CHHATTISGARH SWAMI VIVEKANADA TECHNICAL UNIVERSITY
BHILAI (C.G.)

SCHEME OF TEACHING AND EXAMINATION
BE (VI Semester) CHEMICAL ENGINEERING

S. 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	Chemical Engineering	**319651 (19)**	Systems Analysis and computer programming	3	1	-	80	20	20	120	4
2	Chemical Engineering	**319652 (19)**	Chemical Reaction Engineering	3	1	-	80	20	20	120	4
3	Chemical Engineering	**319653 (19)**	Separation Processes –I	4	1	-	80	20	20	120	4
4	Chemical Engineering	**319654 (19)**	Process Safety and Plant Utility	4	1	-	80	20	20	120	4
5	Chemical Engineering	**319655 (19)**	Process Equipment Design I	4	1	-	80	20	20	120	4
6	Refer Table –I		Professional Elective - I	4	-	-	80	20	20	120	4
7	Chemical Engineering	**319661 (19)**	Systems Analysis and computer programming lab	-	-	3	40		20	60	2
8	Chemical Engineering	**319662 (19)**	Chemical Reaction Engineering Lab	-	-	3	40		20	60	2
9	Chemical Engineering	**319663 (19)**	Separation Processes I Lab	-	-	3	40		20	60	2
10	Chemical Engineering	**319664 (19)**	Process Equipment Design-I Viva	-	-	2	40		20	60	2
11	Management	**300665 (76)**	Managerial Skills	-	-	2	-		20	20	1
12			Seminar/Library	-	-	1			20	20	1
Total				**22**	**4**	**14**	**640**	**120**	**240**	**1000**	**34**

Table – I: Professional Elective - I

Board of Study	Subject Code	Subject
Chemical Engineering	**319671 (19)**	Optimization Technique
Chemical Engineering	**319672 (19)**	Membrane Science and Engineering
Chemical Engineering	**319673 (19)**	Project Engineering
Chemical Engineering	**319674 (19)**	**Nanotechnology**

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

Note:

1. Industrial Training of eight weeks is mandatory for B.E. students. It is to be completed in two equal parts. The first part must have been completed in summer after IV semester. The second part to be completed during summer after VI semester after which students have to submit a training report which will be evaluated by college teachers during B.E. VII semester.
2. 1/4th of total strength of students subject to minimum of 20 students is required to offer an elective in the college in a particular Academic session.
3. Choice of elective course once made for an examination cannot be change in future examination.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**System Analysis & Computer programming**	Code:	**319651 (19)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. The course is designed to provide an overview of C++, Spreadsheet, AUTOCAD,DBMS and ANN.
2. This course provides an introduction to problem solving with computer.

Course Outcome:

1. Apply knowledge of numerical analysis for understanding formulating and solving chemical engineering problems.
2. After completion of this course the students will be able to apply EXCEL, AUTOCAD, MATLAB, DBMS, and ANN

UNIT I Introduction to the concept of System analysis with industrial examples, Flowcharting, Basics of C++, Programs Based on Chemical Engineering Problems.

UNIT II Introduction to Electronic Spreadsheet, Excel Fundamentals: Introduction, Menu, Command, Toolbar and their Icons, Excel and its special features of data generation, Computing Empirical equation, Graphical representation, Applications to simple Chemical Engineering Problems.

UNIT III Introduction to DBMS, Database- System Applications, Purpose of Database System, Relational Databases, Database Design, Introduction to DBMS software packages like visual FOXPRO, Conditional search, simple Applications in Engineering.

UNIT IV Introduction to AUTOCAD Design software, Basic commands in AUTOCAD, Applications in Chemical Engineering Design and Drafting.

UNIT V Introduction of ANN, ANN Terminologies, Learning Rules (Supervised and Unsupervised), Fundamental Models of ANN, Applications of ANN.

