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-VI

Course Code	**DCMA-601**
Course Title	Process Equipment Design
Number of Credits	4 (L: 3: T:0 : P: 2)

COURSE LEARNING OBJECTIVES:

- To apply the basic principles/concepts learned in the subjects of Fluid Mechanics, Heat Transfer, Mass Transfer, and Mechanical Operation in the design of chemical process equipment.
- To develop the skill to select and design the appropriate process equipment for the required unit or process operation.
- To analyses and evaluate the performance of existing equipment.

COURSE OUTCOMES: On completion of the course, the student can able

- To Estimate Steady State Heat Transfer Rates From/To Objects
- To Use Equations For Different Types Of Convection And Solve For Heat Transfer Rate By Convection
- To Estimate The Rate Of Radiation Heat Transfer With And Without Participating Medium, Ability
- To Identify The Roll Of Re-Radiating Surface, Radiation Shields, Boiling And Condensation.
- To Estimate Steam Economy, Capacity Of Single And Multiple Effect Evaporators.

COURSE CONTENT:

UNIT-I: Design of Pressure Vessels: Design of vessels and its components

UNIT-II: Design of heads/closures, design of supports and design of high pressure vessels.

UNIT-III: Design of Storage tanks, Agitated vessels and Reaction vessels.

UNIT-IV: Design of Phase Separation Equipment - Design of physical separation equipments.

UNIT-V: Design of Heat Transfer Equipments such as heat exchangers without and with phase change. Design of Mass Transfer Equipments: Design of mass transfer equipments such as distillation columns, absorption columns, extraction columns..

REFERENCE BOOKS:

1. R. H. Perry, “Chemical Engineers’ Handbook”, 7th Edn., McGraw Hill , New York.
2. R. K. Sinnott, “Chemical Engineering Design”, Coulson and Richardson’s Chemical Engineering Series, Volume-6, Fourth Edition, Butterwoth-Heinemann, Elsevier, New Delhi.
3. L. E. Brownell and E.H. Young, “Process Equipment Design - Vessel Design”, Wiley Eastern Edn. New York.
4. B.C. Bhattacharyya, “Introduction to Chemical Equipment Design Mechanical Aspects”, CBS Publishers & Distributors, New Delhi.
5. D.Q.Kern “Process Heat Transfer”, Tata McGraw Hill Edn..
6. V. V.Mahajani and S. B. Umarjii, “Joshi’s Process Equipment Design”, 4th Edn., Mac Millan Publishers India Limited, New Delhi.
7. D. C. Dikdar, “Process Heat Transfer & Chemical Equipment Design”, Khanna Publishing House, New Delhi

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Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-VI

Course Code	**DCMA-602**
Course Title	(A)Modern Separation Techniques
Number of Credits	4 (L:3: T:1: P:0)

COURSE LEARNING OBJECTIVES:

To identify about the kind of separation processes in general and novel separations are integral part of any process chemical industries.

COURSE OUTCOMES:

On completion of the course the students will be able to

- Differentiate the conventional techniques and modern techniques.
- Understand the principles of modern separation techniques.
- Application of these techniques in Industries.
- Identify the importance of economics involved in its applications.

COURSE CONTENT:

UNIT-I: Thermal Diffusion: Basic Rate Law, Theory of Thermal Diffusion Phenomena for gas and liquid mixtures, Equipments design and Applications. Zone Melting.

UNIT-II: Chromatographic techniques, Equipment and Commercial processes, Molecular Sieves.

UNIT-III: Cryogenic, Supercritical fluid extraction and Azeotropic separation.

UNIT-IV: Principle of membrane separations process; Classification: Reverse osmosis, Ultra-filtration, Micro-filtration, Nano-filtration and Dialysis; Membrane modules and application; Electro-dialysis; Per-vaporation and gas separation using membranes; Electrophorosis; Liquid membranes.

UNIT-V: Foam and bubble separation: Principle; Classification; Separation techniques; Column operations. Surface Adsorption, Nature of foams.

