

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

Sl. No	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Applied Mathematics	319351(14)	Mathematics-III	4	1	-	80	20	20	120	5
2	Chemical Engineering	319352(19)	Inorganic Process Technology	4	-	-	80	20	20	120	4
3	Chemical Engineering	319353(19)	Fundamentals of Chemical Engineering	3	1	-	80	20	20	120	4
4	Chemical Engineering	319354(19)	Applied Physical Chemistry	3	1	-	80	20	20	120	4
5	Mechanical Engineering	319355(37)	Strength of Materials	3	1	-	80	20	20	120	4
6	Chemical Engineering	319356(19)	Instrumentation & Measurement	3	1	-	80	20	20	120	4
7	Chemical Engineering	319361(19)	Inorganic Process Technology Lab	-	-	3	40		20	60	2
8	Chemical Engineering	319362(19)	Applied Physical Chemistry Lab	-	-	3	40		20	60	2
9	Mechanical Engineering	319363(37)	Strength of Materials Lab	-	-	3	40		20	60	2
10	Chemical Engineering	319364(19)	Instrumentation & Measurement Lab	-	-	3	40		20	60	2
11	Humanities	319365(46)	Value Education	-	-	2	-		40	40	1
12			Library	-	-	1					
Total				20	5	15	640	120	240	1000	34

*L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment
Note: Duration of all theory papers will be of Three Hours.*

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319351(14)
Subject:	Mathematics - III		
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 overview of the concepts and results in complex analysis that may be useful in engineering.
2. To give an introduction to Partial differential equations and Laplace transform having considerable engineering application.

- UNIT- I** Fourier series-Euler's formula, Functions having points of discontinuity, Change of interval, Even and odd functions, Half range series, Harmonic analysis, Introduction and properties of Fourier transforms.
- UNIT-II** Laplace transforms- definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by t^n , Division by t , Evaluation of integrals, Inverse Laplace transform, Convolution theorem, Unit step function, Unit impulse function, Periodic function, Application to solution of ordinary differential equations.
- UNIT- III** Partial differential equation- formation (by elimination of constants and function), Solution by direct integration method, Linear equation of first order, Homogeneous linear equation with constant coefficients, Non-homogeneous linear equations, Charpit's method, Method of separation of variables (including solution of two dimensional Laplace equation).
- UNIT-IV** Complex variable- derivative, Cauchy-Riemann equations, Analytic functions, Harmonic functions, Holomorphic function, Flow problems, Complex integration, Cauchy residue theorem (without proof), Cauchy integral formula, Taylor & Laurent series, Singularity, Residue, Evaluation of real definite integrals.
- UNIT-V** Statistics-Random variables, Discrete & continuous probability distributions, Mean & standard deviation, Moments & moment generating function, Distributions- Binomial, Poisson and normal distributions.

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 41th Edition.
2. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern, 5th Edition.

Reference Books:

1. Jain, R.K. and Lyengar S.R.K. Advanced Engineering Mathematics, Narosa Publishing House, 2nd Edition.
2. Pathak, H.K. Applied engineering Mathematics-3, Shiksha Sahitya Prakashan, 2nd Edition.
3. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill, 2007

Course outcomes:

1. After studying this course the students will be able to apply and derive solutions from knowledge of mathematics.
2. After studying this course the students will be able to identify, formulate and solve engineering problems.
3. After studying this course the students will be able to apply the concepts of Fourier series and transforms to the engineering problems.
4. After studying this course the students will be able to model the engineering problems into partial differential equations and obtain the solutions using various methods.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319352(19)
Subject:	Inorganic Process 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 industries with reference to its available raw materials, manufacturing process and process flow diagrams, Unit operations and Unit process involved.
2. To study economic aspects and general engineering problems associated with present status of the industry.

