Chhattisgarh Swami Vivekananda Technical University, Bhilai

Name of program: Bachelor of Technology Branch:All Branches **Semester: III**
Subject: Mathematics – III **Code: B000311(014)**
Total Theory Periods: 03 **Total Tutorial Periods: 01**
Class Tests: Two (Minimum) **Assignments: Two (Minimum)**
ESE Duration: Three Hours **Maximum Marks: 100** **Minimum Marks: 35**

Course Objectives:

1. To provide knowledge of Laplace transform of elementary functions including its properties and applications to solve ordinary differential equations.
2. To have thorough knowledge of partial differential equations which arise in mathematical descriptions of situations in engineering.
3. To study about a quantity that may take any of a given range of values that can't be predicted as it is but can be described in terms of their probability.
4. To provide a thorough understanding of interpolation and methods to solve ordinary differential equation.

UNIT-I Laplace transform: 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- II Partial differential equation: Formation, Solution by direct integration method, Linear equation of first order, Homogeneous linear equation with constant coefficients, Non-homogeneous linear equations, Method of separation of variables.

UNIT- III Random variable: Discrete and continuous probability distributions, Mathematical expectation, Mean and Variance, Moments, Moment generating function, probability distribution, Binomial, Poisson and Normal distributions.

UNIT- IV Interpolation with equal and unequal intervals: Finite differences, Newton's Forward & Backward Difference Formulae, Central Difference Formula, Stirling's Formula, Bessel's Formula, Lagrange's Formula and Newton's Divided Difference Formula.

UNIT-V Numerical Solution of Ordinary Differential Equations: Picard's Method, Taylor's Series Method, Euler's Method, Euler's Modified Method, Runge-Kutta Methods, Predictor-corrector Methods- Milne's Method, Adams-Bashforth Method.

Text Books:

1. "Higher Engg. Mathematics", Dr. B.S. Grewal– Khanna Publishers.
2. "Advanced Engg. Mathematics" , Erwin Kreyszig – John Wiley & Sons.
3. "Numerical Methods in Engineering and Science" , Dr. B.S. Grewal, Khanna Publishers.
4. "Numerical Methods for Scientific and Engineering Computation" , M .K. Jain, S. R. K

Reference Books:

1. "Applied Mathematics", P. N. Wartikar& J. N. Wartikar. Vol-II Pune Vidyarthi Griha Prakashan, Pune.
2. "Applied Mathematics for Engineers & Physicists", Louis A. Pipes- TMH.
3. "Numerical Methods for Scientists and Engineers" K. Shankar Rao, Prentice Hall of India.
4. "Numerical Methods" P. Kandasamy, K. Thilagavathy and K. Gunavathi, S. Chand publication.

Course outcomes: After studying the contents of the syllabus in detail the students will be able to: Define (mathematically) unit step unit impulse, Laplace transform its properties, inverse and applications to solve ordinary differential equations and find Numerical solution of differential equations, which may be arising due to mathematical modelling based on engineering problems. Hands on these Mathematical topics will make them equipped to prepare for higher studies through competitive examinations.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of the Program: **B Tech** in **Chemical Engineering** Semester: **III**
Subject: **Material and Energy Balance Computations** **Code: B019312(019)**
Period per week (L-T-P): **(3-1-0) / Week** Credits: **04**
No. of Class Test to be conducted: **2 (Minimum)** No. of assignments to be submitted: **05**
Scheme of Examination (Theory): **Total Marks-150 [ESE-100**, **CT-20**, **TA-30]**

PREREQUISITES: Knowledge of 10+2 standard of Chemistry, Mathematics and Engineering Chemistry.

COURSE OBJECTIVES:
1. Fundamental and conceptual idea on process calculations.
2. Demonstrative understanding of the concept on ideal and real gases, solutions and phase behaviour.
3. Illustrative knowledge on material balance computations considering with and without chemical reactions.
4. Comprehensive understanding on energy balance calculations.