REFERENCE BOOKS:

1. Schoen H. M., New Chemical Engineering Separation Techniques, 2nd Edition, Inter Science Publications, New York.
2. Seader, J.D, and Henley E.J.,Separation 'Process Principles,' John Wiley & Sons, Inc..
3. Perry R.H. and. Green D.W.,Perry's Chemical Engineers Hand book, 6th Edition. McGraw Hill, NewYork, .
4. King C.J. 'Separation Processes', 4th Edition, Tata McGraw Hill, New Delhi,

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Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-VI

Course Code	**DCMA-603**
Course Title	(B)Waste management
Number of Credits	3 (L:2: T:1: P:0)

COURSE LEARNING OBJECTIVES:

- To recognize and learn about waste management, waste treatment and recycling
- To understand the impacts on our environment.
- To learn about pollution, pollutants, waste disposal processes

COURSE OUTCOMES:

At the end of the course student will be able

- To explain the various functional elements involved in waste management system
- To quantify and categorize solid wastes for any region
- To prepare concept design for the common functional elements of the waste management systems.
- To select suitable waste processing technologies and disposal methods

COURSE CONTENT:

UNIT- I: Types and Sources of Solid and Hazardous Wastes - Need for Solid and Hazardous Waste Management, Waste Generation Rates - Composition – Hazardous Characteristics.

UNIT-II: Waste Sampling - Source Reduction of Wastes - Recycling and Reuse - Handling and Segregation of Wastes at Source - Storage and Collection of Municipal Solid Wastes - Analysis of Collection Systems - Need for Transfer and Transport - Transfer Stations - Labelling and Handling of Hazardous Wastes.

UNIT-III: Waste Processing - Processing Technologies - Biological and Chemical Conversion Technologies - Composting - Thermal Conversion Technologies - Energy Recovery - Incineration - Solidification and Stabilization of Hazardous Wastes - Treatment of Biomedical Wastes .

UNIT-IV: Disposal in Landfills - Site Selection - Design and Operation of Sanitary Landfills – Secure Landfills and Landfill Bioreactors - Leachate and Landfill Gas Management - Landfill Closure and Environmental Monitoring - Closure of Landfills - Landfill Remediation .

UNIT-V: Legislations on Management and Handling of Municipal Solid Wastes, Hazardous Wastes, and Biomedical Wastes - Elements of Integrated Waste Management.

REFERENCE BOOKS:

1. O.P. Gupta, “Elements of Solid Waste Hazardous Management”, Khanna Publishing House, New Delhi, 2018
2. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw-Hill, New York, 19932.
3. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi.

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Undergraduate Diploma Courses in Engineering & Technology
Department of Chemical Engineering
Semester-VI

Course Code	DOE-603
Course Title	Elective – II (A Artificial Intelligence)
Number of Credits	4(L:3; T:1; P:0)

Course Objectives

1. To develop an understanding of intelligent agents and environments, including their types, behaviors, and properties.
2. To provide foundational knowledge of AI methodologies, including search algorithms, fuzzy logic systems, and neural networks, and how these can be applied to problem-solving.

Course outcomes:

At the end of the course, the student will be able to:
CO1: Define Artificial Intelligence, describe its goals, and outline its historical evolution and applications in various fields.
CO2: Analyze the types and characteristics of intelligent agents and the environments in which they operate.
CO3: Apply various search algorithms, including brute-force and heuristic strategies, to solve real-world AI problems.
CO4: Explain the working of fuzzy logic systems, including membership functions, fuzzification, and defuzzification processes.
CO5: Describe the structure and functioning of neural networks and implement basic models like the perceptron for classification tasks.

Unit 1 – Introduction to Artificial Intelligence
• Artificial Intelligence (AI) definition
• Goals of AI
• History of AI
• Applications of AI

Unit 2 – Agents and Environments
• Agent Terminology, Types of Agents – Simple Reflex Agents, Model Based Reflex Agents, Goal Based Agents
• Nature of Environments, Properties of Environments

Unit 3 – Search Algorithms
Terminology
• Brute Force Search Strategies – Breadth First Search, Depth First Search.
• Heuristic Search Strategies, Local Search Algorithms.