Text Books:

1. Balagurusamy E., "Object Oriented Programming with C++ Fourth Edition", Tata Mcgraw Hill.
2. Sanjay Saxena "MS Office 2000 for Everyone" Vikas Publishing House Pvt. Ltd.

Reference Books:

1. Abraham Silberschatz Henry F. Korth ,s. Sudarshan "Database System Concepts Fifth Edition" Mcgraw Hill International Edition.
2. Ashutosh kumar Dubey, "Database Management Concepts ", S.K Kataria & Sons Publishers.
3. Edward Jones, "FoxPro 2.5 for Windows inside & out", Tata Mcgraw Hill Publishing Company Limited.
4. Sham Tickoo, "AUTOCAD 2000 with Application ", Galgotia Publications.
5. S. N Sivanandam, S. Sumathi, S.N Deepa, " Introduction to Neural Networks using MATLAB 6.0", Tata Mcgraw Hill.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Chemical Reaction Engineering**	Code:	**319652 (19)**
Total Theory Periods:	**40**	Total Tutorial Periods:	**10**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:
After undergoing this course the students will be able to understand and analyze simple as well as complex reactions for the development of quantitative relationships for reactor design aspect. Such understanding and analysis will enable them to design various types of industrial reactors. The phenomena and mechanism of heterogeneous catalytic reactions will also be well understood.

Course Outcome:
After understanding this course the student will be able to understand design of Batch, Plug Flow and CSTR reactors both for simple as well as catalytic reactions.

UNIT I Chemical Equilibrium, Effect of Temperature and Pressure on Chemical Equilibrium, Rate and Equilibrium Constant, Molecularity and Order, Arrhenius equation and Energy of Activation, Development of Rate equation for Zero, First and Second order Reactions. Reversible and Irreversible reaction, Reactions in Series and Parallel, Theory of Reaction Rates.

UNIT II Classification of Reactions, Reaction Mechanism, Analysis of Kinetic Rate Data, Differential and Integral Methods of Kinetic Analysis, Total Pressure Method, Variable Volume Reactions.

UNIT III Reactor Design Fundamentals, Classification of Reactors, Batch, PFR, CSTR and Semi Batch Isothermal and Non Isothermal Reactors, Batch Reactor Design. Deviations from Ideal - Reactor Performance.

UNIT IV Design of Plug Flow Reactor, Space Velocity and Residence Time. Residence Time Distribution, Design of CSTR in Single and Multistage Battery Operation. Analytical and Graphical Methods of Design for Multistage CSTR.

UNIT V Heterogeneous Catalytic Reactions, Catalysis and Adsorption Isotherms, Mechanism of Catalytic Reactions, Concept of Rate Controlling Step. Determination of Catalyst Surface Area, Pore Volume and Solid Density, Catalyst Preparation, Promoters and Inhibitors, Catalyst Poisoning and Deactivation, Active Centers, Heterogeneous Catalytic Reactors, Fluidized bed Reactors.

Text Books:

1. J.M. Smith, “Chemical Engineering Kinetics”, McGraw Hill International Edition, 3rd Edition.
2. Octave Levenspiel, “Chemical Reaction Engineering”.

Reference Books:

1. H.Scott Fogler, “Chemical Reaction engineering”
2. Coulsion and Richardson, “Chemical Engineering”, Vol V.
3. S.M. Walas, “Reaction Kinetics for Chemical Engineering”, McGraw Hill Book Co.
4. Houghen and Watson, “Chemical Process Principles, Part III, Kinetics and Catalysis”.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Separation Process – I**	Code:	**319653 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. The general objectives of Separation Process-I are to discuss the fundamental concepts of Mass Transfer principles to apply those concepts to real engineering problems.
2. This course will provide an overview of Mass Transfer Operations at basic to an intermediate level.
3. This course will applies the concepts of diffusion mass transfer, mass transfer coefficient, convective mass transfer, inter-phase mass transfer, equipments for gas liquid operations, absorption and distillation.