- UNIT- I** Fundamentals of inorganic process technology, Soda Ash, Caustic Soda, Salt Industries, Chlor - alkali industries, Br₂ and Cl₂ from sea water, Glauber Salts, Problems related to industries.
- UNIT-II** Sulfur, Sulfuric Acid Industries, Production of sulfuric acid by contact process, DCDA process and Chamber process, Production of alumina from bauxite ore, electrochemical industries, Use of Cl₂, Br₂, and I₂ in industries.
- UNIT- III** Nitrogen industries and nitrogen related compounds, Production of NH₃ and HNO₃, Production of urea, production of ammonium sulfate, Fertilizer industries, Biofertilizers, Explosive.
- UNIT-IV** Acetylene (C₂H₂), Hydrogen by steam reforming process. Uses of industrial gases. Phosphoric acid, Single super phosphate, Triple super phosphate, Portland cement production.
- UNIT-V** Carbohydrates and fermentation industry: Cane sugar refining and decolorization, Sucrose from sugarcane, Beet sugar manufacture, production of ethyl alcohol.

Text Books:

1. Gopal Rao, M, Dryden's Outline of Chemical Technology, EWP publishers, 3rd Edition.
2. Austin, G T, Shreve's Chemical Process Industries, Tata McGraw Hill, 5th Edition

Reference Book:

1. Pandey G.N., A Text Book of Chemical Technology Volume 1, Vikash Publishers, 2nd Edition.

Course outcomes:

1. After undergoing this course the students will acquire knowledge regarding various technological aspects of chemical industries.
2. After undergoing this course the students will acquire knowledge regarding manufacturing process, aspects and general engineering problems associated with it.
3. Students get the overview of production of acid and fertilizers.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319353(19)
Subject:	Fundamentals of Chemical Engineering		
Total Theory Periods:	40	Total Tutorial Periods:	NIL
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. To introduce the students to understand fundamental knowledge of various unit operation unit processes
2. To introduce the students to understand fundamental knowledge of PI diagram and general behavior of chemical Engineering.

- UNIT- I** History, introduction and scope of Chemical Engineering, Overview of industrial scenario, recent developments and Future Prospects.
- UNIT-II** Concept of stage wise and continuous operation, Material and energy balance flow sheet, Symbols of equipment, P&I diagram.
- UNIT- III** Classification of Unit operations and general conceptual introduction to primary equipments for heat transfer evaporation, distillation, absorption, drying, etc.
- UNIT-IV** Classification of Various Unit processes with reference to its industrial application. Conceptual introduction to oxidation, Hydrogenation, Nitration, Polymerization, Chlorination etc.
- UNIT-V** New Horizons in Chemical Engineering, Energy, Environment and Sustainable Development, Overview of Conventional and Non-conventional Energy - A comparative and futuristic outlook.

Text Books:

1. McCabe, W. L., Smith J. C. &Herriot P, Unit Operations of Chem. Engineering., 5th Edition, McGraw Hill Publication.
2. Badger and Banchero , Introduction to Chemical Engineering, 1st Edition, McGraw Hill, New York, 1954.

Reference book:

1. Perry's John H, Chemical Engineers Handbook, McGraw Hill, 8th Edition. Press New York, 1990.

Course outcomes:

1. Students will be able to understand fundamental knowledge of various unit operation unit processes
2. Students will be able to understand fundamental knowledge of PI diagram and general behavior of chemical Engineering.
3. Students will be able to understand fundamental knowledge of sulphonation,polymerization, oxidation, hydrogenation, saponifoication , etherification, nitration, chlorination.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319354(19)
Subject:	Applied Physical Chemistry	Total Tutorial Periods:	10
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 and elementary concept of physical chemistry like Solid and Liquid state, Phase rule, nuclear chemistry, Kinetics, Electrochemistry etc.
2. Make them learn about important physical methods and their industrial application like Fractional Distillation and Steam Distillation, Conductometric Titration etc.
3. Make them aware about the maximum use of renewable source of energy i.e. nuclear energy and different nuclear reactions.
4. For giving them idea about important physical process like conductivity, photo physical process etc which will help in managing industrial processes and conditions.

