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-V

Course Code	**DCMA-501**
Course Title	**Mass Transfer – II**
Number of Credits	**4 (L: 3: T:0 : P: 2)**

COURSE LEARNING OBJECTIVES:

- To impart the basic concept of conventional mass transfer operations.
- To learn the equilibrium characteristics of two phase mass transfer processes.
- To understand the hydrodynamics and operation of mass transfer equipments.
- To develop the skill in the design and analysis of mass transfer equipments in process industries.

COURSE OUTCOMES:

After completing the course, a student can able to

- Have an ability to apply the concepts of mass transfer in Chemical Process industries.
- Analyse the two phase transfer processes and select the transfer equipments.
- Develop equilibrium characteristics from thermodynamic fundamentals.
- Explain the industrial applications of the mass transfer equipment.

COURSE CONTENT:

UNIT-I: Principle, theory, Vapour Liquid Equilibria calculations, Effect of Pressure and temperature on VLE, Methods of distillations, batch, continuous, flash, steam distillation.

UNIT-II: Stage-wise and continuous contactors operations, Mc-Cabe Thiele Method, Azeotropic distillation and Extractive distillation, Introduction - Multi component Flash and differential distillation.

UNIT-III: Liquid - Liquid Equilibria, Effect of Pressure and Temperature on LLE, Solubility criteria, Batch and continuous extraction towers for miscible and immiscible systems. Industrial Applications.

UNIT-IV: Theory, Mechanism, Types of leaching, Solid - Liquid equilibria, Batch and continuous extractors. Equipments and industrial applications.

UNIT-V: Types of adsorption, nature of adsorbents, Adsorption isotherms, Operation of adsorption columns. Batch and continuous operations

REFERENCE BOOKS:

1. R. E. Treybal, “Mass Transfer Operations”, 3rd Edn., McGraw Hill Book Co., New York, 1981.
2. N. Anantharaman and K.M.Meera Sheriffa Begum, “Mass Transfer Theory and Practice”, Printice Hall of India Pvt. Ltd., New Delhi, 2013.
3. M. Coulson and J. F. Richardson, “Chemical Engineering.”, Vol - II, 5th Edn., Pergamon Press, New York,
2002.
4. W. L. Mccabe, J. C. Smith and P. Harriot, “Unit Operations in Chemical Engg.”,7th Edn., McGraw Hill
Book Co., New York, 2004.

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Course Code	**DCMA-502**
Course Title	**Process Control & Instrumentation**
Number of Credits	**4 (L: 3: T:0 : P: 2)**

COURSE LEARNING OBJECTIVES:

- To introduce students to the terminology, concepts and practices of input/output modelling and process control.
- To impart knowledge in the design of control systems for chemical processes.

COURSE OUTCOMES:

On completion of the course, the student:

- Can construct a model of the chemical processes and other elements used in feedback control systems from first principles leading to the development of transfer function models
- Can compute the response of the developed transfer function for various forcing functions providing an understanding of the transient response of the system
- Can derive transfer function models of controllers and compute the transient response under closed loop conditions.
- Can evaluate the stability of the control system given a mathematical model of a control system including its components.
- Different Instrumentations used in Process Industries

COURSE CONTENT:

UNIT-I: Laplace transforms - properties of Laplace transform, solution of linear differential equations using Laplace transform techniques, piecewise continuous functions.

UNIT-II: Dynamic behaviour of systems - derivation of transfer functions for first and second order systems, liquid level, temperature, pressure, flow and concentration control processes, linearization of nonlinear systems, interacting and non-interacting systems.

UNIT-III: Transient response of first and second order systems, natural frequency, damping factor, overshoot, decay ratio, rise time and settling time.

UNIT-IV: Transient analysis of control systems - block diagram algebra, overall transfer function of closed loop control systems, regulator and servo problems, transient response of first and second order systems with P, PI and PID controller. Definition of stability of control systems, Routh test, limitations of Routh test.

UNIT-V: Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

REFERENCE BOOKS:

1. D.R. Coughanowr and S. E. LeBlanc, 'Process Systems Analysis and Control', Mc.Graw Hill, III Edition.
2. G. Stephanopoulous, 'Chemical Process Control – Theory and Practice', Prentice Hall of India Ltd.
3. D.C. Sikdar, "Instrumentation and Process Control", Khanna Publishing House
4. S. Sundaram, "Process Dynamics and Control" CENGAGE Learning.
5. K. Padmanabhan & S. Ananthi, "A Treatise on Instrumentation Engineering" I.K International Publishing Pvt. Ltd.

