thermal & Catalytic Cracking, Reforming. Polymerization, Alkylation, Isomerisation, Refinery Cycle, Knocking & Octane No. Synthetic Gasoline.

[No. of classes: 6 + 2]

Unit – V Diesel Oil Composition & Manufacture - Ignition Lag & Cetane No., Kerosene and Lubricants, Coal tar, Fuels Sampling & Testing of Liquid Fuels & their treatment by Chemical and Physical Methods. Combustion of Liquid Fuels, their atomization & burners.

[No. of classes: 6 + 2]

Name of Text Books:

- (1) Sarkar Sameer, Fuels & Combustion,
- (2) Gupta, O P, Elements of Fuels Furnace & Refractories

Name of Reference books:

1. Brame & King, Fuels, Solid, Liquid and Gases
2. B.K. Sharma, Fuels & Petroleum Processing
3. Chemistry Of Coal Utilization, Vol I & II

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL
UNIVERSITY, BHILAI (C.G.)**

Semester: B E Fourth

Subject: Organic Chemistry

Total Theory Periods: 40

Total Marks in End Semester Exam: 80

Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering

Code: 319416(11)

Total Tut Periods: 00

Note: Internal Choice may be given in any three units

UNIT I Electronic theory and its application to organic reactions (general treatment). Various types of isomerism.-general introduction to the following classes of compounds treated in and elementary manner to develop the concept of processes.

Aliphatic Compound - Preparation, properties & uses of the followings:-

1. Dicarboxylic acids - oxalic & succinic acid
2. Hydroxy acids - lactic acid, citric acid & tartaric acid
3. Unsaturated acids - malaic & fumeric acid.

[No. of classes : 8]

UNIT II

1. Malonic ester & acetoacetic ester - preparations & their synthetic uses
2. Organometallic compounds – Grignard reagent.
3. Nitrogen compounds - amines & urea.

[No. of classes : 8]

UNIT III

1. Carbohydrates – nomenclature & classification
Glucose, fructose, sucrose cellulose & starch
Aromatic compounds -
Properties & uses of the following -
2. Benzene and homologues — substitution in benzene.

[No. of classes : 8]

UNIT IV

Benzene derivatives - halogen derivatives,
Nitrobenzene, aniline, phenol, diazocompounds, benzoic acid, phthalic acid,
benzaldehyde, benzophenone, benzene sulphonic acids. [No. of classes : 8]

UNIT V

1. Naphthalene & its important derivatives,
2. Heterocyclic compounds - preparations, properties & uses of the following: -
furan, pyrrole, thiophene, pyridine and quinoline. [No. of classes : 8]

Name of Text Books:

1. Bahal Arun, Bahal B.S. A Text Book Of Organic Chemistry S. Chand & Co
2. Soni P.L. A Text Book Of Organic Chemistry S. Chand & Comp.
3. Ahluwalia V. K., Goyal M., A Text Book Of Organic Chemistry, Narosa Publishing House

Name of Reference Books:

1. Finar I.L. Organic Chemistry Vol. I & II Elbs (Longman)
2. Morrison R.T., Boyd R.N. Organic Chemistry Prentice Hall Publ.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G.)**

Semester: B.E. Fourth

Branch: Chemical Engineering

Subject: Fluid & Particle Operations Lab

Practical Code 319421(19)

Total Practical Periods: 36

Total Marks in End Semester Exam: 40

Experiments to be performed (minimum 10 experiments)

- 1 To determine the size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter.
- 2 To determine the size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter (by cumulative method).
- 3 To determine the size distribution of the product of laboratory rod mill.
- 4 To determine the size distribution of the product of laboratory ball mill.
- 5 To evaluate the overall effectiveness of given screen.
- 6 To determine the power required in size reduction and to evaluate the Rittinger's Constant in respect of Laboratory Rod Mill and Ball Mill.
- 7 To determine the degree of mixing of a given binary solid system in Tumbler Mixer.
- 8 7. To determine the size distribution in a mass of fine solids by the method of decantation.
- 9 To study the settling characteristics of the given slurry.
- 10 To determine the power required for crushing in Roll Crusher.
- 11 Study of separation of two liquids in laboratory Centrifuge.
- 12 Determination of filtration time required for a given slurry using filter press for constant rate filtration.
- 13 To determine the size of a Thickener for a given slurry.
- 14 Study of Conveyors.
- 15 To study the separation efficiency of a cyclone separator.

