SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4401	Particle and Fluid Particle Processing	3 Hours	3	0	4	3 + 2	70	22

Course Objectives : To understand basic principles of various mechanical operations, construction and working of the equipments.

UNIT - I :

Crushing and Grinding : Handling of particulate solids, Evaluation of size & shape, surface and population of particles, standard screens and screen analysis of solids. Principles of comminuition, size reduction; crushing, grinding, pulverizing and ultra fining size reduction equipment, power requirement in comminuition.

UNIT - II :

Principles of Mixing : Mixing of solids, Mixing equipment's, Design & Power requirement of mixers, Mixer effectiveness and mixing index.

UNIT - III :

Principles of Separation: Principles of Separation techniques for system involving solids, liquids & gases, classification, sedimentation and filtration, Separation equipments.

UNIT - IV :

Selection of Conveying Devices for Solids : Bell, Chain, Screw conveyors, Elevators and pneumatic conveying devices. Elementary design aspects of the devices. Visit to Chemical Engg. Industry engaged mainly with Mechanical Operation.

UNIT - V :

Fluidization : Particulate & aggregative fluidization, Characteristic of fluidized bed due to particle size, size distribution, shape and density. Pressure drop through a fluidized bed, Character of dense phase fluidization as revealed by pressure drop fluctuations. Up flow and down flow fluidization, Fluid Catalytic process, bed drying, Mass transfer in fluidized beds.

List of Experiments :

1. To analyses the given sample by differential, cumulative methods using standard screen.
2. Determination of size and surface area of irregular particles using a measuring gauge.
3. To study the crushing behavior and to determine the Rittinger's and Bond's constant of the given solid in a Jaw crusher.
4. To study the crushing behavior and to determine the Rittinger's and Bond's constant of the given solid in a ball mill.

Course Outcome :

- Ability to understand fluid particle systems and equipment.
- Ability to select suitable size reduction equipment, solid-solid separation method and conveying system.
- Ability to analyze mixing processes.
- Understanding of fluid flow through packed and fluidized beds.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

Contd. … 2

Suggested Readings :-

1. J.K. Beddow, Particulate Science and Technology.
2. Perry RH & Dan WG; PERRYS CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
3. Murthy, Structures and properties of Engg Materials; TMH.
4. Badger and Banchero, "Introduction to Chemical Engg., 1st Edn., McGraw Hill, NewYork, 1954
5. M. Leva, Fluidization.

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4402	Heat Transfer	3 Hours	3	0	4	3 + 2	70	22

Course Outcome:

- Ability to understand fluid particle systems and equipment.
- Ability to select suitable size reduction equipment, solid-solid separation method and conveying system.
- Ability to analyze mixing processes.
- Understanding of fluid flow through packed and fluidized beds.

UNIT - I :

Conduction : Modes of heat transfer one dimensional and two dimensional, heat rate equations. Theory of insulation, critical radius calculations, types of insulation material, conduction through slab, cylinder and sphere.

UNIT - II :

Convection : Convective heat transfer, heat transfer in boundary layer and in films, natural and forced convection, co/counter/cross current contacting for heat transfer, individual and overall heat transfer coefficient, fouling factor.

UNIT - III :

Radiation : Radiative heat transfer, Black body radiation, concept of shape factor, methods of determination of shape factor, radiation exchange in enclosure with black surfaces.

UNIT - IV :

Heat Transfer with Phase Change : Heat transfer under phase change conditions, boiling and condensation of pure components, heat flux temperature diagram for boiling and condensation under vertical and horizontal surfaces, nucleate & pool boiling, effect of surface condition on condensation, correlation for heat transfer under condensation.
Evaporation : Type of evaporators and their applications single and multiple effect evaporators, design and operation of forward-backward and mixed feed operations, effect of boiling point elevation and hydrostatic head, vapour recompression.

UNIT - V :

Heat Exchange Equipment: General design of shell and tube exchangers, condensers, extended surface equipments, heat exchanger equation-coil to fluid, jacket to fluid, double pipe, shell & tube & finned tube heat exchanger.

List of experiments:

1. To determine the thermal conductivity of metal rod.
2. To determine the equivalent thermal conductivity of composite wall.
3. To determine heat transfer coefficient in force convection.
4. To determine heat transfer coefficient in Natural convection.
5. To determine heat transfer coefficient with the help of Steafan Boltzman Apparatus.
6. To calculate emissivity of the test plate by emissivity measurement apparatus.
7. To determine heat transfer coefficient in double pipe heat exchanger.
8. To study the heat transfer characteristics of a shell and tube heat exchanger (heating/cooling) of water.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

Contd. … 2

9. To determine heat transfer coefficient in parallel and counter flow heat exchanger.
10. To measure the rate of evaporation using an open pan evaporator.
11. To measure the rate of condensation of pure water vapour and to determine the heat transfer coefficient.
12. Demonstrate the film-wise drop-wise condensation and determination of he heat transfer coefficient.
13. To study the single effect evaporator and find out the heat transfer coefficient.