Course outcome:

Under graduate Chemical Engineering students will be able to understand the basic principles of mass transfer and to apply these principles aided by computational tools to the design of equipments used in chemical process industries.

UNIT I Diffusion – Fick's law of Diffusion, steady state molecular diffusion in fluid under stagnant Laminar conditions, Diffusion through variable cross sectional area, Diffusion coefficient measurement and prediction, Measurement of liquid phase diffusion coefficient, Multi- component diffusion, Diffusivity in solids and it's applications.

UNIT II Mass Transfer Coefficient: Individual and over all mass transfer coefficient, Inter-phase Mass Transfer Theory, Penetration Theory, Boundary Layer Theory, Reynolds, Prandtl and Taylor Analogy, Mass Transfer with Chemical Reaction.

UNIT III Distillation: Introduction to distillation, Rault's law, Relative volatility, Vapor liquid equilibrium (VLE), Boiling point diagram, Partial vaporization and condensation, Flash and Differential distillation for binary mixtures, Steam distillation, Azeotropes and Extractive distillation.

UNIT IV Continuous distillation with rectification, Calculation of Number of plates - Lewis Sorel Method, McCabe Thiele Method, Reflux Ratio- Optimum and Minimum Reflux Ratio, Underwood Fens key Equation, Plate efficiency, Enthalpy - Concentration diagram.

UNIT V Absorption: Introduction to absorption, Henery's Law, Design of packed absorption tower based on Over all mass transfer coefficient, Counter current multistage, absorption, Continuous contact equipments.

Text Books:

1. Treybal, R.E., "Mass Transfer Operations", McGraw –Hill International Edition, 3rd Ed., 1998
2. McCabe, W.L., Smith, J. and Harriot, P., " Unit Operation of Chemical Engineering", McGraw-Hill International Edition, 6th Ed., 2001

References Books:

1. Geankoplis, C.J., " Transport Process and Unit Operations", Prentice Hall, 3rd Ed., India, 1993.
2. Badger, W.L., Banchero, J.T. " Introduction to Chemical Engineering", Tata McGraw Hills Publishing Company Limited , 3rd Ed., 1997

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Process Safety & Plant Utility**	Code:	**319654 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. To impart the basic concepts of Process Safety and plant Utility in chemical plants
2. Learn about the various utilities used in the process industries.
3. Learn to evaluate the utility requirements in process industries.
4. Design utility transportation systems.
5. Learn about various safety methods and instruments used for such purposes.
6. learn the advanced risk assessment analysis
7. Inherent Safer Concept in designing a chemical plant

Course outcome:

1. Analyze factors contributing to accidents in the process industries
2. Apply reliability analysis on equipment for the development of a chemical plant
3. Analyze the impact of major hazard by using computer
4. Design a chemical plant with the use of Inherent Safer concept

UNIT I Introduction: Different utilities. Role of utilities in process plant operations and criteria for selection and estimation of suitable utilities.

Water: Water resources. Process water, Cooling water, drinking water and boiler feed water, Water quality Standards, Water treatment processes Storage and handling of water. Types and selection of pumps, piping and accessories.

Air: Compressed air, blower air, fan air. Types of compressor and vacuum pumps and selection. Power requirements, performance and related calculations. Quality of compressed air for instruments and processes. Compressed air distribution system- piping and accessories.

UNIT II **Steam and Power:** Steam generation in chemical plants. Types of boilers and waste heat boilers. Fuels-types, Calorific value. Proximate and ultimate analysis. and related calculations. Cogeneration power plants. Boiler performance. Related Calculations. Economy of steam generation with different fuels, Steam storage and handling-piping and accessories.

UNIT III **Safety:** Elements of safety, safety and site selection; Plant layout and unit plot planning Introduction to Process Safety- Intrinsic & Extrinsic Safety. The Hazards- Toxicity, Flammability, Fire, Explosions. Sources of ignition, Pressure.

