

**CHHATTISGARH SWAMI VIVEKANAD TECHNICAL UNIVERSITY,
BHILAI (C.G.)
SCHEME OF TEACHING AND EXAMINATION
BE (Chemical Engineering) IV Semester**

S. No	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam Theory/Practical			Total Marks	Credit
				L	T	P	ESE	CT	TA		
1	Chemical Engineering	319451(19)	Fluid and Particle Operations	4	1	-	80	20	20	120	5
2	Chemical Engineering	319452(19)	Environmental Pollution and Control	3	1	-	80	20	20	120	4
3	Chemical Engineering	319453(19)	Process Stoichiometric Calculations	3	1	-	80	20	20	120	4
4	Chemical Engineering	319454(19)	Material Technology	4	0	-	80	20	20	120	4
5	Chemical Engineering	319455(19)	Fuel Technology	4	0	-	80	20	20	120	4
6	Applied Chemistry	319456(11)	Organic Chemistry	4	0	-	80	20	20	120	4
7	Chemical Engineering	319461(19)	Fluid and Particle Operations Lab	-	-	3	40		20	60	2
8	Chemical Engineering	319462(19)	Environmental Pollution and Control Lab	-	-	3	40		20	60	2
9	Chemical Engineering	319463(19)	Fuel Technology Lab	-	-	3	40		20	60	2
10	Applied Chemistry	319464(11)	Organic Chemistry Lab	-	-	3	40		20	60	2
11	Humanities	319465(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, CT: Class Test, TA: Teachers 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. student. It is to be completed in two parts. 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

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319451(19)
Subject:	Fluid & Particle Operations		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. To study the separation process of solid particle operation.
2. To provide an understanding of the function of size reduction equipments.
3. To familiarize students with mixing and agitation.
4. To provide detailed knowledge of conveyers and filters.

- UNIT- I** Properties of solids, particle size, Separation of solids from solids by screening, Types of screens, comparison in idea and actual screen, screen analysis, screening Equipment, surface area and particle population based on screen analysis, jigging, types of separators: cyclone separator, electrostatics, and magnetic separation processes.
- UNIT-II** Size reduction equipments, Crushers, Grinders, Disintegration of coarse & intermediate & fine grinding, energy and power requirements, Rittinger's, Kick's and Bond's law, Work index.
- 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.
- UNIT-IV** Sedimentation, settling velocity, flocculation, Thickener, Classifier. Filtration, filter media, filter aids, batch & continuous filtration, filtration equipment, filter press, leaf filter, cartridge, vacuum filter, rotary drum filters. Centrifugal filtration
- UNIT-V** Conveyers: belt conveyer, bucket elevator, flight conveyer, apron conveyer, screw conveyer, pneumatic conveyer.

Text Books:

1. McCabe W. L., Smith J. C. & Harriott Peter, Unit Operations of Chem. Engineering., 5th Edition, McGraw Hill Publication.
2. Badger & Bancho, Introduction to Chemical Engineering, McGraw Hill Edition 1997.

Reference Books:

1. G.G. Brown, Unit operations, CBC Publishers, 1995
2. Alan S Foust, Principles of unit operations, John Wiley and Sons, 2nd Edition.

Course outcomes:

1. The student will be able to know about various types of separator.
2. Get the overview how to design and work crusher grinder
3. Understand the concept of mixing and agitation
4. Students are able to work on conveyor.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319452(19)
Subject:	Environmental Pollution and Control		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. The students will understand various aspects of industries for pollution control in their premises so as to comply with newer and tougher laws and acts that are being enforced in India and globally.
2. The principles and methods to control air, water and soil pollution to the students of chemical engineering.
3. The topics cover sources of water, air and land pollution; legislation and standards; Recycle and reuse of waste, energy recovery and waste utilization.
4. Air pollution and its measurement, design of pollution abatement systems for particulate matter and gaseous constituents.