Note: Each student should perform at least eight experiments out of the above list.

Course Outcome:

- Ability to understand and solve conduction, convection and radiation problems.
- Ability to design and analyze the performance of heat exchangers and evaporators.
- Ability to design and analyze reactor heating and cooling systems.

Suggested Readings:

1. Donald Q. Kem- PROCESS HEAT TRANSFER-Tata McGraw Hill.
2. Alan J. Chapman-HEAT TRANSFER-IV Ed. -Collier McMillan.
3. Heat Transfer by Y.V.C. Rao.

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4403	Material Technology	3 Hours	3	0	0	3 + 0	70	22

Course Objectives : This course is a multi-disciplinary subject, this course deals with basics knowledge related to pure metals their alloys like Fe-C curve etc.

UNIT - I :

Engineering Materials : Classes of engineering materials, Mechanical, Thermal & Electrical properties of Materials and their measurement. Engineering requirement of materials, selection of materials, structure of atoms and molecules Bonding in solids - types of bonds and comparison of bands.

UNIT - II :

Crystallanity : Atomic Structure, Inter atomic attraction, Molecular structure, crystallanity, Solid solutions, crystal imperfections, Electronic structure and Electromagnetic properties.

UNIT - III :

Phase Deformation : Single phase metal deformation, Failure of Metals, Theories of alloying, phase relationship, iron-carbon diagram, Nomenclature of steels, utilization of cast iron, mild steel, stainless steel, lead and graphite in Chemical Engg. System.

UNIT - IV :

Corrosion : Theories of Corrosion and corrosion-control, stability of materials in service: Chemical, Thermal and Radiolytic stability.

UNIT - V :

Composite materials: Semiconductors, Superconductors, Surface Modifications using linings of plastics, rubber, glass, ceramics with special reference to the applications in chemical Industries. Course outcomes: after end of this course pupil get knowledge of composite materials like cementitie, austenite, refactories etc, will come to know about terms like toughness, hardness, creep, tensile strength etc.

Course Outcomes :

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to function on multidisciplinary teams.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for, and an ability to engage in life-long learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modem engineering tools necessary for engineering practice.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

Contd. … 2

Suggested Readings :-

1. VAMLACK, MATERIAL SCIENCE
2. WOOLEF: VOL 1,2,3,4.
3. Robert H. Perry & Don W. Green - PERRYS CHEMICAL Engineering HAND BOOK - VII Ed. Mc Graw Hill.
4. O.P. Khanna-MATERIAL SCIENCE & METALLURGY - Dhanpat Rai Publication.
5. S.K. Hajra Chhoudhury-MATERIALS SCIENCE & PROCESSES - Indian Book Distributing Co.
6. V. Raghavan, Materials Science and Engineering, Prentice Hall

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CHEMICAL ENGINEERING, UEC, UJJAIN.

Syllabus for Four Years Bachelor of Technology Degree Course as per NEP-2020

July-2024

SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4404	Organic Process Technology	3 Hours	3	0	4	3 + 2	70	22

Course Objectives : To study process technologies of various organic process industries.
Study of organic process industries involving process technology, raw material availability. production pattem, Engg. Problems involving material of construction, Environment pollution, waste utilization and disposal ,, energy consumption and conservation Equation.

UNIT - I :

Industrial Microbial Processes and Edible Oils : Fermentation processes for the production of ethyl alcohol, alcohol derivatives like acetic acid, acetic anhydride, vinyl acetate, ethylene glycol, pyridine, citric acid and antibiotics, Refining of edible oils and fats, fatty acids, Soaps and detergents.

UNIT - II :

Cellulosic Processes : Pulp and paper, pulping process chemical recovery pulp preparation and paper making.

UNIT - III :

Petrochemicals : Intermediates for petrochemical from petroleum based stocks, phenol, methanol, ethylene, propylene, benzene, toluene and xylene, acrylonitrile, styrene, butadiene.

UNIT - IV :

Fine Chemicals and Fibers : Dyes and Dye intermediates, carbohydrates and sugar, man made fibers; rayon, polyester, polyamides and acrylics, cellulose acetate, insecticides and pesticides.

UNIT - V :

Unit Processes : Nitration: nitrating agents, equipments for nitration, mixed acid preparation, Sulfonation and sulfation agents.

Course Outcomes :

- Ability to understand the manufacturing of various organic chemicals.
- Ability to understand the process flow diagram and various process parameters.
- Ability to identify and solve engineering problems during production.

