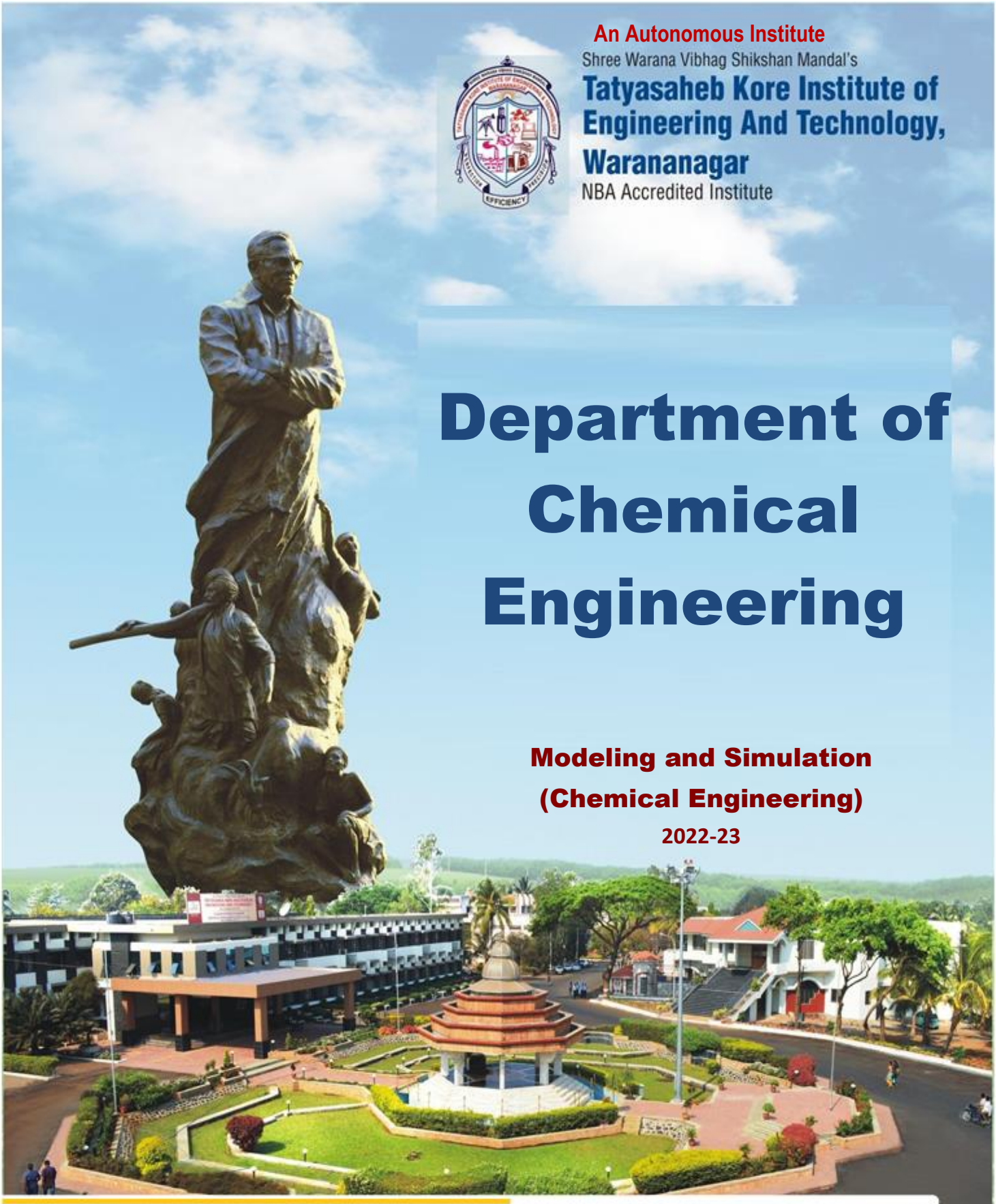
An Autonomous Institute

Shree Warana Vibhag Shikshan Mandal's

Tatyasaheb Kore Institute of Engineering And Technology, Warananagar

NBA Accredited Institute



Department of Chemical Engineering

Modeling and Simulation (Chemical Engineering)

2022-23

Honor Degree Course in Chemical Engineering

Syllabus Structure and Curriculum under Autonomy

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Department of Chemical Engineering

❖ VISION

To become an academy of excellence in technical education and human resource development.

❖ MISSION

- To develop engineering graduates of high repute with professional ethics.
- To excel in academics and research through innovative techniques.
- To facilitate the employability, entrepreneurship along with social responsibility.
- To collaborate with industries and institutes of national recognition.
- To inculcate lifelong learning and respect for the environment.

❖ QUALITY POLICY

To promote excellence in academic and training activities by inspiring students for becoming competent professionals to cater industrial and social needs.