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Course Code	**DCMA-503 (A)**
Course Title	**Petroleum Engineering**
Number of Credits	**3 (L: 3: T:0 : P: 0)**

COURSE LEARNING OBJECTIVES:
To provide
- an overview of petroleum industry.
- Petroleum exploration and exploitation techniques,
- oil and gas reserve identification and evaluation.
- Drilling and production of oil and gas. Disposal of effluents.

COURSE OUTCOMES
After completing the course, a student can able to understand the various processes involved in the upstream processes of petroleum Engineering

COURSE CONTENT:

UNIT-I: Earth science - occurrence of petroleum Rocks and traps. Reservoir rocks and properties. Classification of oil and gas reserves Reservoir mechanics and drive mechanism.

UNIT-II: Drilling – introduction to drilling of oil and gas wells. Drilling rigs and equipments. Drilling fluids and cementing.

UNIT-III: Logging techniques. Various types of logs. Formation parameters. Log applications. Formation evaluation. Well completion.

UNIT-IV: Petroleum exploration – well testing, production potential and well performances. Material balance, Artificial lift, Improved recovery methods.

UNIT-V: Surface equipments, processing of oil and gas. Transportation of oil and gas. Effluent treatment. Petroleum economics. Supply and demand trends.

REFERENCE BOOKS:
1. Geology of Petroleum by Leverson A.L.- 2nd edition The AAPG foundation.
2. Principles of oil production by T.E.W Nind- 2nd edition Mc Graw-Hill.
3. Introduction to Petroleum Engineering by Geltin
4. Vikas Mahto, Objective Questions & Answers in Petroleum Engineering, Khanna Publishing House, New Delhi
5. Wellsite Geological Techniques for petroleum exploration, Oxford and IBH publishing Company.

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Course Code	**DCMA-503 (B)**
Course Title	**Material Science and Technology**
Number of Credits	**3 (L: 3: T:0 : P: 0)**

COURSE LEARNING OBJECTIVES:

- To impart the basic concept of material science.
- To understand the various properties, corrosion and heat treatment of engineering materials
- To understand the engineering requirement and selections of materials based on the properties for various applications.

COURSE OUTCOMES:

- After completion of the course, the students can understand the basics knowledge such as internal structure, crystal geometry, crystal imperfection of the engineering materials
- Understand the various properties and corrosion behavior of the selected materials in chemical industries
- Experience in the metallic and nonmetallic material selection and handling material in chemical engineering in the areas of equipment design.

COURSE CONTENT:

UNIT-I: Atomic Bonding: Classes of engineering materials - engineering requirement of materials - selection of materials - structure of atoms and molecules - Bonding in solids - types of bonds and comparison of bonds.

UNIT-II: Structure and Imperfections in Crystals: Crystal structure Crystal geometry, structure of solids, methods of determining structures. Imperfection in crystals - types of imperfection. Point imperfection.

UNIT-III: Properties and Corrosion of Material: Mechanical, Electrical and magnetic properties of materials - Deformation of materials - Heat Treatment techniques - corrosion, theories of corrosion - control and prevention of corrosion.

UNIT-IV: Metals: Engineering materials - ferrous metals - Iron and their alloys Iron and steel Iron carbon equilibrium diagram. Non-ferrous metals and alloys - Aluminium, copper, Zinc, lead, Nickel and their alloys with reference to the application in chemical industries.

UNIT-V: Non Metals: Inorganic materials: Ceramics, Glass and refractories - organic materials: wood, plastics, and rubber and wood - Advanced materials (Biomaterials, nanomaterials and composites) with special reference to the applications in chemical Industries.

REFERENCE BOOKS:

1. V. Raghavan, “Materials Science and Engineering- A First course”, Prentice Hall of India Pvt. Ltd.
2. R. Balasubramaniam, “Callister’s Materials Science and Engineering”, Wiley

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Course Code	**DCMA-504 (A)**
Course Title	**Chemical Technology**
Number of Credits	**3 (L: 3: T:0 : P: 0)**

COURSE LEARNING OBJECTIVES:

- To impart the basic concepts of chemical technology.
- To develop understanding about unit process and unit operations in various industries.
- To learn manufacturing processes of organic and Inorganic Chemicals and its applications and major engineering problems encountered in the process.
- To learn the process flow sheet drawing for the manufacturing chemical processes.