- UNIT- I** Solid state: Elementary ideas of crystalline state, shapes, lattices unit cells, crystal planes, X-Ray and crystal Structure, Bragg's equation. Structure of solids, non- metals and simple inorganic compounds, Solution of gases in liquid, Influence of pressure Henry's Law, Raoult's Law, Ideal and non Ideal solution, Lowering of vapor pressure and elevation of boiling points, Solution of liquid in liquid, Vapor distillation of liquid mixtures.
- UNIT-II** Osmosis and osmotic pressure: Determination of osmotic pressure by Berkley & Hartley's method and Moss and Frazer's Method. Semipermeable membrane and its mechanism, Osmotic pressure and pressure relationship, Abnormal osmotic pressure, Chemical kinetics, Rate of a chemical reaction, Rate law and rate constant, Order and molecularity of a reaction, Effect of temperature on rate of reaction, Theories of reaction rate.
- UNIT- III** Phase rule: One component system, Water system, Sulfur system, Two components System, Salt hydrates (FeCl_2 -water & Na_2SO_4), Distribution law. Adsorption: Adsorption of gases, Types of adsorption, Langmuir's adsorption isotherm, physical adsorption isotherms. Gibb's equation, Applications of adsorption.
- UNIT-IV** Electrochemistry: Conductance of electrolytes, Laws of electrolysis & its significances, Migration of ions & Kohlrausch law, Transference numbers and its determination, Equivalent Conductance and its measurement, E.m.f. and its measurement, Free energy changes in cells, Proton transfer theory, Ionization constant, pH – Scale and buffer solution, Theory of indicator, Application of conductivity measurements, conductometric titrations.
- UNIT-V** Photochemistry: Lambert's Law, Grotthus - Draper Law, Einstein's Law of Photo-chemical equivalence, and photochemical reaction, Quantum Yield, Dissociation of HI and photochemical reaction of H and Cl, Photo physical process. Nuclear chemistry: Radio activity, Detection of ionizing radiation, Group displacement law, Determination of rate of radioactive disintegration, Radio- active series. Isotopes and their separation, Nuclear reactions, Nuclear energy.

Text Books:

1. Glasstone Samuel, Text Book of Physical Chemistry, Macmillan, 2nd Edition.
2. GurdeepR, Advanced Physical Chemistry, Goel Publishing House, Meerut, 21st Edition.

Reference book:

1. Bahl&Bahl, Essentials of Physical Chemistry, S. Chand , 23rd 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 electrochemistry.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319355(37)
Subject:	Strength of Materials		
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. This course aims at giving an insight to students about the behavior of material under external forces.
2. This course aims at teaching the students the concept of stress, strain elasticity etc as applied to various structural members under loading are included.

- UNIT- I** Stresses & Strain, Hooke's law, Elastic limit, Yield stress, Ultimate stress, Working stress, Factor of safety, Poisson's ratio, Shear stress and strain, Modulus of rigidity, Bulk modulus, Relationship between elastic constants, Thermal stresses.
- UNIT-II** Principal planes and Principal Stresses (two-dimensional)- Mohr's circle of stress. Mechanical properties of metals, Testing of materials, Classification and importance of mechanical tests, Destructive test, Nondestructive test.
- UNIT- III** Loads, support, Types of beam, shear force and bending moment, calculation of shear force and bending moment at any section, shear force diagram, bending moment diagram, Relation between load, shear force and bending moment, inclined loading, simply supported beam with couples. Bending and shearing stresses in a beam, position of simple neutral axis, Theory of simple bending, Design criteria and section modulus, Practical application of bending equation.
- UNIT-IV** Bolted joint, Welded joint, types of riveted connections, Failure of riveted joints, types of welds, strength of welds, Fillet welding of unsymmetrical section.
- UNIT-V** Stresses and Strains in thin cylindrical and spherical shells subjected to internal pressure, Design of thin cylindrical shell, Stresses in walls of thick cylinders under internal pressure (excluding compound cylinders). Lamé's equations.