List of Equipments/Machines Required

- 1 Standard Sieves
2. Roll Crusher
3. Sieve Shaker
4. Ball Mill
5. Rod Mill
6. Centrifuge
- 7 Tumbler Mixer
8. Mixer -Settler
9. Decantation Jar
- 10 Filter Press Unit
- 11 Conveyors
- 12 Cyclone separator

Recommended Books:

- 1 W. L. McCabe, J. C. Smith & Peter Harriott, 'Unit Operations of Chem. Engg.' 5th Ed. McGraw Hill Pub.
- 2 Hiramath, Kulkarni, Unit Operation I, Everest Publication, Pune
- 3 Badger & Banchero, 'Introduction to Chemical Engg.' McGraw Hill
- 4 Brown et al., 'Unit operations', John Wiley sons
- 5 A.S. Froust ET. al. 'Principles of unit operations', John Wiley and Sons

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
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Semester: B.E. Fourth
**Subject: Computer Applications Lab in
Chemical Engineering**

Branch: Chemical Engineering
Practical Code: 319422(19)

Total Practical Periods: 36

Total Marks in End Semester Exam: 40

Experiments to be performed (minimum 10 experiments)

- 1 Sum of two Real numbers.
- 2 Find the smallest number among three numbers.
- 3 Find the sum of positive integer between 100-200.
- 4 Program for sum of three digit numbers.
- 5 Find the greatest number among three numbers.
- 6 Sum and reverse of three digit numbers.
- 7 Sum of odd numbers up to N numbers .
- 8 Sum of series $(1+X +X^2 +X^3)$.
- 9 Program for income tax for given income.
- 10 Program for finding average marks.
- 11 Program for finding sum of fibonnaci series.
- 12 Sum of series up to 10 terms.
 $S=!(1+1/2)+(1+1/2+1/3).....$
- 13 Sum of N real numbers.
- 14 Determination of Pr. Number.
- 15 Program for calculation of entropy.
- 16 Factorial of any number.
- 17 Calculation of gravitational force.
- 18 Finding sum of series $s=!+1/2!+1/3!.....$
- 19 Calculation of Re. number.
- 20 Conversion of $^{\circ}\text{C}$ to $^{\circ}\text{F}$.

List of Equipments/Machines Required

- 1 Computer with C++

Recommended Books:

1. Robert Laphore, Object oriented programming C++, Gavesh Publication
2. Kanitkar, Let us C++
- 3 Venugopal, Programming in C++.
- 4 Balagurusamy E, Programming in C++
- 5 RaviChandran, Programming in C++

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G.)**

Semester: B.E. Fourth

Branch: Chemical Engineering

Subject: Fuel Technology Lab

Practical Code 319423(19)

Total Practical Periods: 36

Total Marks in End Semester Exam: 40

Experiments to be performed (minimum 10 experiments)

1. Determination of Viscosity of the Given Oil by RedWood Viscometer No. 1.
2. Determination of Viscosity of the Given Oil by RedWood Viscometer No. 2.
3. Determination of Flash & Fire Point of Given Oil Sample by Pensky-Marten's Apparatus.
4. Determination of Cloud & pour point Of Given Oil Sample.
5. Proximate Analysis of the Given Coal Sample.
6. Determination of Moisture Content in the Given liquid fuel sample.
7. Determination of Moisture Content in the Given Coal Sample by Dean & Stark Method.
8. Determination of Carbon Residue of a Sample of Fuel by Conradson's Apparatus

9. Determination of Penetration No. of the Sample of Grease by Penetrometer.
10. Determination of calorific value of the given fuel sample by Bomb Calorimeter
11. Study of Distillation Characteristics of the Sample of Petroleum Products.
12. Analysis of combustion products using Orsat Apparatus.
13. Ultimate analysis of coal and coal sample.
14. Characterization of crude petroleum.
15. Analysis of coal tar sample.