Unit 4 – Fuzzy Logic Systems
Introduction to Fuzzy Logic and Fuzzy systems,
• Membership functions,
• Fuzzification/Defuzzification

Unit 5 – Neural Networks
Basic structure of Neural Networks
• Perceptron
• Back-propagation

Suggested Learning Resources:
Artificial Intelligence By Example:Develop machine intelligence from scratch using real artificial intelligence use cases Denis Rothman Packt Publishing ISBN – 978-1788990547

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Department of Chemical Engineering

Semester-VI

Course Code	DOE-603
Course Title	Elective – II (B Renewable Energy Technologies)
Number of Credits	4 (L:3; T:1; P:0)

Course Objectives

Maintain the renewable energy technology equipment.

Course outcomes:

At the end of the course, the student will be able to:

CO1: Explain the working principles, construction, and site-specific implications of various ocean energy technologies such as tidal, wave, marine current, and OTEC systems.
CO2: Analyze different types of solar energy systems, including PV and concentrated solar power technologies, and evaluate their components, layout, and functioning.
CO3: Compare the configurations and components of large wind power plants and differentiate between constant speed and variable speed generator systems.
CO4: Illustrate the working of small wind turbines of various types and describe installation methods and suitable electric generators for rooftop and field applications
CO5: Evaluate the properties of biomass fuels and describe the layout and functioning of biochemical, thermochemical, and agrochemical biomass-based power plants.

Unit – I Ocean Energy Technologies

Ocean energy map of India and its implications; Specification, Construction and working of the following ocean energy technologies:

- Tidal power technologies
- Wave power technologies
- Marine current technologies
- Ocean Thermal Energy Conversion (OTEC) technologies

Unit – II Solar PV and Concentrated Solar Power Plants

- Solar Map of India: Global solar power radiation, Solar PV
- Concentrated Solar Power (CSP) plants, construction and working of: Power Tower, Parabolic Trough, Parabolic Dish, Fresnel Reflectors
- Solar Photovoltaic (PV) power plant: components layout, construction, working.
- Rooftop solar PV power system

Unit – III Large Wind Power Plants

Wind Map of India: Wind power density in watts per square meter, Lift and drag principle; long path theory, Geared type wind power plants: components, layout and working, Direct drive type wind power plants: components, layout and working, Constant Speed Electric Generators: Squirrel Cage Induction Generators (SCIG), Wound Rotor Induction Generator (WRIG), Variable Speed Electric Generators: Doubly-fed induction generator (DFIG), wound rotor synchronous generator (WRSG), permanent magnet synchronous generator (PMSG).

Unit– IV Small Wind Turbines

Horizontal Unit– IV Small Wind Turbines

- Horizontal axis small wind turbine: direct drive type, components and working.
- Horizontal axis small wind turbine: geared type, components and working.
- Vertical axis small wind turbine: direct drive and geared, components and working.
- Types of towers and installation of small wind turbines on roof tops and open fields.
- Electric generators used in small wind power plants.

Unit– V Biomass-based Power Plants

- Properties of solid fuel for biomass power plants: bagasse, wood chips, rice husk, municipal waste.
- Properties of liquid and gaseous fuel for biomass power plants: Jatropha, bio-diesel gobar gas.
- Layout of a Bio-chemical based (e.g. biogas) power plant.
- Layout of a Thermo-chemical based (e.g. Municipal waste) power plant.
- Layout of a Agro-chemical based (e.g. bio-diesel) power plant.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
2. Neill, Simon P.; Hashemi, M. Reza: Fundamentals of Ocean Renewable Energy: Generating Electricity from the Sea, Academic Press, ISBN:978-0-12-810448-4
3. David M. Buchla, Thomas E. Kissell, Thomas L. Floyd, Renewable Energy Systems, Pearson Education New Delhi , ISBN: 9789332586826,
4. Rachel, Sthuthi, Earnest, Joshua; -Wind Power Technologies, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9
5. Deambi, Suneel: From Sunlight to Electricity: a practical handbook on solar photovoltaic application; TERI, New Delhi ISBN:9788179935736
6. Gipe, Paul: Wind Energy Basics, Chelsea Green Publishing Co; ISBN: 978-1603580304
7. Wizelius, Tore, Earnest, Joshua - Wind Power Plants and Project Development, PHI Learning, New Delhi, ISBN:978-8120351660
8. Kothari, D.P. et aL: Renewable Energy Sources and Emerging Technologies, PHI Learning, New Delhi, ISBN: -978-81-203-4470-9
9. Bhadra, S.N., Kastha, D., Banerjee, S, Wind Electrical Systems installation; Oxford University Press, New Delhi, ISBN: 9780195670936.