COURSE DETAILS:

Unit 1: Introduction to Process Calculations (04 Hrs)
Units and dimensions; Conversion of units and equations; Dimensional homogeneity; Dimensionless equations; Dimensional analysis and methods, Concepts of graphical differentiation and integration, triangular diagram; Application of rectangular, log-log and semi-log graph papers.

Unit 2: Fundamental Concepts of Process Calculations (06 Hrs)
Introduction to mole concept; Molal quantities for chemical calculations; Specific gravity and density, types and calculation; Fundamental concepts on composition of solids, liquids and gases, other expressions of concentrations; Chemical reactions and process calculations.

Unit 3: Properties of Gases, Solutions and Phase Behaviour (10 Hrs)
Ideal gas equations; Mixtures of ideal gases, reactions and laws; Real gases: Critical properties, equations of state, compressibility factor, principles of corresponding states and generalized compressibility charts; Mixture of real gases and properties; Vapour pressure and boiling point; Phase behaviour of pure substances; Vapour pressure and temperature relationship and equations, concept of Cox chart; Ideal and non-ideal solutions and deviation, laws and applications; VLE, P-x-y, T-x-y, y-x diagrams; Humidity: Introduction and classification; Saturation; Humidity chart; Humid heat, volume and enthalpy; Dew point, bubble point; Dry-bulb and wet-bulb temperatures.

Unit 4: Material Balance Computations (10 Hrs)
Material balance without chemical reactions: Basic concepts and principles; Basis of calculation; Steady state and unsteady state processes; Tie element; Degrees of freedom; Batch and continuous processes in unit operations; Bypass, recycle and purging.
Material balance with chemical reactions: Combustion of solid, liquid and gaseous fuels; Oxidation of carbon, phosphorus, sulphur and related processes; Nitrogen and chlorine compounds, Hydrogenation and oxidation; Recycle and purging.

Unit 5: Energy Balance Computations (10 Hrs)
Energy balance: Introduction and significance; Law of conservation of energy; Fundamental components of different energies for energy balance computations; Principles of heat capacities and application to mixture of solids, liquids and gases; Calculation of enthalpy change during phase changes, heat of fusion, vaporization, formation, mixing; Introduction to Steam Tables; Energy balance in cyclic, flow and non-flow processes, Bernoulli's equation; Heat effects involving chemical reactions, effect of temperature on standard heat of reaction. Introduction to combined material and energy balance calculations.

On completion of each unit, students have to submit one assignment from every unit.

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1. Interpret and demonstrate the use of different set of units, graphical plots and solve dimensional problems capably.
CO2. Define and establish the mole concept and compositions of solids, liquids and gases with and without chemical reactions.
CO3. Determine and explain the properties of ideal and real gases, solution and phase behaviors.
CO4. Illustrate and solve the intricate problems of material balance using principles and theories in unit operations and unit processes efficiently.
CO5. Exemplify and make useful solution efficiently to the complex problems of energy balance using fundamental principles and theories.
CO6. Demonstrate and elucidate the complicated calculations of material and energy balance using the principles of process calculations.

TEXT BOOKS:

1. Chemical Process Principles, Hougan D. A., Watson K.M. and Ragatz R. A., Asia Publishing House, Vol. 1.
2. Stoichiometry, Bhatt B.I. and Vora S.M., Tata McGraw-Hill Publishing Company Ltd.

REFERENCE BOOKS:

1. Basic Principles and Calculations in Chemical Engineering, Himmelblau D.M., Prentice Hall.
2. Elementary Principles of Chemical Processes, Felder R.M. and Rousseau R.W., 3rd ed., John Wiley.

OPEN SOURCE LEARNING:
http://nptel.ac.in/
http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Fuel Technology** **Code B019313(019):**
Period per week (L-T-P): **(3-1-0) / Week** Credits: **04**
No. of Class Test to be conducted: **2 (Minimum)** No. of assignments to be submitted: **05**
Scheme of Examination (Theory): **Total Marks-150 [ESE-100**, **CT-20**, **TA- 30]**

PREREQUISITES: Knowledge of 10+2 standard of Chemistry, Engineering Chemistry and Environmental Science.