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Department of Chemical Engineering

❖ PROGRAM EDUCATIONAL OBJECTIVES

Graduates will be able to,

1. Model and simulate the chemical processes by using advanced software.
2. Do Economic design and demonstrate safety and environmental aspects in chemical processes.
3. Understand the impact of Chemical Engineering solutions within realistic constraints in global and societal context.

❖ PROGRAM OUTCOMES

After completion of the Program, graduates will,

1. Apply knowledge of science, mathematics and engineering fundamentals to the solution of problems of chemical engineering.
2. Identify and integrate the major elements to formulate and solve chemical engineering problems.
3. Design a system, component or process to meet desired objectives within realistic constraints such as economic, environmental, social, political, ethical, manufacturability, sustainability, health and safety aspect
4. Conduct experiments using research based knowledge and research method safely to analyze and interpret data to provide valid conclusions.
5. Create and use the appropriate techniques, resources, modern engineering tools and advanced software's necessary for model prediction and simulation of chemical engineering processes.
6. Apply reasoning informed by contextual knowledge to assess impact of contemporary issues as societal, health, safety, legal, cultural and consequent responsibilities relevant to chemical engineering practices.
7. Understand the impact of engineering solution in a global, economic, environmental, societal context and need for sustainable development.
8. Understand professional ethics, responsibilities and norms of chemical engineering practices.
9. Work effectively as a member in multidisciplinary teams to have better understanding of leadership.
10. Communicate effectively and comprehensively in oral and written form
11. Apply knowledge of chemical engineering and understand management principle to manage projects in multidisciplinary environment.
12. Recognize the need for and have an ability to engage in lifelong learning.

❖ PROGRAM SPECIFIC OUTCOMES

1. Graduates will be able to Model and simulate the chemical processes by using advanced software.
2. Graduates will be able to do Economic design and demonstrate safety and environmental aspects in chemical processes.
3. Graduates will be able to understand the impact of Chemical Engineering solutions within realistic constraints in global and societal context.

SWVSM'S

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Abbreviations

Sr.No.	Acronym	Definition
1	ISE	In-Semester Examination
2	ISE-I	In-Semester Examination-I
3	ISE-II	In-Semester Examination-II
4	ESE	End Semester Examination
5	ISA	In-Semester Assessment (Term Work)
6	L	Lecture
7	T	Tutorial
8	P	Practical
9	CH	Contact Hours
10	C	Credit

Course/ Subject Categories

Sr.No.	Acronym	Definition
1	ESC	Engineering Science Course

Course/ Subject Code

CH	E	H	5	0	1
Branch Code		Honor Degree Course	Semester	Course Number	

Course Term work and POE Code

CH	H	H	5	0	1	T/P / A
Branch Code		Honor Degree Course	Semester	Course Number		T- Term work P- POE A- Audit Course

Honor Degree Course in Modeling and Simulation

(Chemical Engineering)

Structure under Autonomous Status of TKIET, Warananagar

2022-23

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

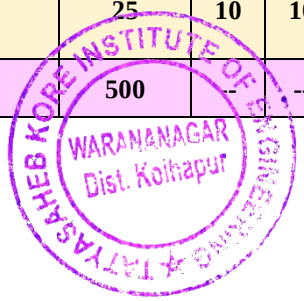
Honor Degree Course in Modeling and Simulation (Chemical Engineering)

Semester-V

(To be implemented from 2022 - 23)

Credit Scheme

Course Code	Course Title	Semester	Category	Teaching and Credit Scheme					Examination & Evaluation Scheme			
				L	P	T	CH	C	Components	Marks	Min for Passing	
CHE-H-501	Process Simulation and control using ASPEN PLUS	V	ESC	4	--	--	4	4	ESE	60	24	40
									ISE	40	16	
CHE-H-601	Pro Max Software	VI	ESC	4	--	--	4	4	ESE	60	24	40
									ISE	40	16	
CHE-H-701	PDMS Aveva (Design Software)	VII	ESC	4	--	--	4	4	ESE	60	24	40
									ISE	40	16	
CHE-H-801	Process Simulation using Uni-Sim (Design Software)	VIII	ESC	4	--	--	4	4	ESE	60	24	40
									ISE	40	16	
CHE-H-501T	Process Simulation and control using ASPEN PLUS	V	ESC	--	--	--	2	1	ISA	25	10	10
CHE-H-601T	Pro Max Software	VI	ESC	--	--	--	2	1	ISA	25	10	10
CHE-H-701T	PDMS Aveva (Design Software)	VII	ESC	--	--	--	2	1	ISA	25	10	10
CHE-H-801T	Process Simulation using Uni-Sim (Design Software)	VIII	ESC	--	--	--	2	1	ISA	25	10	10
				16	--	--	24	20	--	500	--	--



Evaluation:

For each course 100 marks evaluation. (60 marks End Semester Examination and 40 marks In Semester Examination which will consist of test, assignment, and presentations by students.)
For each course, the student should submit the assignment, tutorials, perform the hands on experience (Practical's based on the course) and the online courses as per the guidelines by the Programme. And the ISA will be based on assignments, tutorials and hands on experiments.