Text Books:

1. Ramamrutham S., Strength of Materials, DhanpatRaiPublication, 15th Edition.
2. Singh Sadhu , Strength of Materials , Khanna Publishers , 5th Edition

Reference Books:

1. Rajput R.K., Strength of Materials, S.Chand, 1st Edition.
2. Popov P.E. ,Engineering Mechanics of Solids, Prentice Hall of India ,Eastern Economy,Edition

Course outcomes:

After completing this course the students should be able to solve

1. Cases of axially loaded members for stresses
2. Beams under bending for stresses
3. Know the basic of mechanical design of process vessels
4. Solve transversely loaded beams for internal shear forces, bending moments and deflection.
5. Understand the importance and application of material testing.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Chemical Engineering	Code:	319356(19)
Subject:	Instrumentation and Measurement		
Total Theory Periods:	40	Total Tutorial Periods:	NIL
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

1. This course is designed to familiarize the students with various instrumental methods and measurement techniques of chemical analysis that engineers come across during their course work.
2. Introduction to the principles of chemical analysis, matrix effects, detailed instrumentation, operation and interpretation of data, error analysis and statistical methods of data handling.
3. Standard Operation Techniques of Pressure measurement instruments, Flow measurement instruments, Liquid level measurement instruments and analytical measurement instruments

UNIT- I Principles of measurement: Error analysis, Static & dynamic characteristics of measurements, Dynamic response of I & II order instruments. Temperature measurement: Expansion thermometers, Thermocouples, Resistance temperature detectors, Thermistors & pyrometers and their calibrations.

UNIT-II Pressure measurement: Manometers, Bourdon tubes, Bellows, Measurement of gage pressure and vacuum. Measurement of absolute pressure, McLeod gage, Pirani gage, Ionization gage, Vacuum sensor, Thermal vacuum sensor, Response of mechanical pressure gages, Strain Gages & LVDT.

UNIT- III Building blocks of an instrument: Classification, Principals and applications of transducer & amplifier. Signal conditioner, its isolation and signal transmitter. Display data acquisition modules, I/O devices, Interfaces. Flow measurement: Head flow meters, Area flow meters, Open channel meters, Positive displacement meters, Control valves and their characteristics.

UNIT-IV Liquid level measurement: Direct level measurement, Interface measurement, Hydrostatic head level measurement in pressure vessels, Ultrasonic level devices, Point & continuous level measurement using radioactive devices, Capacitance type devices, Resistance sensors, Nuclear radiation type level gages & level switches.

UNIT-V Analytical instrumentation: Gas Chromatography, Operating principles, Type, Components & applications, High performance liquid chromatography, Refractive index, pH, viscosity, density & conductivity measurement, Gas analyzers.

Text Books:

1. Johnson C., Process Control Instrumentation Technology, 8th Edition, Prentice-Hall. (2005)
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications (1975)

Reference Books:

1. Nakra B.C. and Chaudhary K.K., Instrumentation, Measurement and Analysis, 2nd Edition, Tata McGraw Hill (2004)
2. Andrew W. G. Applied Instrumentation in the Process Industries, Volume I, II & III, Gulf Publication. (1993)

Course outcomes:

1. At the end of the course the students would be able to handle the analysis at mg, ppm and ppb levels by appropriate instrumental methods.
2. Students will understand the procedure to operate and handle the Pressure measurement instruments, Flow measurement instruments, Liquid level measurement instruments and analytical measurement instruments.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Chemical Engineering**

Subject: **Inorganic Process Technology Laboratory**

Semester: **III**

Code: **319361(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 percentage purity of H_2SO_4 of given sample.
2. Determination of percentage composition of NaOH and Na_2CO_3 in a given mixture.
3. Determination of percentage composition of Na_2CO_3 and $NaHCO_3$ in a given mixture.
4. Determination of moisture present in the given cement sample.
5. Determination of combustion loss in the given cement sample.
6. Determination of percentage silica present in the given cement sample.
7. Determination of percentage Cu present in the given copper sulphate sample.
8. Determination of the hardness of the water sample.
9. Determination of percentage silica in given ash sample.
10. Determination of percentage Ca in given Dolomite sample.
11. Determination of percentage Ca in given Lime stone sample.
12. Study of biodiesel production process.
13. Determination of percentage of nitrogen present in fertilizer sample.
14. Determination of percentage of phosphorus present in fertilizer sample.
15. Determination of percentage of potassium present in fertilizer sample.