COURSE OBJECTIVES:

1. Adequate knowledge to distinguish various types of fuels and their characteristics and properties.
2. Executable approach about the sampling, testing methods and applications of different fuels.
3. Through understanding about the various storage methods of solid, liquid and gaseous fuels and precautionary measures during transportation, storage and usage.
4. Demonstrative capacity about the combustion mechanisms and equipments there under.

COURSE DETAILS:

Unit 1: Solid Fuels-I **(04 hrs)**
Wood, wood charcoal and peat, origin, composition, characteristics and significance of constituents of coal, washing of coal, the storage of coal and properties: oxidation and spontaneous combustion.

Unit 2: Solid Fuels-II **(06 hrs)**
Pulverized fuel/coal, uses of coal, selection of coal for different uses, properties and testing of coal, classification of coal, carbonization of coal-coke making and by products recovery, characteristics and distribution of Indian coals, briquetting of solid fuels/coal, safety measures.

Unit 3: Liquid Fuels **(12 hrs)**
Liquid fuels: Origin, composition, classification and constituents of petroleum-Indian crudes, processing of crude oil, distillation, thermal and catalytic cracking, thermal and catalytic reforming, properties of petroleum products, coal tar fuels (C.T.F.), knocking index, anti-knock value, octane and cetane numbers, rating, requisites of good quality gasoline, diesel, petrol, other fuel oil and petroleum products, liquid fuel from coal, hydrogenation and liquefaction, storage and handling of liquid fuels/fuel oils, safety measures.

Unit 4: Gaseous Fuels **(08 hrs)**
Gaseous fuels: Natural gas, methane, wood gas, biogas, gobar gas, sewage gas, underground gasification of coal, liquefied petroleum gas (LPG), refinery gases, producer gas, water gas, blast furnace gas, coke oven gas, usage and safety measures.

Unit 5: Combustion Processes and Furnaces **(10 hrs)**
General principles of combustion, types of combustion processes, combustion of solid fuels: grate firing and pulverized fuel firing system, burners for liquid and gaseous fuels, combustion processes and mechanisms, combustion calculations, calorific value determination, GCV, NCV.

On completion of each unit, students have to submit one assignment from every unit.

COURSE OUTCOMES:
On completion of the course, students will be able to:

CO1. Interpret and demonstrate the types of solid fuels, origin, storage and processing methods.
CO2. Illustrate about the classification, properties, process mechanisms and usage of different categories of coal.
CO3. Exemplify about the sources, classification, properties, process mechanisms and usage of different categories of liquid fuels.
CO4. Explicate about the sources, classification, properties, process mechanisms and usage of different categories of gaseous fuels.
CO5. Demonstrate capably the various combustion parameters, processes thoroughly and executable knowledge on various equipments and accessories, such as furnaces, burners and other supporting system.
CO6. Elucidate the complicated calculations of various combustion processes using the principles of process calculations.

TEXT BOOKS:

1. Samir Sarkar, Fuels & Combustion, Orient Longman Limited, Mumbai.
2. Brame & King, Fuels: Solid, Liquid and Gases.

REFERENCE BOOKS:

1. Om Prakash Gupta, Elements of Fuels, Furnace & Refractories, Khanna Publishers, Delhi.
2. Stoichiometry, Bhatt B.I. and Vora S.M., Tata McGraw-Hill Publishing Company Ltd.

OPEN SOURCE LEARNING:
http://nptel.ac.in/
http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Inorganic Process Technology** **Code: B019314(019)**
Period per week (L-T-P): **(2-1-0) / Week** Credits: **03**
No. of Class Test to be conducted: **2 (Minimum)** No. of assignments to be submitted: **05**
Scheme of Examination (Theory): **Total Marks-150 [ESE-100**, **CT-20**, **TA- 30]**

PREREQUISITES: Knowledge of Engineering Chemistry and Environmental Science.