- UNIT- I** Air pollution and meteorology, Air pollution from major industrial operations and some typical chemical industries, Air pollution control methods and equipment.
- UNIT-II** Air pollution sampling and measurement (Analytical methods), Air pollution legislation and regulation.
- UNIT- III** Water pollution- Sources of water pollutants, classification and characteristics of waste water, water pollution control methods and equipment, primary, secondary and tertiary treatment of waste water, legislation regarding prevention and control of water Pollution.
- UNIT-IV** Nuclear waste materials and their disposal, hazards of radioactive materials and their handling, Treatment and disposal of nuclear waste materials, source reduction and recycling of solid wastes.
- UNIT-V** Noise Pollution- evaluation, International standards for control, Noise control criteria, Administrative and engineering control, Effects of noise in Communication, working efficiency, industrial accidents etc, monitoring and control of Noise pollution, Noise measuring instruments.

Text Books:

1. RaoM.N and RaoH.V.N, Air Pollution, Tata McGraw Hill, 1989.
2. RaoS., Environmental Pollution control engineering, Wiley Eastern Limited, 1st Edition.

Reference books:

1. PandeyG.N. and Carney G.C., Environmental engineering,Tata McGraw Hill.
2. SingalS P, Noise Pollution and control, Narosa publishing House, New Delhi 2005.
3. Gill LMc.,Haldan F.R., Air Pollution Handbook, Tata McGraw Hill.

Course outcomes:

- 1 After studying the students are able to treatindustrial effluent.
- 2 Student must be able to understand the concept of water, air and land pollution as well as methods to control air, water and soil pollution.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319453(19)
Subject:	Process Stoichiometric Calculations		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. To provide an understanding of gas behavior.
2. To understand the concept of humidity.
3. To impart significance of theoretical and excess air.
4. To familiar with the material balance, recycle, bypass and purging.

- UNIT- I** Basic and derived units, Expressing compositions on mass basis, mole basis, normality etc and interconversions. Concept of stoichiometric relations. Numerical problems to illustrate these principles.
- UNIT-II** Calculations of pressure, volume and temperature using ideal gas law. Gaseous mixtures, vapor pressure, partial pressure. Gases in chemical reaction.
- UNIT- III** Humidity and saturation, Wet and dry bulb thermometry, Solubility and crystallization, Illustrative numerical problems based on above.
- UNIT-IV** Material Balance with chemical reactions, Limiting reactant and excess reactant, conversion, yield. Recycle operations.
- UNIT-V** Energy balances, Combustion calculations, Fuel and flue gas analysis, Air fuel ratio, Percentage excess air, Heat capacity calculations. Enthalpy changes associated with chemical reactions.

Text Books:

- 1 Bhatt B.I. and Vora S.M., Stoichiometry, McGraw Hill Publications, 4th Edition.
- 2 Hougen and Watson, Chemical Process Principles (Part – I Material and Energy Balance), CBC Publishers, 2nd Edition

Reference Books:

1. Himmelblau David M, Basic Principles and Calculations in Chemical engineering, Prentice Hall, 6th Edition.
2. Ghoshal, Sanyal, & Datta, Introduction to Chemical Engineering, Tata McGraw Hill, 5th Edition.

Course outcomes:

1. Students will gain an understanding of gas and liquid behavior.
2. Students will be familiar with the material balance, recycle, bypass and purging.
3. Students will be able to understand the concept of Energy balances, Combustion calculations.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319454(19)
Subject:	Material Technology		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. To give the students knowledge of corrosion and their control method.
2. To give the students knowledge of oxidation and reduction reactions as they relate to engineering applications, such as corrosion.
3. To give the students knowledge of behavior of materials useful in chemical equipments.

UNIT- I Introduction to materials, Properties and behavior of materials useful in structure, machines and equipments, Atomic arrangements in material and imperfections, Elasticity, micro elasticity and phase transformation, Theories of corrosion and methods of corrosion control.

UNIT-II Theory of alloying and their construction, Applications of alloys in industries, Constitutional diagrams, Cast iron as material of construction with reference to its application in chemical Engineering.

UNIT- III Materials of construction with reference to application in chemical industry, Mild steel, High carbon steel, Stainless steel, High silicon steel, Molybdenum and tungsten steel.