COURSE OUTCOMES:

On completion of the course, the student can be able to
- Understand the various unit operations and processes with their symbols
- Understand the manufacturing process of natural products processing and industrial microbial processes and edible oils.
- Understand the various chemical reactions involved in the process
- Understand the manufacturing process of inorganic chemicals
- Draw the process flow sheet and understand the major engineering problems encountered in the processes.

COURSE CONTENT:

UNIT-I: Natural Products Processing: Production of pulp, paper and rayon, Manufacture of sugar, starch and starch derivatives, Gasification of coal and chemicals from coal.

UNIT-II: Industrial Microbial Processes and Edible Oils: Fermentation processes for the production of ethyl alcohol, citric acid and antibiotics, Refining of edible oils and fats, fatty acids, Soaps and detergents.

UNIT-III: Alkalies and Acids: Chlor - alkali Industries: Manufacture of Soda ash, Manufacture of caustic soda and chlorine - common salt. Sulphur and Sulphuric acid: Mining of sulphur and manufacture of sulphuric acid. Manufacture of hydrochloric acid.

UNIT-IV: Cement Gases, Water and Paints: Types and Manufacture of Portland cement, Glass: Industrial gases: Carbon dioxide, Nitrogen, Hydrogen, Oxygen and Acetylene - Manufacture of paints - Pigments

UNIT-V: Fertilisers: Nitrogen Fertilisers; Synthetic ammonia, nitric acid, Urea, Phosphorous Fertilisers: Phosphate rock, phosphoric acid, super phosphate and Triple Super phosphate

REFERENCE BOOKS:

1. R. Gopal and M. Sittig, " Dryden's Outlines of Chemical Technology: For The 21st Century" Third Edition, Affiliated East-West Publishers.
2. G.T. Austin, "Shreve's Chemical Process Industries", McGraw Hill, NewYork.
3. O.P. Gupta, "Chemical Process Technology", Khanna Publishing House
4. W.V.Mark, S.C. Bhatia "Chemical Process Industries volume I and II" CBS Publishers & Distributors
5. S. D. Shukla and G. N. Pandey, "Text book of Chemical Technology" Vol 2, Vikash Publishing Company.

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Course Code	**DCMA-504 (B)**
Course Title	**Food Technology**
Number of Credits	**3 (L: 3: T:0 : P: 0)**

COURSE LEARNING OBJECTIVES:
To impart knowledge to the students about advanced technology in food science and recent trends adapted in food industry.

COURSE OUTCOMES:
Upon successful completion of this course, the student should be able to
- Explain properties of food in relation to its quality.
- Elucidate the theory and applications of unit operations in food processing.
- Describe the various equipments used in food industry.
- Explain the factors affecting the growth and survival of food microorganisms.
- Describe various food preservation techniques.

COURSE CONTENT:

UNIT-I: Fundamentals of Food Process Engineering, Application of Quantitative methods of Material & Energy balances in Food Engineering Practices. Constituents of Food, Quality and Nutritive aspects, Food Adulterations, Deteriorative factors and Control.

UNIT-II: Fluid Flow, Thermal Process Calculations, Refrigeration, Evaporation and Dehydration operations in Food Processing.

UNIT-III: Fundamentals of Food Canning Technology, Heat Sterilization of Canned food, Containers – metal, Glass and Flexible packaging. Canning Procedures for Fruits, Vegetables, Meat, Poultry and Marine Products.

UNIT-IV: Preservation by Heat and Cold, Dehydration, Concentration, Drying, Irradiation, Microwave heating, Sterilization and Pasteurization, Fermentation and Pickling, Packaging Methods.

UNIT-V: Cereal, Grains, Pulses, Vegetables, Fruits, Spices, Fats and Oils, Bakery, Confectionary and Chocolate Products. Soft and Alcoholic Beverages, Dairy Products, Meat, Poultry and Fish Products.