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Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-VI

Course Code	DHS - 604
Course Title	Entrepreneurship and Start-ups
Number of Credits	3 (L:3; T:0; P:0)

Course Objectives:

1. Acquiring Entrepreneurial spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
4. Acquiring entrepreneurial quality, competency, and motivation.
5. Learning the process and skills of creation and management of entrepreneurial venture.

Course Outcome:

At the end of the course, the student will be able to:

1. Understanding the dynamic role of entrepreneurship and small businesses
2. Organizing and Managing a Small Business
3. Financial Planning and Control
4. Forms of Ownership for Small Business
5. Strategic Marketing Planning

Unit 1 - Introduction to Entrepreneurship and Start – Ups

- Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- Types of Business Structures, Similarities/differences between entrepreneurs and managers.

Unit 2 – Business Ideas and their implementation

- Discovering ideas and visualizing the business
- Activity map
- Business Plan

Unit 3 – Idea to Start-up

- Market Analysis – Identifying the target market,
- Competition evaluation and Strategy Development,
- Marketing and accounting,
- Risk analysis

Unit 4 – Management

- Company's Organization Structure,
- Recruitment and management of talent.
- Financial organization and management

Unit 5 - Financing and Protection of Ideas

- Financing methods available for start-ups in India
- Communication of Ideas to potential investors – Investor Pitch
- Patenting and Licenses.

Reference Books:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company Steve Blank and Bob Dorf K & S Ranch
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to
Create Radically Successful Businesses Eric Ries Penguin UK ISBN – 978-0670921607
3. Demand: Creating What People Love Before They Know They Want It Adrian J
. Slywotzky with Karl Weber Headline Book Publishing
ISBN – 978-0755388974
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way
You Do Business Clayton M. Christensen Harvard business

SUGGESTED SOFTWARE/LEARNING WEBSITES:

a. https://www.fundable.com/learn/resources/guides/startup
b. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/
c. https://www.finder.com/small-business-finance-tips
d. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

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Undergraduate Diploma Courses in Engineering & Technology

Department of Chemical Engineering

Semester-VI

Course Code	DCMA - 606
Course Title	Major Project-II (Project Execution)
Number of Credits	0 (L:2; T:0; P:0)

Course Outcomes:

After completion of this course, students will be able to:
CO1: Identify and execute chemical engineering projects addressing industrial and societal needs.
CO2: Apply principles of chemical engineering fundamentals for process design, analysis, and optimization.
CO3: Use modern engineering tools for modeling, simulation, and experimentation of chemical processes.
CO4: Demonstrate effective teamwork, project planning, safety, and professional ethics.
CO5: Prepare comprehensive technical reports, documentation, and presentations in accordance with industry standards.

Guidelines

.Students shall execute the project approved in Project Phase I through process design, experimentation, modeling, fabrication, pilot-scale studies, or simulation, relevant to chemical engineering applications.
The project work shall emphasize practical application of theoretical knowledge to develop a working prototype, experimental setup, process model, or simulation study. Activities include process flow development, material and chemical selection, equipment sizing, experimental trials, data collection, troubleshooting, safety analysis, and performance evaluation.
Students may use appropriate software tools such as ASPEN Plus/HYSYS, MATLAB, COMSOL, ANSYS, ChemCAD, or equivalent platforms.
A comprehensive final project report must be submitted including problem definition, literature review, process methodology, design and calculations, experimental/simulation results, discussion, conclusions, and future scope. Students shall also deliver a seminar presentation followed by viva-voce examination.
Emphasis shall be given to process safety, sustainability, innovation, teamwork, environmental considerations, and proper technical documentation.

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Semester-VI

Course Code	DEA - 607
Course Title	Indian Constitution
Number of Credits	0 (L:2; T:0; P:0)

Unit 1 – The Constitution - Introduction
- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

Unit 2 – Union Government
- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit 3 – State Government
- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit 4 – Local Administration
- District Administration
- Municipal Corporation
- Zila Panchayat

Unit 5 – Election Commission
- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Reference Books:
1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi,2008
2. The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3. Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:
a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/