UNIT-IV Nonferrous metals – Copper, Aluminum, Lead, Chromium, Tin, Brass, Bronze and Monel metal.

UNIT-V Non-metals – Glass, Enamels, Chemical stonewares, Graphite, Wood, Plastics, Rubber, Polymers and Ceramics.

Text Books:

1. Agrawal B.K., Introduction to Engg Materials, Tata McGraw Hill, Edition 1988.
2. Khurmi R.S., Materials Science, S Chand, 1st edition.

Reference Books:

1. Gupta K.M., Material Science & Engineering, Umesh Publication, 1st Edition.

Course outcomes:

1. Students will gain an understanding of oxidation and reduction reactions as they relate to engineering applications, such as corrosion.
2. To study and behavior of materials useful in chemical equipments

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319455(19)
Subject:	Fuel Technology	Total Tutorial Periods:	NIL
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

1. To study the types of fuel and their characteristics and uses.
2. To study the classification, preparation and storage of solid fuels.
3. To understand the carbonization process and physical and chemical properties of coke.
4. To understand the composition manufacturing, testing and treatment of liquid fuels.
5. To know the composition and calorific values of different types of gaseous fuels.

- UNIT- I** Types of coal, classification of coal, Indian coal reserves, Preparation and pretreatment of coal, Storage of coal, Coal washing process, Mechanical stokers.
- UNIT-II** Coal carbonization & bye product recovery, Physical & chemical properties of coke. Pulverized fuel, Proximate and Ultimate analysis.
- UNIT- III** Origin of petroleum, Classification of crude petroleum, Indian petroleum resources. Thermal & catalytic cracking, Knocking & Octane Number, Flash & Fire Point, Cloud & Pour Point, Redwood Viscometer.
- UNIT-IV** Diesel oil composition, Ignition Lag & Cetane number, Kerosene and Lubricants, Coal tar Fuels, Sampling & Testing of liquid fuels, Liquid fuel burners, Atomizing oil burners, Vaporizing oil burners, Fractional Distillation.
- UNIT-V** Composition of different gaseous fuels & their calorific values, Study producer gas, Coal gas, water gas, carbureted water gas & natural gas, Combustion process and calculations.

Text Books:

1. Sarkar Samir, Fuels & Combustion, Orient Longman Limited 2nd Edition.
2. Brame & King, Fuels, Solid, Liquid and Gases, London, E. Arnold [1961, ©1955] 4th Edition.

Reference books:

1. Gupta O.P., Elements of Fuels Furnace & Refractories, Khanna Publishers, 3rd Edition.

Course outcomes:

1. The students will be able to understand the origin of fuels and their characteristics.
2. The students will be able to understand the application of fuel in daily life as well as in industries.
3. The students will be able to understand how the quality of fuel to be enhances.
4. The students will be able develop the instrument in which these fuels are used.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Chemical Engineering	Code:	319456(11)
Subject:	Organic Chemistry	Total Tutorial Periods:	NIL
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

1. To make students familiar and aware about various important concept of organic chemistry like preparation, properties and uses of aliphatic compounds, organometallic compounds, amines, urea, esters, carbohydrates, benzene and its derivatives, heterocyclic compounds etc.
2. Make them learn about important organic compounds and their industrial application.
3. For giving them idea about important mechanisms of chemical reaction like electrophillic substitution reactions, Cannizaro reaction, Benzoin condensation, Riemer-Tiemann reaction, Perkin reaction, Aldol condensation etc which will help in managing industrial processes and conditions.
4. Make students to perform experiments related to organic compound synthesis, organic compound identification, and functional group test to create better ways of productions.
5. Make students able to do some important chemical production.

UNIT- I Preparations properties and uses of electronic theory and its application to organic reactions. Various types of isomerism, Aliphatic compounds, Dicarboxylic acids - oxalic & succinic acid, Hydroxy acids, lactic acid, citric acid & tartaric acid, Unsaturated acids – malic & fumaric acid.

UNIT-II Malonic esters & acetoacetic esters, preparations & uses, Organometallic compounds – Grignard reagent, Nitrogen compounds - amines & urea.