REFERENCE BOOKS:
1. B Sivasankar, 'Food Processing and Preservation,' PHI Learning Pvt. Ltd.,
2. Rao D G, 'Fundamentals of Food Engineering', PHI Learning Private Ltd.,.
3. R Paul Singh, Dennis R Heldman, 'Introduction to Food Engineering,' 4/e, Elsevier,.
4. Da-Wen Sun, 'Emerging Technologies for Food Processing', Elsevier.

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Course Code	DOE-505
Course Title	Open Elective –I (A) Economic Policies In India
Number of Credits	3 (L:3: T:0: P:0)

Course Objectives:
The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.

Course outcomes:

At the end of the course, the student will be able to:
1 Understand Indian economics policy, planning strategies
2 It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes
3 Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives
4 Able to identify the problems and capable to decide the application for future development
5 Analyze economic issues and find solutions to complex economic problems and take correct economic judgment

UNIT-I: Basic features and problems of Indian Economy: Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

UNIT-II: Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

UNIT-III: Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

UNIT-IV: Economic Policies: Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India

UNIT-V: External sector in India: - India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

Reference Books:
1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

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Course Code	DOE-505
Course Title	Open Elective –I (B) Disaster Management
Number of Credits	3 (L:3: T:0: P:0)

Course Objectives:
Following are the objectives of this course:
1 To learn about various types of natural and man-made disasters.
2 To know pre- and post-disaster management for some of the disasters.
3 To know about various information and organisations in disaster management in India.
4 To get exposed to technological tools and their role in disaster management..

Course outcomes:
After competing this course, student will be:
CO1 Acquainted with basic information on various types of disasters
CO2 Knowing the precautions and awareness regarding various disasters
CO3 Decide first action to be taken under various disasters
CO4 Familiarised with organisation in India which are dealing with disasters
CO5 Able to select IT tools to help in disaster management

Unit – I: Understanding Disaster
Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity– Disaster and Development, and disaster management.

Unit – II: Types, Trends, Causes, Consequences and Control of Disasters
Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire)
Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

Unit- III: Disaster Management Cycle and Framework
Disaster Management Cycle – Paradigm Shift in Disaster Management.
Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.
During Disaster – Evacuation-Disaster Communication-Search and Rescue -Emergency Operation Centre Incident Command System – Relief and Rehabilitation
Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure
Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Stretegy, Hyogo Framework of Action.

Unit– IV: Disaster Management in India
Disaster Profile of India – Mega Disasters of India and Lessons Learnt.
Disaster Management Act 2005 – Institutional and Financial Mechanism,
National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies

Unit– V: Applications of Science and Technology for Disaster Management
Geo-informatics in Disaster Management (RS, GIS, GPS and RS).
Disaster Communication System (Early Warning and Its Dissemination).
Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions,
Structural and Non Structural Mitigation of Disasters
S&T Institutions for Disaster Management in India

Reference Books:

1. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi
3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4. Alexander, David, Natural Disasters, Kluwer Academic London
5. Ghosh, G. K., Disaster Management, A P H Publishing Corporation
6. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

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Course Code	**DCMA-506**
Course Title	**Summer Internship – II**
Number of Credits	**1 (L: 0: T:0 : P: 2)**

COURSE LEARNING OBJECTIVES:

The following objective should be fulfilled in industrial training–II, 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.

- 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.

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Course Code	**DCMA-507**
Course Title	**Major Project – I (Project Planning)**
Number of Credits	**1 (L: 0: T:0 : P: 2)**

COURSE LEARNING OBJECTIVES:

Course Outcomes:

Build projects as per industry and society demands.

Guidelines:

1. Project Selection

- Choose a practical and chemicakl engineering -related topic .
- Work in a team of **3–5 students** with guidance from a faculty mentor.

2. Literature Survey

- Study similar projects or technologies from books, internet, or journals.
- Understand existing solutions and identify improvements.

3. Define Problem & Plan

- Clearly define the **project title, aim, and objectives**.
- Prepare a **basic design or layout**.
- List tools, materials, and software to be used.

4. Work Schedule

- Make a **week-wise plan** (who will do what and when).
- Plan for material purchase or design work (for Phase 2).

5. Report Content (Phase 1)

- Title & team info
- Certificate
- Introduction & objectives
- Literature review
- Project plan & tools
- Timeline chart
- Conclusion & references