Suggested Readings :

1. V.B. Gupta & V. K. Kathari - MANUFACTURING FIBER TECHNOLOGY-Chapman Hall, Newyork Edition 1997
2. V.K. Kathari- PROGRESS IN TEXTILE, SCIENCES TECHNOLOGY, VOL I & II-IAFL Publications, S-351 Greater Kailash Part I New Delhi-481 Ed.
3. Austin, G.T. SHREEVES CHEMICAL PROGRESS INDUSTRIES-5th Ed. Mc. Graw Hill New York 1984
4. Dryden C.E. -OUTLINES OF CHEMICAL TECHNOLOGY-3rd Ed. Affilicted. East West press, New Delhi, 1997

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4405	Numerical Method in Chemical Engineering	3 Hours	3	0	4	3 + 2	70	22

UNIT - I :

Treatment of Engineering Data : Graphical representation Empirical equations, Interpolation, Newton's formula, Lagrange's Interpolation formula, extrapolation, Integration, graphical Integration, Graphical Construction of Integral curves, Numerical Integration.

UNIT - II :

Interpretation of Engineering Data : Significant figure Classification of Measurements, Propagation of Errors, Variation and Distribution of Random Errors, Properties of Variance, Confidence limits for small samples.

UNIT - III :

Ordinary Differential Equations : Formulation, Application of law of Conservation of Mass Mixing in flow process. Classification of ordinary Differential Equations and its applications to common Chemical Engineering problems.

UNIT - IV :

Numerical Solutions of Ordinary Differential Equations : Linear Second-order Equation with variable coefficients, Numerical solution by Runge Kutta Method. Its application to higher-order equations.

UNIT - V :

Formulation of Partial Differential Equations : Finite difference, linear finite difference equations, nonlinear difference equations Optimization, types of methods its application relating to chemical processes.

Suggested Reading :-

1. Mickley, H.S Sherwood T.S. Read- APPLIED MATHMATICS IN CHEMICAL ENGINEERING Tata McGraw Hill Pub.
2. Jenson & Jeffreys - MATHMATICS IN CHEMICAL ENGINEERING.

List of experiments

1. Data representation and treatment by Graphical methods, Pressure Volume- Temperature and concentration relationships for gases and their mixtures.
2. Integrated methods of data processing Integral functions and their graphical representation.
3. Estimation of properties from empirical correlations (Nokay).
4. Estimation of critical properties from group contribution method.
5. Redtich kwong equation of slate and other Virial equations to estimate thermodynamic properties like compressibility factor molar volume and P-V-T relationship.
6. To study the effect of liquid viscosity and dissolved gases on pump efficiency, reciprocating pump performance.
7. Measurement errors their propagation and minimization of random errors. Selection of confidence limits.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

Contd. … 2

8. Mass balance problems using continuity equation applied to a dynamic system. Formation of differential equations (component balance) and their solution & examples- CSTR and flow through pipes.
9. Numerical Solutions of batch reactor problems. Euler Algorithm.
10. Runge Kutta algorithm and its application in chemical Engineering. Implicit and explicit calculations. Problems related to effect design, optimum liquid concentration.
11. Transient flow of fluid unsteady temperature and varying concentration problems and use of partial differential equation to solve them.

Note : Each student should perform at least eight experiments from the above list.

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CHEMICAL ENGINEERING, UEC, UJJAIN.

Syllabus for Four Years Bachelor of Technology Degree Course as per NEP-2020

July-2024

SUBJECT		Exam Duration	Contact Hours per Week			Credits	Max. Marks	Min Pass Marks
Code	Title		L	T	P			
CM-4406	Computer Aided Process Calculation	--	0	0	2	0 + 1	30	--

Course Objectives : All major manufacturing companies and their suppliers use CAD software to design parts and evaluate them with respect to fit, form and function. This course introduces students to CAD Software in general and Solid Works 2016 software in particular. Students will learn theory and practice related to solid modeling, assembly modeling, drafting, parametric modeling, freeform surface modeling, and use of CAD models for some downstream engineering activities such as motion simulation and manufacturing.
On completing the course, the student will be able to:

1. Use basic and advanced features of current CAD software.
2. Understand how CAD technology can be leveraged in the design process

Syllabus:

1. Introduction to Microsoft Excel.
2. Basic Operations
3. Using functions
4. Unit conversions of chemical process.
5. Material Balance solution using Excel.
6. Energy balance solution using Excel

Course outcomes: Upon successful completion of this course, the student will be able to:

1. Design a part or assembly of parts using Computer-Aided Design software.
2. Use parametric modeling techniques to reflect engineering requirements.
3. Apply top-down design principles to model a design.
4. Use motion and interference checking to ensure that parts will not interfere throughout their complete range of motion.
5. Use CAD software collaboratively when designing on a team.
6. Make appropriate selection of CAD functionality to use as tools in the design process.
7. Communicate effectively the geometry and intent of design features.
8. This course contributes to the assessment of the following program (student) outcome: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

1 Hour Lecture (L) = 1 Credit 1 Hour Tutorial (T) = 1 Credit 2 Hours Practical (P) = 1 Credit

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