UNIT- III Carbohydrates – nomenclature & classification of glucose, fructose, sucrose cellulose & starch, Aromatic compounds- properties and uses, benzene and homologue, substitution in benzene, Huckel's rule of aromaticity.

UNIT-IV Benzene and halogen derivatives: nitrobenzene, aniline, phenol, diazocompounds, benzoic acid, phthalic acid, benzaldehyde, benzophenone, benzene sulphonic acids.

UNIT-V Naphthalene and naphthalene derivatives, Heterocyclic compounds: preparations, properties & uses of furan, pyrrole, thiophene, pyridine and quinoline.

Text Books:

1. Bahal A., Bahal B.S. , A Text Book of Organic Chemistry S. Chand & Cooperation, 14th Edition.
2. Soni P.L., A Text Book of Organic Chemistry, S. Chand & Company.
3. Ahluwalia V. K., Goyal M., A Text Book of Organic Chemistry, Narosa Publishing House.

Reference Books:

1. Finar I.L, Organic Chemistry Volume I & II, Elbs Publishers, (Longman)
2. Morrison T. R. & Boyd, Organic Chemistry, Prentice Hall Publication, 6th Edition.

Course outcomes:

1. The students will be able to understand the concept of state of matter.
2. The students will be able to understand the practical knowledge of titration.
3. Familiar and aware about various important concept of organic chemistry.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Chemical Engineering**

Subject: **Fluid & Particle Operations Laboratory**

Semester: **IV**

Code: **319461(19)**

Total Lab Periods: **36**

Batch Size: **15**

Maximum Marks: **40**

Minimum Marks: **20**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Determination of size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter.
2. Determination of size distribution of a sample of particulate solid by sieve analysis and to evaluate the average particle diameter (by cumulative method).
3. Determination of size distribution of the product of laboratory rod mill.
4. Determination of size distribution of the product of laboratory ball mill.
5. To evaluate the overall effectiveness of given screen.
6. Determination of power required in size reduction and to evaluate the Rittinger's constant in respect of laboratory rod mill and ball mill.
7. Determination of degree of mixing of a given binary solid system in Tumbler Mixer.
8. Determination of size distribution in a mass of fine solids by the method of decantation.
9. To study the settling characteristics of the given slurry.
10. Determination of 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. Determination of the size of a Thickener for given slurry.
14. Study of Conveyors.
15. Study the separation efficiency of a cyclone separator.

Equipment/Machines/Instruments/Tools/Software Required:

- Ball Mill
- Rod Mill
- Pot Mill
- Roll Crusher
- Centrifuge

Recommended Books:

1. McCabe W. L., Smith J. C. & Harriott Peter, Unit Operations of Chemical Engineering, McGraw Hill Publication, 5th Edition
2. Badger & Banchemo, Introduction to Chemical Engineering, McGraw Hill, 1st Edition.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program: **Bachelor of Engineering**
Branch: **Chemical Engineering**
Subject: **Environmental Pollution & Control Laboratory**
Semester: **IV**
Code: **319462(19)**
Total Lab Periods: **36**
Maximum Marks: **40**
Batch Size: **15**
Minimum Marks: **20**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Determination of BOD value of the given sewage sample.
2. Determination of COD value of the given sewage sample.
3. Determination of DO, TDS, Temperature, Conductivity and ORP of water sample by portable water analysis kit.
4. Determination of acid - base characteristics of given waste water sample using digital pH meter.
5. Determination of percentage composition of given solution by photoelectric colorimeter.
6. Determination of percentage absorption, percentage concentration percentage composition of given solution by UV-VIS Spectrophotometer
7. Determination of presence of alkali metals in the given solution using Flame Photometer.
8. Determination of turbidity of given sample using Nephelo-Turbidity meter.
9. Physico-chemical analysis of soil
10. Determination of SPM concentration in polluted air sample
11. Analysis of oil & grease in wastewater sample
12. Determination of hardness of water
13. Determination of fluoride, silica, sodium, calcium, potassium, magnesium, sulphide, sulphate, phosphate, nitrate, iron and heavy metals