COURSE OBJECTIVES:

1. Conceptual ideas on the significance and usage of various unit operations and process in inorganic process industries.
2. Adequate knowledge to differentiate the various inorganic and organic chemicals.
3. Through understanding about the principles, working methodologies and technologies in inorganic process industries.
4. Demonstrative competences to read and execute the process flow diagrams and capably conclude the effective engineering solutions.

COURSE DETAILS:

Unit 1: Introduction to Unit Operations and Processes **(04 hrs)**
Unit operation and Unit process concepts, Soda Ash, Common Salt, Salt Cake and Glauber's Salt, Chlorine and Caustic Soda.

Unit 2: Inorganic Process Industries-I **(08 hrs)**
Sulfur and Sulfuric Acid Industries, Industrial Gases-Acetylene, Oxygen and Nitrogen, Carbon Dioxide, Hydrogen, Bromine.

Unit 3: Inorganic Process Industries-II **(12 hrs)**
Nitrogen Industries-Ammonia, Nitric Acid, Ammonium Nitrate, Hydrochloric Acid, Phosphorous, Phosphoric Acid, Calcium Phosphates, Ammonium Phosphates, Urea.

Unit 4: Inorganic Process Industries-III **(10 hrs)**
Glass Industries, Sodium silicates, Ceramic Industries, Alumina, Aluminum, Magnesium Portland Cements, Lime.

Unit 5: Explosive Industries **(06hrs)**
Explosives-Types and Characteristics; Nitroglycerin and Dynamite, Nitrocellulose, Hydrazine, Military Explosives.

On completion of each unit, students have to submit one assignment from every unit.

COURSE OUTCOMES:
On completion of the course, students will be able to:

CO1. Demonstrate capably the concept of unit operation and processes in the fraternity of inorganic process industries.
CO2. Exemplify the technical problems and solutions in the production processes of sulfur and sulfuric acid industries, industrial gases, such as acetylene, oxygen, nitrogen, carbon dioxide, hydrogen, bromine etc.
CO3. Explicate the technical problems and solutions in the production processes of nitrogen, phosphorus and allied compounds, hydrochloric acid and fertilizers.
CO4. Illustrate the technical and scientific knowledge about the industrial production methods of glass, ceramic, aluminium and alumina, magnesium, cements and lime.
CO5. Elucidate the production processes and problems there under in explosive industries with appropriate technical knowledge for useful solutions.
CO6. Execute the complicated problems with industrial solutions in the fraternity of inorganic process industries using chemical process principles, unit operations and processes.

TEXT BOOKS:

1. M. Gopala Rao and Marshall Sittig: Dryden's Outlines of Chemical Technology, III Edition; Affiliated East-West Press Pvt Ltd, New Delhi.
2. George T. Austin : Shreve's Chemical Process Industries, McGraw Hill Book Company.

REFERENCE BOOKS:

1. S.D. Shukla and G.N. Pandey, Text Book of Chemical Technology Vol 1, 1977.

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Instrumentation and Measurement** **Code: B019315(019)**
Period per week (L-T-P): **(2-0-0) / Week** Credit: **02**
No. of Class Test to be conducted: **2 (Minimum)** No. of assignments to be submitted: **05**
Scheme of Examination (Theory): **Total Marks-150 [ESE-100**, **CT-20**, **TA- 30]**

PREREQUISITES: Knowledge of Engineering Physics and Mathematics

COURSE OBJECTIVES:

1. Adequate knowledge on various types of process instruments and their principles.
2. Illustrative understanding of the measurement characteristics of instruments in process industries.
3. Demonstrative concept on chemical analysis, matrix effects, detailed instrumentation, operation and interpretation of data, error analysis and statistical methods of data handling.
4. Deliverable understanding on the standard operation techniques such as on pressure measurement instruments, flow measurement instruments, liquid level measurement instruments and analytical instrumentation.

