

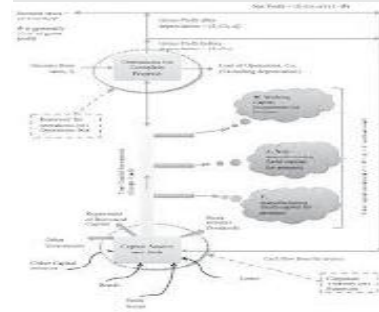
# 16CH401 CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	-	15	45	-	-	5	5



## Course Description and Objectives:

This course deals with fundamental concepts of process design and economics. The objective of this course is to familiarise the student with estimation of capital investments, Interest, investment cost, taxes, insurance, depreciation, profitability and optimum design in chemical process industries.

## Course outcomes:

The student will be able to:

- compare projects using the methods of net present value, discounted cash flow and equivalent minimum investment period.
- estimate plant capital cost based on published data.
- determine the impact of taxation, depreciation and investment incentives on the economic viability of a project.
- understand the procedures involved in optimum designing.

## SKILLS:

- ✓ *Analyze, synthesize and design processes for manufacturing products commercially.*
- ✓ *Use commercial flowsheeting software to simulate processes and design process equipment.*
- ✓ *Recognize economic, construction, safety, operability and other design constraints.*
- ✓ *Estimate fixed and working capitals and operating costs for process plants.*
- ✓ *Evaluate the profitability of process industrial projects.*

**ACTIVITIES:**

- *Identify a location for establishing a particular type of industry.*
- *Design a typical master plot plan for a particular plant.*
- *Perform the cost and profit analysis for a given type of plant.*
- *Prepare the list of safety and loss prevention factors for a given plant.*
- *Draw the combined detailed flow diagram for a given manufacturing process.*

**UNIT - 1****L-9, T-3**

**INTRODUCTION TO PROCESS DESIGN** : Introduction – Process design development, Design project procedure, General design considerations, Health and safety hazards, HAZOP study, Environmental protection, Plant location, Plant layout, Cost and asset accounting.

**UNIT - 2****L-9, T-3**

**ESTIMATION OF CAPITAL INVESTMENT** : Cash flow for industrial operations, Cumulative cash position, Factors effecting investment and production costs, Estimation of capital investments, Cost indexes, Cost factors in capital investment, Methods for estimating capital investment, Estimation of total product cost.

**UNIT - 3****L-9, T-3**

**INTEREST AND INVESTMENT COSTS** : Types of interest, Simple interest, Compound interest, Nominal and effective interest rates, Continuous interest, Present worth and discount, Annuities, Perpetuities and capitalized costs, Costs due to interest on investment.

**UNIT - 4****L-9, T-3**

**TAXES, INSURANCE & DEPRECIATION** : Types of taxes, Federal income taxes, Carry back and carry forward of losses, Taxes and depreciation, Excess profits tax, Tax returns, Insurance – Types of insurance, Self insurance.

**DEPRECIATION** : Types of depreciation, Service life, Salvage value, Present Value, Methods for determining depreciation, Single unit and group depreciation.

**UNIT - 5****L-9, T-3**

**PROFITABILITY & OPTIMUM DESIGN** : Profitability standards, Mathematical methods for profitability evaluation, Rate of return on investment, Discounted cash flow, Net present worth, Capitalized costs, Payout period, Alternative investments, Replacements

**OPTIMUM DESIGN** : General procedure for determining optimum conditions - Procedure with one variable, Procedure with two or more variables, Optimum production rates.

**TEXT BOOKS:**

1. Timmerhaus K. D and Peters M. S, "Plant Design and Economics for Chemical Engineers", 4<sup>th</sup> edition, McGraw-Hill, 2004.
2. Gavin Towler and Ray Sinnott, "Chemical Engineering Design - Principles, Practice and Economics of Plant and Process Design", 2<sup>nd</sup> edition, Elsevier Science, 2012.

**REFERENCE BOOK:**

1. Gavin Towler and Ray Sinnott, "Chemical Engineering Design", 2<sup>nd</sup> edition, Butterworth-Heinemann, 2013.