Equipment/Machines/Instruments/Tools/Software Required:

- pH Meter
- TDS Meter
- Conductivity Meter
- UV-VIS Spectrophotometer
- Flame Photometer
- Portable water analysis kit
- BOD Incubator

Recommended Books:

1. Dara S.S., A Text book on experiments and calculation in engineering chemistry, S. Chand Company.
2. Rao M.N and Rao H.V.N, Air Pollution, Tata McGraw Hill, 1989.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Chemical Engineering**
Subject: **Fuel Technology Laboratory**

Total Lab Periods: **36**
Maximum Marks: **40**

Semester: **IV**
Code: **319463(19)**
Batch Size: **15**
Minimum Marks: **20**

List of Experiments: (At least Ten experiments are to be performed by each student)

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 nitrogen in coal by Kjeldahl method.
9. Determination of penetration Number of the sample of grease by Penetrometer.
10. Determination of calorific value of the given fuel sample by bomb calorimeter
11. Study of flue gas analysis by Orsat apparatus.
12. Study of Distillation Characteristics of the sample of petroleum products.
13. Study of Ultimate analysis of coal.
14. Study of characteristics of crude petroleum.
15. Analysis of coal tar sample.

Equipment/Machines/Instruments/Tools/Software Required:

- Redwood Viscometer no.1
- Redwood Viscometer no.2
- Peneskey Martine Closed cup Apparatus
- Cloud and Pour Point apparatus
- Hot Air Oven
- Muffle Furnace
- Kjeddal Apparatus
- Orset apparatus
- Dean and Stark apparatus
- Penetrometer

Recommended Books:

1. Sarkar Samir, Fuels & Combustion, Orient Longman Limited, 2nd Edition.
2. O.P. Gupta, Elements of Fuels Furnace & Refractories, Khanna Publishers, 3rd Edition.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Chemical Engineering**
Subject: **Organic Chemistry Laboratory**

Semester: **IV**
Code: **319464(11)**
Batch Size: **15**
Minimum Marks: **20**

Total Lab Periods: **36**
Maximum Marks: **40**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Preparation of oxalic acid from Sucrose (cane sugar) by oxidation with concentration 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 and Phthalic acid).
10. Identify the given organic compound (Phenol, Resorcinol, alpha-naphthol, beta-naphthol)
11. Identify the given organic compound (Glucose, Fructose, Sucrose, and Starch).
12. Identify the given organic compound (Acetamide, Benzamide, and Urea).

Recommended Books

1. Bahal Arun, Bahal B.S. , A Text Book Of Organic Chemistry , S. Chand & Cooperation, 14th Edition.
2. Robert Thornton Morrison & Boyd” Organic Chemistry” Prentice Hall Publication 6th Edition.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Chemical Engineering**

Subject: **Health, Hygiene & Yoga**

Semester: **IV**

Code: **319465(46)**

No. Of Periods: **2 Periods/Week**

Total Tutorial Periods: **NIL**

Maximum Marks: **40**

Minimum Marks: **24**

Course Objectives:

- 1 To provide understanding the importance of health.
- 2 To provide insight into the hygiene aspect & quality of life.
- 3 To study the concepts of various medical therapy.
- 4 To practice the various yogasans.
- 5 To provide knowledge about common diseases and its cure through yagasans and pranayam.
- 6 To develop concentration through various methods.

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 underrating, 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 MateriaMedica with symptoms, causes, asans and herbal treatment.

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

UNIT-V CONCENTRATION: Concentration of mind and how to achieve it. Tratak (त्राटक), Concentration on breath, Japa (जप), Ajapajap (अजपाजप), internal silence (अन्तर्मान), visualization in mental sky (चिदाकाश धारणा), Concentration on point of light (ज्योति ध्यान), Concentration on feeling (भाव ध्यान), Concentration on figure (मूर्त्त ध्यान).

Text Books:

Health, Hygiene & Yoga, Dr P B Deshmukh, Gyan Book Pvt Ltd. New Delhi.

Reference Books:

- (1) Yogic MateriaMedica
- (2) Asan, Pranayam and Bandh.