POLYTECHNIC ENGINEERING

Sri Satya Sai University of Technology & Medical Sciences, Sehore (M.P.)

Syllabus of Examination - AICTE Pattern

Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-III

Course Code	**DCMA-301**
Course Title	Fuel Technology
Number of Credits	3 (L: 2, T: 1, P: 0)

Course Objectives:

- To learn the characteristics of coal relevant to its preparation
- To identify the different unit operations used for the preparation of coal for its utilization in thermal power plants and coke ovens
- To get fundamental understanding of operation of industrial coal preparation plants.
- To train personnel in the method and development of fuel cell technology.

Course Outcomes:

- Appreciate the importance of coal and coal preparation for the Indian and global economies
- Understand the construction and operation of crushers and screens used for coal preparation
- Determine the expected yield and quality, and the expected difficulty of beneficiating a coal
- Understand the operation of beneficiation units for coarse coal and fine coal, in Indian context
- Carry out the performance analysis of coal beneficiation equipment
- Get orientation of industrial coal preparation flowsheets.

UNIT-1: Solid Fuels & Coal Carbonization: Coal & lignite reserves in India, classifications ofcoal, washing of coal, analysis of coal, proximate and ultimate analysis. Mechanism of low temperature carbonization and high temperature carbonization, byproduct recovery from coke oven, properties of coke coal, grinding, pulverization, briquetting of solid fuels.

UNIT-2 : Liquid Fuels: Origin of petroleum production, distillation, thermal & catalytic cracking,coking, reforming, isomerizations, crude oil classification, reserves of hydrocarbon in India, introduction to petroleum refining and processing.

UNIT-3 : Petroleum Products Properties and Its Utilization : Petroleum product and theirutilization, diesel, petrol, blending of petrol for octane number boosting, AVL (aviation liquid fuel), kerosene, fuel & furnace oil, testing of petroleum product: flash point, pore point, fire point, octane number, cetene number, viscosity and viscosity index, API.

UNIT-4 : Gaseous fuels: Natural gas, synthesis gas, producer gas, water gas, coal gas, LPG,CNG and hydrogen as a fuel, composition properties and uses.

UNIT-5 : Renewable Energy Sources and Fuel cell: Types of solar cell and fabrication, windenergy, principles of tidal energy. Principle and working of fuel cell, various types, construction and its application.

References:

1.Sarkar S; Fuel and Combustion; Orient Long men Ltd.
2.Gupta OP; Fuel and Combustion; Khana Pub Gary ; Refining of Petroleum Techonology
3.D.P. Kothari, K. C. Signal, R. Rajan, Renewable Energy Sources and Emerging technology, PHI Learni pvt. Ltd.
4.G.D. Roy, Non Conventional Energy Source, Khanna Publisher
5.J. Twidel, T Weir, Renewable Energy Sources, Taylor and Francis

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Course Code	**DCMA-301**
Course Title	Fuel Technology(lab)
Number of Credits	1 (L: 0, T: 0, P: 2)

List of Experiments:

1. To carry on proximate analysis of the given coal sample.
2. To determine the calorific value of the coal by Bomb-Calorimeter method.
3. To determine the viscosity of the given oil sample by Redwood Viscometer. No. 1 and No. 2
4. To determine the viscosity of a given oil sample by Saybolt viscometer.
5. To determine viscosity of a given coal tar with the help of tar viscometer.
6. To determine the flash and fire points of the given oil sample by PenskeyMartin'sapparatus..
7. To determine the flash and fire points of the given oil sample by Abel's apparatus.
8. To determine the flash and fire points of the given oil sample by Cleveland apparatus.
9. To determine the carbon residue of the given oil by Conradson method.
10. To determine cloud and pour point of given oil sample (coconut) by cloud and pour point apparatus.

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Department of Chemical Engineering

Semester-III

Course Code	**DCMA-302**
Course Title	Momentum transfer
Number of Credits	3 (L: 2, T: 1, P: 0)

COURSE LEARNING OBJECTIVES:

- To impart the fundamental concepts of fluid statics, pressure distribution and dimensional analysis.
- To nurture the students to solve fluid dynamics problems using Newton's laws of motion.
- To enable students to compute velocity profile, friction factor and head loss in pipes and fittings.
- To impart the knowledge of metering and transportation of fluids and fluid moving machinery performance.

COURSE OUTCOMES On completion of the course, the students would have,

- The knowledge of fundamental concepts in fluids statics and to use dimensional analysis for scaling experimental results
- The ability to solve hydrostatic and fluid flow problems using Newton's laws of motion
- The ability to analyze frictional flow in pipes and piping networks and to compute the head loss and power requirements for chemical process equipments.
- The ability to select the metering equipments and fluid moving machinery for appropriate chemical engineering operations.