Safety devices: Pressure relief valves. Ruptures discs. Blow down systems. Flare systems. Flame arrestors. Deflagration arrestors and explosion suppression. Personal safety devices

Process safety analysis: HAZAN and HAZOP comparison. Sequence of operability study. Risk analysis and estimation. Safety check list.

UNIT IV Industrial Safety: Safety Rules and Disciplines, Emergency Action Plan, Indian Factories Act, Fire training, Protections and Fire Drills, Case Study

UNIT V Control of process, Prevention of losses, Pressure relief, Provision of fire fighting equipments, Technology selection and transfer, choosing the right process Prevention of hazardous deviation in process variables: e.g. pressure, temperature flow by provision of automatic control systems- interlocks, alarms, trips together with good operating practices and management. Regulations and legislation, Role of government, risk management routines and tackling disaster.

Text Books:

1. Perry, Chemical Engineers Handbook, 8th Edition, McGraw Hill.
2. Sinnot, R.K., Coulson and Richardson's Chemical Engineering- Vol 6, Pergamon, 1996.
3. G. L. Wells, Safety in Chemical Process Industries, McGraw Hill
4. Crowl, D.A. & Louvar, J.F.. "Chemical Process Safety: Fundamentals with Applications". New Jersey: Prentice-Hall. (1989).

Reference books:

1. Goodall, P. M., "The Efficient Use Of Steam" IPC Science and Technology (1980). Reference Books
2. Lees, F. P., "Loss Prevention in Process Industries 3 volume set" Butterwort - Heinemann, Oxford
3. Daniel A. Crow, Joseph F Louvar, "Chemical Process Safety, Fundamentals with Application", 2nd Edition, Prentice Hall, 2002

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Process Equipment Design – I**	Code:	**319655 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Note: Question on Tank Design based on Unit I will be compulsory and will carry 30 marks. Other two questions based on Unit II and Unit III shall have options and will be of 25 marks each.

Course Objective:

1. Process Equipment Design course in Chemical Engineering is designed to understand the design parameters like loads, stresses, factor of safety, theory of failure etc. and corrosion, temperature and pressure considerations which are important in basic design of equipment.
2. The subject includes design of storage vessels for storing various fluids and equipment of small and tall vessels operating at high internal and external pressures with flanges, openings and supports.

Course Outcome:

The course is meant for understanding the design approaches and methods of scientific and engineering principles for designing, debottlenecking and troubleshooting chemical plant equipment.

UNIT I Material Specifications-types of materials and their basic characteristics, Indian standards on materials. Materials for specific environments like high temperature, low temperature, corrosive services. Storage Vessels: Study of various types of storage vessels and applications, vessels for storing volatile and nonvolatile liquids, storage of gases, Losses in storage vessels, various types of roofs used for storage vessels, manholes, nozzles and mountings. Design of cylindrical storage vessels as including base plates, shell plates, roof plates, wind girders, curb angles for self supported and column supported roofs as per IS: 803, Design of columns, girders and rafters.

UNIT II Basic Principles of design: Design Factors, Design procedure, Codes and Standards, Optimization, Design Loads, Types of Stress and Strain Curves for Ductile and Brittle Materials, Factor of Safety, Young's Modulus Fatigue, Creep, Section Modulus. Pressure Vessels - Types of pressure vessels, Proportioning of pressure vessels, selection of L/D ratio, Optimization, Design of unfired pressure vessels as per Code for unfired pressure vessels (IS: 2825; 1969).

Pressure vessels subjected to internal pressure: Complete design involving

1) Shells: cylindrical, spherical
2) Various closures (heads): Torrispherical, Elliptical, Hemispherical, Conical.

Pressure vessels subjected to external pressure: Design of shell, heads & stiffening rings.

Classification of flanges, types of flanges, Design of flanges, Gasket - types, selection, and design, Compensation for opening in vessel design.