List of Equipments/Machines Required

1. RedWood Viscometer No. 1
2. RedWood Viscometer No. 2
3. Pensky-Marten's Apparatus.
4. Cloud & pour point Apparatus
5. Dean & Stark Apparatus
6. Conradson's Apparatus
7. Penetrometer
8. Bomb Calorimeter
9. Orsat Apparatus
10. Air Oven
11. Muffle Furnace
12. Petroleum Distillation Unit

Recommended Books:

1. Brame & King, Fuels, Solid, Liquid and Gases
2. B.K. Sharma, Fuels & Petroleum Processing
3. Chemistry Of Coal Utilization, Vol I & II
4. Sarkar Sameer, Fuels & Combustion,
5. Gupta, O P, Elements of Fuels Furnace & Refractories

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI (C.G.)**

Semester: B.E. Fourth
Subject: Organic Chemistry Lab

Branch: Chemical Engineering
Practical Code : 319424(11)

Total Practical Periods: 36

Total Marks in End Semester Exam: 40

Experiments to be performed (minimum 10 experiments)

1. Preparation of Oxalic acid from Sucrose (Cane Sugar) by oxidation with Conc.HNO₃
2. Preparation of p-bromoacetanilide from acetanilide (Bromination)
3. Preparation of m-dinitrobenzene from nitrobenzene(Nitration).
4. Preparation of 2,4,6,trinitroaniline from aniline .
5. Preparation of acetylsalicylic acid from salicylic acid(Acetylation).
6. Preparation of 2,4,6, trinitrophenol (Picric Acid) from phenol(Nitration).
7. Identify the functional group in the given organic compound (Carboxylic acid, Amide, Phenolic)
8. Identify the functional group in the given organic compound (Carbohydrate, Aldehyde, Ketone)
9. Identify the given organic compound (Oxalic, Salicylic, Benzoic, Citric, Pthalic acids).
10. Identify the given organic compound(Phenol, Resorcinol, alpha-naphthol, beta-naphthol)
11. Identify the given organic compound (Glucose, Fructose, Sucrose, Starch).
12. Identify the given organic compound (Acetamide, Benzamide, Urea).

List of Equipments/Machines Required

- (i) Weighing Balance
- (ii) Hot plate
- (iii) Water bath
- (iv) Oven

Recommended Books:-

1. Finar I.L. , Organic Chemistry Vol.I & II , Elbs (Longman)
2. Morrison R.T., Boyd R.N., Organic Chemistry. Prentice Hall Publ.
3. Bahal Arun, Bahal B.S. A text Book Of Organic Chemistry S. Chand & Comp.
4. Soni P.L., A Text Book Of Organic Chemistry, S. Chand & Comp.
5. Ahluwalia V. K., Goyal M., A Text Book Of Organic Chemistry, Narosa Publishing House.

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,
BHILAI**

Semester : IV Sem.

Subject : **HEALTH, HYGIENE & YOGA**

No. of Periods : 2 pds/week

Total Marks in End Semester Exam. : NIL

Minimum number of class tests to be conducted: Two

Branch: Common for all branches

Code : 300425 (46)

Tutorial Periods : NIL

Teacher's Assessment: 40 Marks

UNIT- I

HEALTH & HYGIENE: Concept of health, Physical health and mental health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and undereating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food vs nutritious food; fruits, vegetables cereals and qualities of each of these.

UNIT- II

INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE: History, development, basic concepts, modes of operation of Alopahy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Accurpressure, Accupunture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.

UNIT- III

YOGASANS: Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasan, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Sinhasan, Shashankasan, Surya Namaskar, Halasan, Janushirasan, Utshep Mudra,

UNIT- IV

YOGASANS FOR COMMON DISEASES: From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

- **Modern silent killers:** High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomach disorders, such as, indigestion, acidity, dycentry, piles and fissures, artheritis, its causes, prevention and cure.
- **Asans for relaxation:** Shavasan, Makarasan, Matsyakridasan, Shashankasan.
- **Asans to increase memory and blood supply to brain :** Shirsh padasan, Shashankasan.
- **Asans for eye sight:** Tratak, Neti Kriya .
- **Pranayam :** Definition and types : Nadi Shodhan, Bhastrik, Shitakari, Bhramari useful for students.

UNIT V

CONCENTRATION: Concentration of mind and how to achieve it. Tratak
[1/4=kVd1/2] Concentration on breath, Japa [1/4ti1/2] Ajapajap [1/4vtikti1/2] internal
silence [1/4vUrekSZu1/2] visualization in mental sky [1/4fpnkdk'k /kkj.kk1/2]
Concentration on point of light [1/4T;ksfr /;ku1/2] Concentration on feeling [1/4Hkko
/;ku1/2] Concentration on figure [1/4ewÙkZ /;ku1/2]-

REFERENCES

- (1) Yogic Materia Medica
- (2) Asan, Pranayam and Bandh