COURSE CONTENT:

UNIT-I: Properties of fluids and concept of pressure: Introduction - Nature of fluids - physical properties of fluids - types of fluids. Fluid statics: Pressure - density - height relationships. Pressure measurement. Dimensional analysis. Similarity - forces arising out of physical similarity – dimensionless numbers.

UNIT-II: Momentum Balance and their Applications: Kinematics of fluid flow; Newtonian and non-Newtonian fluids - Reynolds number - experiment and significance - Momentum balance – Forces acting on stream tubes - Bernoulli's equation - Correction for fluid friction

UNIT-III: Flow of incompressible fluids in pipes – laminar and turbulent flow through closed conduits velocity profile & friction factor for smooth and rough pipes - Head loss due to friction in pipes, fitting etc.

UNIT-IV: Flow of Fluids through Solids: Form drag - skin drag - Drag co-efficient. Flow around solids and packed beds. Friction factor for packed beds. Ergun's Equation - Motion of particles through fluids - Terminal settling velocity. Fluidisation - Mechanism, types, general properties – applications

UNIT-V: Transportation and Metering: Measurement of fluid flow: Orifice meter, Venturi meter, Pitot tube, Rotameter, weirs and notches Wet gas meter and dry gas meter. Hot wire and hot film anemometers. Transportation of fluids: Fluid moving machinery performance. Selection and specification. Positive displacement pumps, Rotary and Reciprocating pumps, Centrifugal pumps and characteristics, Introduction to Fans, Blowers & Compressors

REFERENCE BOOKS

1. A. K. Mohanty, "Fluid Mechanics", Prentice Hall of India Ltd, New Delhi.

2. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,

3. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol 1, Butterworth Heinemann.

4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors.

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Course Code	**DCMA-302**
Course Title	Momentum transfer(lab)
Number of Credits	1 (L: 0, T: 0, P: 2)

List of Experiments:

To conduct experiment to study

1. Different types of manometers
2. Major losses in pipe flow
3. Minor Losses (Globe Valve, Bends and Elbows)
4. Major losses in spiral coil flow
5. Major losses in helical coil flow
6. Flow Through Packed Bed
7. Flow Through Fluidized Bed
8. Calibration of orifice meter
9. Calibration of venturi meter
10. Calibration of pitot tube
11. Calibration of channel
12. Characteristics of reciprocating pump
13. Characteristics of centrifugal pump

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Semester-III

Course Code	**DCMA-303**
Course Title	Mechanical Operation
Number of Credits	3 (L: 2, T: 1, P: 0)

COURSE LEARNING OBJECTIVES:

To impart knowledge on

- Understand basic principles of particle preparation and their characterization
- Understand the performance of different equipments for separation of solids and size reduction
- Basic principles in various operations such as Size Reduction, Filtration, Sedimentation, Mixing and Agitation etc.
- Study various methods for storage of solids and conveyors available for their transportation.

COURSE OUTCOMES

On completion of the course, students are expected to

- To understand the basic principles of particles preparation and their characterization.
- To have knowledge about different size reducing equipment and power requirements during size reduction.
- To have an understanding on solid fluid separation equipment.
- To have an understanding of solid storage and their conveying in chemical process industries.

COURSE CONTENT:

UNIT-I: Characteristics of Particulate Material: Properties and characterisation of particulate solids, Flow properties of particulates.

UNIT-II: Introduction to size reduction equipment, energy and power requirement in milling operations

UNIT-III: Separation of solids, Solid – Solid Separation Equipments

UNIT-IV: Particulate Processes: Solid-Liquid and Gas-Solid separation methods, Equipments Classificatio by size, agitation and mixing of solids and liquids,

UNIT- V: Handling of Particulate Material: Conveying methods, Storage methods, Feeders and elevators.

REFERENCE BOOKS

1. Anup. K.Swain, Hemlata Patra, G.K.Roy., “Mechanical Operations”, McGraw Hill Education.

2. McCabe and J.C.Smith,” Unit Operation of Chemical Engineering”, McGraw Hill., New York.

3. M. Coulson and J.F. Richardson, “Chemical Engineering”, Vol. II, Butterworth- Heinemann.

4. Badger and Banchero, “Introduction to Chemical Engineering”, McGraw Hill, New York.

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Semester-III

Course Code	**DCMA-303**
Course Title	Mechanical Operation(lab)
Number of Credits	1 (L: 0, T: 0, P: 2)

List of practical to be performed:

CONTENTS:

1. Different types of density of particle (Bulk, Particle, Repose)
2. Angle of repose
3. Particle size distribution
4. Screen effectiveness
5. Jaw crusher
6. Ball mill
7. Drop weight crushes
8. Drag studies
9. Settling studies
10. Separation of solids using settling characteristics
11. Constant Pressure Filtration
12. Constant Volume Filtration
13. Elutriation
14. Agitated vessel
15. Storage of Solids

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Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-III

Course Code	**DCMA-304**
Course Title	Introduction to Chemical Engineering
Number of Credits	3 (L: 3, T: 1, P: 0)

Course Learning Objectives:

- To give a comprehensive knowledge on various aspects practiced in chemical engineering
- To give the sources of information on related topics.