UNIT III Design of Tall Vessels-Stresses in the shell of a tall vertical vessel, Calculation of shell thickness. Vessel Supports-Introduction and classification of supports, design of skirt supports considering stresses due to dead weight, wind load, design of base plate, skirt bearing plate, anchor bolts, bolting chairs and skirt shell plates, Design of saddle supports. Equipment Fabrication, Welding and Post weld heat treatments, Inspection and testing of equipment e.g. Pressure tests, Radiography tests, Dye penetration tests, Ultrasonic test.

Text Books:

1. "Process Equipment Design" by L.E. Brownell and E. Young, John Wiley, New York, 1963.
2. "Introduction to Chemical Equipment Design" by B.C. Bhattacharya, C.B.S.Publications, New
3. Delhi, 2009.

Reference Books:

1. "Process Equipment Design" by M.V. Joshi, McMillan India.
2. IS Code – 803 for material specification and storage vessels.
3. IS Code – 2825 for unfired pressure vessels.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**System Analysis & Computer Programming Laboratory**	Code:	**319661 (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. Program for rate of first order chemical reaction. Using C++.
2. Program for rate of second order chemical reaction. Using C++.
3. Program for calculation of Prandtl Number (Pr.).Using C++.
4. Program for calculation of Reynolds Number (Re.).Using C++.
5. Program for Dittus –Boelter equation. Using C++.
6. Program for calculation of Nusselt Number (Nu.).Using C++.
7. Program for calculation of entropy.Using C++.
8. Under standing various 3D CAD commands and creating simple 3D objects.
9. Creation of objects by Extrusion, revolved features (Simple protrusion), patterns and copies.
10. Merge the cells from A2 to G2. Apply the following changes to the title line:
    a. Change the horizontal and vertical text alignments as center.
    b. Change the row height of row 2 as 25.
    c. Change the font, font size, font style and font color as Tahoma, 18, bold, blue.

List of Equipments/Machines Required

1. Computer with C++.
2. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14" Color Monitor, 52 X CD RW, Laser Scroll Mouse.
3. Software Required – Ms Office, Auto CAD, Visual FOXPRO.

Recommended Books:

1. Balagurusamy E., "Object Oriented Programming with C++ Fourth Edition", Tata Mcgraw Hill.
2. Sanjay Saxena "MS Office 2000 for Everyone" Vikas Publishing House Pvt. Ltd.
3. S. N Sivanandam, S. Sumathi, S.N Deepa, " Introduction to Neural Networks using MATLAB 6.0", Tata Mcgraw Hill.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Chemical Reaction Engineering Laboratory**	Code:	**319662 (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. To study the Kinetics of Irreversible reaction in Batch Reactor.
2. To study the Kinetics of Reversible reaction in Batch Reactor.
3. Kinetics of Irreversible reaction in Isothermal Plug Flow Reactor.
4. Kinetics of Reversible reaction in Isothermal Plug Flow Reactor.
5. Kinetics of Irreversible reaction in Adiabatic Plug Flow Reactor.
6. Kinetics of Reversible reaction in Adiabatic Plug Flow Reactor.
7. Kinetics of Irreversible reaction in CSTR.
8. Kinetics of Reversible reaction in CSTR.
9. Performance of combined reactor (CSTR+PFR).
10. Performance of combined reactor (PFR+CSTR).
11. Kinetics of Irreversible reaction in Heterogeneous Catalytic reactor.
12. Kinetics of Irreversible reaction in Biochemical Reactor.
13. Study of Residence Time Distribution.
14. Kinetics of Irreversible reaction in Semi batch Reactor

Equipments/Machines/Instruments/Tools Required:

1. Batch Reactor
2. Plug Flow Reactor (PFR)
3. Adiabatic Reactor
4. Mixed Flow Reactor (MFR)
5. Heterogeneous Catalytic Reactor
6. Biochemical Reactor
7. Semi batch Reactor

Recommended Books:

1. Octave Levenspiel, “Chemical Reaction Engineering”.
2. H.Scott Fogler, “Chemical Reaction engineering”

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Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Separation Process – I Laboratory**	Code:	**319663 (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. To determine the Diffusivity Coefficient of Acetone in Air by Natural Diffusion.
2. To determine the Diffusivity Coefficient of Acetone in Air by Forced Diffusion.
3. To determine the Rectification Characteristics of Binary Liquids systems.
4. To plotting Vapor Liquid Equilibrium (V.L.E.) diagram of Binary Liquid.
5. To determine the Relative Volatility of Binary Liquid (Benzene Toluene Mixture) by Simple Distillation.
6. To determine the Relative Volatility of Binary Liquid (Benzene Toluene Mixture) by Steam Distillation.
7. To verify Rayleigh's Equations for Differential Distillation in Binary System.
8. Study of operation of Laboratory Scale Bubble cap Column.
9. Study of operation of Laboratory Scale Absorption Column.
10. Study of operation of Laboratory Scale Wetted Wall Column.

List of Equipments:

1. Vapor Liquid Equilibrium (V.L.E.) Apparatus
2. Travelling Microscope
3. Forced Diffusion Apparatus
4. Laboratory Scale Bubble cap Column
5. Laboratory Scale Absorption Column
6. Laboratory Scale Wetted Wall Column

Text Books:

1. Treybal, R.E., "Mass Transfer Operations", McGraw –Hill International Edition, 3rd Ed., 1998
2. McCabe, W.L., Smith, J. and Harriot, P., " Unit Operation of Chemical Engineering", McGraw-Hill International Edition, 6th Ed., 2001

References Books:

1. Geankoplis, C.J., " Transport Process and Unit Operations", Prentice Hall, 3rd Ed., India, 1993.
2. Badger, W.L., Banchero, J.T. " Introduction to Chemical Engineering", Tata McGraw Hills Publishing Company Limited , 3rd Ed., 1997

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Process Equipment Design – I Viva**	Code:	**319664 (19)**
Total Lab Periods:	**36**		
Maximum Marks:	**40**	Minimum Marks:	**20**

Viva-Voce Examination based on the syllabus of Process Equipment Design-I

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	**Bachelor of Engineering**		
Branch:	**Common to All Branches**	Semester:	**VI**
Subject:	**Managerial Skills**	Code:	**300665 (76)**
No. of Lectures:	**2/Week**	Tutorial Period:	**NIL**
Total Marks in ESE:	**NIL**	Marks in TA:	**40**
Minimum number of Class Tests to be conducted:	**Two**		

Objective:
The course is introduced to develop managerial skills tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Managerial skills are essential for overall professional development of an individual apart from gaining technical knowledge in the subject.

Course Objectives
Upon completion of this course, the student shall be able
- To define and explain the concept of managerial, written and oral communication skill;
- To understand the leadership skill;
- To develop self-appraisal and understand distinction between leader and manager;
- To develop positive attitude and thinking; and
- To understand managerial functions and develop creativity.

UNIT I **Managerial Communication Skills:** Importance of Business Writing: writing business letters, memorandum, minutes, and reports- informal and formal, legal aspects of business communication, oral communication- presentation, conversation skills, negotiations, and listening skills, how to structure speech and presentation, body language.

UNIT II **Managerial skills - Leadership**: Characteristics of leader, how to develop leadership; ethics and values of leadership, leaders who make difference, conduct of meetings, small group communications and Brain storming, Decision making, How to make right decision, Conflicts and cooperation, Dissatisfaction: Making them productive.

UNIT III **Proactive Manager:** How to become the real you: The journey of self-discovery, the path of self-discovery, Assertiveness: A skill to develop, Hero or developer, Difference between manager and leader, Managerial skill check list, team development, How to teach and train, time management, Stress management, Self-assessment.

UNIT IV **Attitudinal Change:** Concept of attitude through example, benefits of right attitude, how to develop habit of positive thinking, what is fear? How to win it? How to win over failure? How to overcome criticism? How to become real you? How to Motivate? How to build up self confidence?