Equipment/Machines/Instruments/Tools/Software Required:

- Digital balance
- Hot air oven
- Muffle furnace
- Bunsen burner

Recommended Books:

1. Gopal Rao, M, Dryden's Outline of Chemical Technology, EWP publishers, 3rd Edition.
2. S.S. Dara, A Text book on Experiments and Calculation in Engineering Chemistry, S. Chand company.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Chemical Engineering**

Subject: **Applied Physical Chemistry Laboratory**

Semester: **III**

Code: **319362(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 relative viscosity of the given liquid at room temperature.
2. Determination of percentage composition of the given mixture containing two liquid components, A & B by viscosity method.
3. Determination of relative surface tension of the given liquid at definite temperature.
4. Determination of percentage composition of the given mixture containing two components by surface method.
5. Determination of solubility of benzoic acid at different temperatures, Draw the solubility curve.
6. Determination of solubility of salicylic acid at different temperature
7. To investigate adsorption of acetic acid by activated charcoal.
8. To investigate adsorption of oxalic acid by activated charcoal method.
9. To determine partition coefficient of benzoic acid between water and CCl_4 at room temperature.
10. To determine partition coefficient of solute (iodine) between solvent (water) and organic solvent CCl_4 at room temperature.
11. Study of hydrolysis of ester, such as methyl acetate, catalyzed by an acid.
12. Study of hydrolysis of ester such as ethyl acetate catalyzed by an acid
13. Conductometric titration between strong acid and strong base.
14. To determine molecular weight of given acid by Victor- Mayer method.
15. To study variation in boiling point of a solution with different concentrations.
16. To draw the solubility curve for a given salt sample.

Equipment/Machines/Instruments/Tools/Software Required:

- Digital balance
- Hot air oven
- Muffle furnace
- Bunsen burner

Recommended Books:

1. S.S. Dara ,A Text book on Experiments and Calculation in Engineering Chemistry, S. Chand Company
2. GlasstoneSamuel, Text Book of Physical Chemistry, Macmillan, 2nd Edition.
3. GurdeepRaj,Advanced Physical Chemistry, Goel Publishing House,Meerut,21st Edition.
4. Bahl&Bahl, Essentials of Physical Chemistry, S. Chand, 23rd Edition.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Chemical Engineering**
Subject: **Strength of Materials Laboratory**

Semester: **III**
Code: **319363(37)**

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. To study the Universal Testing Machine.
2. To perform the tensile Test of Mild Steel on U.T.M. and Draw Stress- Strain Curve.
3. To determine strength of wood on U.T.M. (i) Along the Grain (ii) Across the Grain.
4. To determine shear strength of Mild Steel on U.T.M.
5. To observe Flexural Behavior of Timber specimen and to determine its strength under transverse loading on U.T.M.
6. To study the Impact Testing Machine and test specimen of Izod and Charpy tests.
7. To determine Izod and Charpy Value of the given mild steel specimen.
8. To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.
9. To study the Spring Testing Machine.
10. To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.
11. To study the Torsion Testing Machine
12. To determine ultimate shear stress and modulus of rigidity under Torsion.
13. To study the Cupping Test Machine and to determine Erichsen value of Mild Steel Sheet.
14. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
15. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
16. To study the Vickers Hardness Machine and to conduct a test on the machine.

Equipment/Machines/Instruments/Tools/Software Required:

- UTM
- Izode and charpy apparatus
- Fatigue Testing Machine
- Impact Testing Machine
- Torsion Testing Machine
- Spring Testing Machine
- Rockwell Hardness Testing Machine
- Cupping Testing Machine
- Brinell Testing Machine
- Vickers Hardness

Recommended Books:

1. Ramamrutham S., Strength of Materials, Dhanpat Rai Publication, 15th Edition
2. Rajput R.K., Strength of Materials, S.Chand, 1st Edition.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program: **Bachelor of Engineering**
Branch: **Chemical Engineering**
Subject: **Instrumentation & Measurement
Laboratory**

Semester: **III**
Code: **319364(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 the percentage composition of unknown liquid using abbe refractometer
2. Determination of the TDS value of the given sample using TDS meter.
3. Determination of the specific conductance of given liquid using digital direct reading conductivity meter.
4. Determination of TDS, temperature, conductivity, ORP and DO of water sample by portable water analyzer kit.
5. Determination of acid - base characteristics of given sample using digital pH meter.
6. Determination of the percentage composition of given solution by photoelectric colorimeter.
7. Determination of the percentage composition of given solution by UV-VIS spectrophotometer.
8. To detect the presence of alkali metals in the given solution using flame photometer.
9. Determination of turbidity of given sample using nephelo-turbidity meter.
10. Measurement of temperature of hot surface using thermocouple.
11. Determination of wavelength at which given liquid shows maximum absorbance using UV-VIS spectrophotometer.