COURSE DETAILS:

Unit 1: Characteristics of Measurement **(10 Hrs)**
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 2: Pressure Measurement **(10 Hrs)**
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 3: Flow Measurement **(04 Hrs)**
Head flow meters, Area flow meters, Open channel meters, Positive displacement meters, Control valves and their characteristics

Unit 4: Liquid Level Measurement **(06 Hrs)**
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 5: Analytical Instrumentation **(05 Hrs)**
Gas Chromatography, Operating principles, Type, Components & applications, High performance liquid chromatography, Refractive index, pH, viscosity, density & conductivity measurement, Gas analyzers

On completion of each unit, students have to submit one assignment from every unit.

COURSE OUTCOMES:
On completion of the course, student will be able to:

CO1. Define and elaborate the various characteristics of instrumentation measurements and calculations.
CO2. Demonstrate the principles, construction and working methodologies of various types of pressure measuring instruments.
CO3. Exemplify the different types of flow measurement techniques and allied instruments for diversified applications.
CO4. Illustrate the different types of instruments of liquid level measurement with methodologies and applications.
CO5. Describe the principles, construction, working methodologies of analytical instruments and their applications.
CO6. Elucidate the technical applicability, extended uses and performance characteristics of different types of instruments under considerable process variables.

TEXT BOOKS:

1. Johnson C., Process Control Instrumentation Technology, Prentice-Hall.
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications.

REFERENCE BOOKS:

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

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Fuel Technology Lab** **Code: B019321(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40**, **TA- 20]**

PREREQUISITES: Knowledge of 10+2 standard of Chemistry, Engineering Chemistry and Fuel Technology.

COURSE OBJECTIVES:

1. Adequate knowledge and deterministic approach on the physical and chemical properties of different categories of fuels.
2. Ability to apply conceptual ideas and correlate the technical theories during experimentation.
3. Illustrative understanding about the characterizations of different types of fuels as well as their applications by hands on training.
4. Demonstrative skills on the usage of the various instruments.

PRACTICAL DETAILS:

***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 penetration Number of the sample of grease by Penetrometer.
9. Determination of calorific value of the given fuel sample by bomb calorimeter
10. Study of flue gas analysis by Orsat apparatus.
11. Study of Distillation Characteristics of the sample of petroleum products.
12. Study of Ultimate analysis of coal.
13. Study of characteristics of crude petroleum.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1. Define and exemplify the physical and chemical characteristics of different types of fuels and calculations there under.
CO2. Describe and analyze the adopted experimental procedures of the different fuel sampling and testing processes for significant outcomes.
CO3. Demonstrate and deduce the suitable conclusions about the various properties of the different fuels through exact hands on experimentation processes.
CO4. Illustrate the operating principles and working methodologies of various types of instruments used to determine the physical and chemical properties of the fuel samples.

TEXT BOOKS:

1. Samir Sarkar, Fuels & Combustion, Orient Longman Limited, Mumbai.
2. Brame & King, Fuels: Solid, Liquid and Gases.

REFERENCE BOOKS:

1. Om Prakash Gupta, Elements of Fuels, Furnace & Refractories, Khanna Publishers, Delhi.
2. Stoichiometry, Bhatt B.I. and Vora S.M., Tata McGraw-Hill Publishing Company Ltd.

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Inorganic Process Technology Lab** **Code: B019322(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40**, **TA- 20]**

PREREQUISITES: Knowledge of Engineering Chemistry and Inorganic Process Technology.

COURSE OBJECTIVES:

1. Adequate and conceptual knowledge on various unit operations and process applicable in inorganic process industries.
2. Through understanding about the principles, working methodologies and technologies in inorganic process industries.
3. Illustrative understanding about physical and chemical characteristics of the various inorganic chemicals through hands on suitable experimentation processes.
4. Demonstrative skills on the usage of the various instruments pertaining to the respective experimentations.

PRACTICAL DETAILS:

***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_3in 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 cements ample.
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.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1. Define and exemplify the physical and chemical characteristics of different types of inorganic chemicals and calculations there under.
CO2. Describe and analyze the adopted experimental procedures of the different inorganic samples for significant outcomes.
CO3. Demonstrate and deduce the suitable conclusions about the various properties of the different inorganic samples through exact hands on experimentation processes.
CO4. Illustrate the operating principles and working methodologies of various types of instruments used for analytical studies.