Course Outcomes: At the end of the course, the student can able to:

- Appreciate various unit operations and processes followed in transforming raw material into value added materials,
- Understand the various representation of flow processes
- Significance of Chemical Engineering to the society in the areas of health, energy, environment and food.

Course Content:

UNIT I-Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II-Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III-Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flowsheet representation of process plants,

UNIT IV-Role of Computer in Chemical Engineering; Chemical Engineering Software; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc.

UNIT V-Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

REFERENCE BOOKS:

1. S. K. Ghosal, S. K., Sanyal and S. Datta, “Introduction to Chemical Engineering”, Tata McGraw Hill Education Pvt. Ltd., New Delhi.

2. Pushpavanam.S., “Introduction to Chemical Engineering”, PHI Learning Pvt. Ltd., New Delhi,

3. Badger W.L. and Banchero J.T., “Introduction to Chemical Engineering”, 6thEdition, Tata McGraw Hill, 1997.

4. Dryden, C.E., “Outlines of Chemicals Technology”, Edited and Revised by Gopala Rao, M. and M.Sittig, 2nd Edition, Affiliated East-West press, 1993

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Department of Chemical Engineering

Semester-III

Course Code	**DCMA-305**
Course Title	Chemical Process Calculations
Number of Credits	3 (L: 3, T: 1, P: 0)

COURSE LEARNING OBJECTIVES

- To give students fundamental knowledge on Unit processes and Unit operations, Units and conversions and also the basic laws governing chemical operations.
- To impart knowledge on material and energy balance with and without reactions.

COURSE OUTCOMES On completion of the course, the students would have,

- The capability to understand the need for study of unit operations and processes. Convert units and dimensions and also modify equations from system to another.
- The capability to apply the laws of physics and chemistry in solving process industry related applications.
- Proficiency to integrate the data and formulate the mass and energy balance problems
- The capability to use mathematical knowledge for solving mass and energy balance problems with and without chemical reactions.

COURSE CONTENT

UNIT-I: Basics of unit operations and unit processes, Units and dimensions.

UNIT-II: Stoichiometric principles – composition relations, density and specific gravity. Behaviour of Ideal gases - application of ideal gas law - gaseous mixtures - volume changes with change in composition.

UNIT-III: Vapour pressure - effect of Temperature on vapour pressure - vapour pressure plots – vapour pressure of immiscible liquids - solutions. Humidity and Solubility: Humidity - saturation –vaporization - wet and dry bulb thermometry.

UNIT-IV: Material Balance - Processes involving chemical reaction - Combustion of coal, fuel gases and sulphur - Recycling operations - bypassing streams - Degree of conversion – excess reactant –limiting reactant. Unsteady state problems

UNIT-V: Energy Balance: Thermo chemistry - Hess's law of summation - heat of formation, reaction, combustion and mixing - mean specific heat - Theoretical Flame Temperature.

REFERENCE BOOKS

1. K.V. Narayanan and B. Lekshmikutty, "Stoichiometry and Process Calculations", Prentice Hall of India

Ltd, New Delhi..

2. V.Venkataramani, N.Anantharaman and K.M. Meera Sheriffa Begum, 'Process Calculations' Prentice

Hall of India Ltd, New Delhi.

3. B. I. Bhatt, "Stoichiometry", Tata McGraw Hill Publishers Ltd., New Delhi.

4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors.

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Semester-III

Course Code	**DCMA-306**
Course Title	Summer Internship 04 weeks after IIsem
Number of Credits	2 (L: 2, T: 0, P: 0)

Course objectives:

The following objective should be fulfilled in Summer Internship and student must participate in any Chemical, Petrochemical, Pharmaceutical, Oil and Gas industry where they can learn to apply the Technical knowledge in real Industrial situations.

Course Outcomes:

Gain experience in writing Technical reports/projects.

- Expose students to the engineer's responsibilities and ethics.
- Expose the students to future employers.
- Understand the social, economic and administrative considerations that influence the working environment of industrial organizations

Guidelines:

- The industrial training is also a kind of team activity. Here development and design work with a focus on learning application environment.
- The software analysis in industries should be 50% of the total work.
- Industrial training cater a system required in laboratory or real life.
- Student is expected to learn out specifications, methodology, resources required, critical issues involved in design and implementation of software.
- The student is expected to exert on testing of the proposed results as per the industry