Equipment/Machines/Instruments/Tools/Software Required:

- Aberefractometer
- Digital TDS Meter
- Digital pH Meter
- Digital Colorimeter
- UV-VIS Spectrophotometer

Recommended Books:

1. Johnson C., Process Control Instrumentation Technology, 8th Edition, Prentice-Hall. (2005)
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications (1975)
3. Nakra B.C. and Chaudhary K.K., Instrumentation Measurement and Analysis, 2nd Edition, Tata McGraw Hill (2004)
4. Andrew W. G. Applied Instrumentation in the Process Industries, Volume I, II & III , Gulf Publication (1993)

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Chemical Engineering**

Semester: **III**

Subject: **Value Education**

Code: **319365(46)**

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

Total Tutorial Periods: **NIL**

Maximum Marks: 40

Minimum Marks: 24

Course Objectives:

1. This course is designed to provide the importance of education with why, what & how.
2. To impart students with an understanding of fundamental humanitarian viewpoint and its outcomes.
3. To provide the knowledge about whole existence and its impact on values.
4. To bring the awareness about life long exercise so that they can fulfill their responsibility towards themselves, the family, the society, the planet.

UNIT-I Aim of Education and Necessity for Value Education: Education in values/wisdom/etc and education in traits/technologies/etc as the two fundamental strands of education; Answer to the frequently asked questions such as “Why to do studies”, “What studies to do in overall”, “How to do studies in a proper way”, “How to think systematically and talk systematically”

UNIT-II Humanitarian Viewpoint and Basic Human Objective: Meaning and concept of happiness, Need for a fundamental viewpoint to judge things in all cases of human concerns, Proposal of the natural path of humanitarian coexistentialism; Consciousness development and its expression; Fundamental want of sustainable happiness in human being; Understanding the distinct activities and needs of self (I) and body in human being; Fundamental goal of human being; Sustainable-solution in individual (At the place of delusion); Sustainable-prosperity in family (At the place of poverty); Sustainable-cooperation in society (At the place of competition); Sustainable-coexistence in planet (At the place of struggle)

UNIT-III Elements of Holistic and Systematic Perspective: Need for study of fundamental information categories to develop holistic perspective; Particular-time actions and general-time laws; Need for fundamental information sequence to develop systematic perspective, Some examples for systematic study sequence

UNIT-IV Elements of Society-friendly and Environment-friendly Goals: Elements of Knowledge of whole existence; Elements of Knowledge of human being; Elements of fundamental Values and Wisdom; Value spectrum with reference to general relationships and particular relationships of the objects in nature; Elements of History and Contemporarity used to set current goals; Elements of Sciences and Techniques to formulate methods to achieve goals; Elements of Motoricity and Mattericity to make actions to execute the methods

UNIT-V Lifelong Exercise for All-round Sustainability: Collecting information for sustainability issues; Motivating people towards sustainable life-style; Ability to identify and develop appropriate technologies and management patterns for society-friendly and environment-friendly systems for production /protection/ utilization/ experimentation ; Ability to establish and execute the fundamental five-fold system in order to ensure sustainable peace-and-prosperity worldwide.

Text Books:

Value Education for Consciousness Development by Dr P B Deshmukh, Radha K Iyer, and Deepak K Kaushik (2nd Edition, 2012, ISBN: 978-81-924034-0-3)

Reference Books:

1. International Research Handbook on Values Education and Student Wellbeing by Terence Lovat, Ron Toomey, Neville Clement (Eds.), Springer 2010, ISBN: 978-90481-86747
2. Values Education and Lifelong Learning: Principles, Policies, Programmes by David N Aspin and Judith D Chapman (Eds.); Springer 2007, ISBN: 978-1-4020-6183-7
3. Fundamentals of Ethics for Scientists and Engineers by E G Seebaur and Robert L Berry, 2000, Oxford University Press