TEXT BOOKS:

1. M. Gopala Rao and Marshall Sittig: Dryden's Outlines of Chemical Technology, III Edition; Affiliated East-West Press Pvt Ltd, New Delhi.
2. George T. Austin : Shreve's Chemical Process Industries, McGraw Hill Book Company.

REFERENCE BOOKS:

1. S.D. Shukla and G.N. Pandey, Text Book of Chemical Technology Vol 1, 1977.

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Instrumentation and Measurement Lab** **Code: B019323(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Practical): **Total Marks-60 [ESE-40**, **TA-20]**

PREREQUISITES: Knowledge of Engineering Physics, Mathematics and Instrumentation & Measurement.

COURSE OBJECTIVES:

1. Adequate knowledge and deterministic approach on various types of process instruments and their working principles.
2. Demonstrative skills on the usage of the various instruments.
3. Illustrative understanding of the measurement characteristics of different instruments through hands-on training.
4. Ability to apply conceptual ideas of instrumentation measurements and correlate the technical theories during experimentation.

PRACTICAL DETAILS: ***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.

COURSE OUTCOMES:
On completion of the course, student will be able to:

CO1. Define and elaborate the various characteristics of instrumentation measurements and calculations there under.
CO2. Demonstrate and exemplify the operating principles and working methodologies of various types of measuring instruments for different applications such as for pressure, flow, liquid level etc.
CO3. Illustrate and deduce the conceptual ideas of instrumentation measurements for suitable applications and correlate the technical theories during experimentation.
CO4. Exemplify the real time experimentations of different types of process instruments with explanation.

TEXT BOOKS:
1. Johnson C., Process Control Instrumentation Technology, Prentice-Hall.
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications.

REFERENCE BOOKS:
1. Nakra B.C. and Chaudhary K.K., Instrumentation, Measurement and Analysis, Tata McGraw Hill.
2. Andrew W. G. Applied Instrumentation in the Process Industries, Volume I, II &III, Gulf Publication.

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **III**
Subject: **Software Lab** Code: **B019324(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory):**Total Marks- 60 [ESE-40, TA- 20]**

PREREQUISITES: Knowledge of Basic Computer Application and Engineering Mathematics.

COURSE OBJECTIVES:

1. In the Chemical Engineering fraternity, students will be able to prepare necessary technical report and datasheet using suitable software.
2. Ability to develop technical competency to solve the complex problems of Chemical Engineering on applying appropriate software.

COURSE DETAILS (At least ten experiments):

1. To take two numbers as input and perform addition, subtraction and multiplication through programming.
2. Write'C' programming to compare quotient and reminder.
3. To calculate the area of a circle.
4. Write a program to find out ASCII value of a character.
5. Write a program to check whether a number is even or odd.
6. Write 'C' program to check whether a year in leap year or not.
7. Write a program to check whether the number is prime number or not.
8. Find out the area of a square.
9. Write 'C' program to find out the roots of a quadratic equation.
10. Write down a program to calculate the volume of a cylinder using $V = \pi r^2 h$
11. Write down a program to calculate the volume of a sphere using $V = \frac{4}{3}\pi r^3$
12. Write down a program to calculate the volume of a right circular cone using $V = \frac{4}{3}\pi r^2 \frac{h}{3}$

COURSE OUTCOMES (COs):

On completion of the course, students will be able to:

CO1: Develop programming code in the given software

CO2: Solve programming calculations for Chemical Engineering problems.

CO3: Understand programming logic.

CO4: Show the competency to solve complex problems of Chemical Engineering.

TEXT BOOKS:

1. Let us C by YashavantKanetkar, BPB Publication, 16th Edition
2. Programming in ANSI C by E. Balagurusamy, Mc Graw Hill Education Publication, 8th Edition

OPEN SOURCE LEARNING:

http://nptel.ac.in/

http://ocw.mit.edu/courses/chemical-engineering/