UNIT V **Creativity**: Creativity as a managerial skill, Trying to get a grip on creativity. Overview of Management Concepts: Function of Management: Planning, organizing, staffing, controlling.

Course Outcome
- The students will be able to develop formal and informal, negotiation, written and oral communication skill;
- The students will be able to develop manage groups, resolve conflicts and leadership skill and decision making qualities;
- The students will be able to develop self-appraisal, teaching, training and managing stress and time;
- The students will be able develop positive thinking, motivating team members and winning race; and
- The students will be able to develop creativity and fundamental management functions.

Text Books:

1. Basic Managerial Skills for all by E.H. Mc Grawth, Prentice Hall India Pvt Ltd,2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

Reference Books:

1. How to develop a pleasing personality by Atul John Rego, Better yourself bools, Mumbai,2006
2. The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006
3. How to Success by Brian Adams, Better Yourself books, Mumbai, 1969

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Optimization Technique (Professional Elective – I)**	Code:	**319671 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. The aim of the course is to study about procedure for solving optimization problems.
2. The purpose of the course is to study the linear programming.
3. Study of optimization applications.

Course Outcome:

1. After undergoing this course the students will acquire knowledge regarding solving optimization problems.
2. After undergoing this course the students will acquire knowledge about linear programming and study of optimization applications.

UNIT I Introduction to optimization and its scope in chemical processes: Essential features of optimization problems, General procedure for solving optimization problems. Fitting models to data: Classification of models, How to select and build a model, Method of least squares.

UNIT II Formulation of objective functions: Investment costs and operating costs in Objective functions. Basic concepts of optimization: Continuity of functions, uni modal vs.multi modal functions, Convex and concave functions, convex region.

UNIT III Unconstrained single variable optimization: Numerical methods for one dimensional search, Newton, Quasi-Newton and Secant methods, Region elimination methods, Polynomial approximation methods.

UNIT IV Linear programming: Basic concepts, Degenerate LP problems, Linear constraints, Simplex method, Standard LP form, Duality in linear programming.

UNIT V Optimization applications: Heat transfer and energy conservation, Separation processes, Fluid flow systems.

Text Books:

1. F.Edgar and D.M.Himmelblau, “Optimization of Chemical Processes”.
2. T, Peter Englezos, Nicolas Kalogerakis, “Applied Parameter Estimation for Chemical Engineers”, McGraw-Hill Book Co.

Reference Books:

1.Chapra & Canal, “Numerical methods for Engineers”.
2 .S. S. Rao, “Optimization”.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Membrane Science & Engineering (Professional Elective – I)**	Code:	**319672 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objectives:

1. The aim of the course is to study about types of membrane and membrane module.
2. The purpose of the course is to study the reverse osmosis, ultra filtration and micro filtration.
3. Study of ion exchange and gas separation.

Course Outcomes:

1. After undergoing this course the students will acquire knowledge regarding membrane and membrane module.
2. After undergoing this course the students will acquire knowledge about reverse osmosis, ultra filtration, micro filtration, ion exchange and gas separation.

UNIT I Introduction, Classification and Types of Membrane, Methods of manufacturing Membranes, Membrane module, Diffusions models.

UNIT II Reverse Osmosis: Mechanism, Modules Design and Applications.

UNIT III Ultra Filtration and Micro Filtration: Mechanism, Modules Design and Applications.

UNIT IV Ion exchange and Electro Dialysis: Mechanism and Applications.

UNIT V Gas Separation: Mechanism, Modules Design and Applications.

Text Books:

1. Coulson & Richardson, “Chemical Engineering”, Volume 1.
2. James W. Baker, “Membrane Separation”.

Reference Books:

1. J H Perry, “Chemical Engineers Hand Book” 3rd Edition.
2. McCabe & Smith, “Unit Operation of Chemical Engineering”, McGraw Hill Book Company.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Project Engineering (Professional Elective – I)**	Code:	**319673 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. The aim of the course is to study about origin of chemical project.
2. The purpose of the course is to study the plant location and site selection, capital cost estimation, working and capital estimation.
3. The purpose of the course is to study about process development, process selection, process design and utilities.

Course Outcomes:

1. After undergoing this course the students will acquire knowledge about chemical projects.
2. After undergoing this course the students will acquire knowledge about process development, process selection, process design and utilities.

UNIT I Origin of chemical project; Feasibility studies.

UNIT II Techno-economic report; Plant location and site selection; Capital cost estimation; Working capital estimation.

UNIT III Profitability indices; Discounted cash flow; Cost-benefit analysis; Sensitivity analysis.

UNIT IV Process development; Process Selection; Process Design; Utilities; Scale up.

UNIT V Optimization; Project Construction; Project scheduling; Network analyses; Project report; Plant and Equipment specification; Problem solving by using PERT & CPM technique.

Text books:

1. J H Perry, “Chemical Engineers Hand Book”, 3rd Edition.
2. Peter Timmer Hauss, “Plant Design and Economics”.

Reference Book:

1. O.P. Kharbanda, “Process plant and Equipment Costing”.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	**Chemical Engineering**	Semester:	**VI**
Subject:	**Nanotechnology (Professional Elective – I)**	Code:	**319674 (19)**
Total Theory Periods:	**48**	Total Tutorial Periods:	**12**
No. of class Tests to be conducted:	**2 (Minimum)**	No. of assignments to be submitted:	**2 (Minimum)**
ESE Duration:	**Three Hours**	Maximum Marks in ESE: **80**	Minimum Marks in ESE: **28**

Course Objective:

1. It is proposed to include a new scientific domain, Nanotechnology, in the curriculum of chemical engineering students, which deals with material and structures in nanometer scales. The technology deals with miniaturization of the current and new instruments, sensors and machines e.g. computers.
2. The aim is to summarize the scientific fundamentals and understand techniques of synthesis and processing of nonmaterials

Course Outcome:

Students are expected to learn Nanotechnology to design, fabricate and use nanostructures or nanomaterials for various applications in their fields of interest.

UNIT I **Introduction**: Nanotechnology and nonmaterials, How it all began, Carbon nanostructures, Classification of nonmaterial: 3D,2D,1D,0D materials, Surface and interface effect, Van der Waals Forces between colloidal particles.

UNIT II **Synthesis procedures of nonmaterials** : Methods of synthesis. Top down approach, Bottom up approach, , Spontaneous growth, Template based synthesis, Production and use of nanotubes, nanorods, nanowires, Film growth, Physical Vapour Deposition (PVD), Chemical Vapor Deposition (CVD), Patterning, Itching.

UNIT III **Nanostructures Fabricated by Physical Techniques:** Lithography, Nanomanipulation and nanolithography, Soft lithography, Assembly of nanoparticles and nanowires.

UNIT IV **Characterizations of nonomaterials :** Structural characterization, Physical characterization, Physical properties of nonmaterial.

UNIT V **Applications and Safety:** Nanotechnology and Chemical Engineering Applications: Environment, Waste Water Treatment, Photo catalytic reactors, .Photo electrochemical cells, Self cleaning Materials, Nanobiotechnology : Drug Delivery, Nanocomposites, Surface coatings, Biological nonmaterial. Nanoelectronics. nanomachines & nanodevices Safety aspects, Societal, Health and Environmental Impacts.

Text Books:

1 Guozhong, Cao, "Nanostructures and Nanomaterials", Imperial College Press, 2004
2 Edelstein, C, "Nanomaterial: Synthesis, Properties and Applications", Institute of Physics Publication,
3 Philadelphia

Reference Books:

1 Kulkarni S K, "Nanotehnology: Principles and Practices", Capital Publishing Company
2. Poole, C P, Owens, F J Introduction to Nanotechnology", John Wiley & Sons publication.

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