Guidelines for Honors Degree:

As per the guidelines provided by AICTE APH 20-21 Chapter 7 Section 7.3.2, institute has made the provision to opt for Honors for its students to achieve specialization in the area of his / her interest.

Approval Process Handbook_2021-22.pdf - AICTEhttps://www.aicte-india.org › sites › default › files PDF 30-Apr-2021 — Courses as per Chapter VII of the Approval Process Handbook. 38 "Level" means Diploma, Post Diploma Certificate, Under Graduate Degree, ...309 pages

Honors Degree:

Under Graduate Degree Courses in EMERGING AREAS shall be allowed as specialization from the same Department or compatible Dept. as specialization in that particular area.

1. Students from same department are eligible for Honor degree.
2. Students can select advanced courses from their respective specialization in which they are perusing the degree. e.g. If Chemical Engineering student selects advanced subjects from same branch under this scheme, he/she will get Major degree along with Honor degree of Chemical Engineering.
3. Student can select one subject per semester from the list of Honor courses of a branch in which they are perusing the degree.
4. Online courses as per the AICTE APH are from platforms from nationally/Internationally recognized institutes, Universities, Companies / platforms approved by concern BoS.

Guidelines to the Departments:

Sixteen (16) additional Credits are to be considered for Honors Degree

Student shall be eligible for Honors degree of respective program in the Vth semester of Third Year by fulfilling the criteria prescribed by the institute.

- Department should introduce:
- 01 course per semester (V to VIII semester) having 03 credits (*5 Credits shall be given to one practical based course)
- 01-02 Online courses of minimum duration 8-12 weeks from nationally /internationally recognized institutes, Universities, Companies / platforms having 05 credits and department should carry out its ESE in addition to certification by online offering agency.

Honors Course

Sr. No.	Course Name	Credits	Semester	Remark
1	Process Simulation and control using ASPEN PLUS	4+1	V	In-House
2	Pro Max	4+1	VI	Online
3	PDMS Aviva	4+1	VII	In-House
4	UNI –SIM	4+1	VII/VIII	Online

Honor Degree Course in Modeling and Simulation

(Chemical Engineering)

Syllabus under Autonomy of TKIET, Warananagar

2022-23

CHE-H-501- PROCESS SIMULATION AND CONTROL USING ASPEN PLUS

Teaching Scheme			**Evaluation Scheme**		
Lectures	**:**	4 hrs per week	**ISE**	**:**	40 Marks
Credits	**:**	4	**ESE**	**:**	60 Marks
Practical	**:**	--	**ISA**	**:**	25 Marks
Credits	**:**	1	**POE**	**:**	--
Total Credits	**:**	5	**Total Marks**	**:**	125 Marks

Course Objectives: The objective of the course is to

1. Introduce the student's process monitoring, optimization and conceptual design
2. Introduce the different terminologies for the modeling and simulation.
3. Solve processes from the chemical industries.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Able to express general flowsheet concepts.	Understand
CO2	Able to set up basic requirements of simulation.	Analyze
CO3	Able to evaluate adequate physical properties.	Evaluate
CO4	Able to express major and common unit operations.	Understand
CO5	Able to create process flowsheet.	Create
CO6	Able to evaluate results in excel and graphical form.	Evaluate

Description:

Process Simulation and control using ASPEN PLUS:

Aspen Plus is a process modeling tool used for process monitoring, optimization and conceptual design, especially by chemical process industries. This is a simple course on Aspen Plus Simulation engine that will teach one how to model the most common unit operations of a chemical plant. Basic unit operations such as Pump, Reactor, Valve, Heater, Distillation Column etc. will be demonstrated which would be helpful for students, teachers, engineers and researchers in the area of R&D and Plant Design/Operation. The course is didactic, with a lot of applied theory and case studies. At the end of the course one will be able to setup a simulation, run it, get design parameters, optimize and get results. This is highly recommended for those who are willing to take a career in simulation/modeling via software.

Prerequisites	1:	Knowledge of Heat Transfer, Fluid Mechanics, Chemical Engineering Thermodynamics, and Mechanical Operations.
	2:	Knowledge of Chemical Reaction Engineering and Mass Transfer.

Section -I		
Unit 1	**Steady State Simulation and Optimization using Aspen Plus**	
	1. Introduction and Stepwise Aspen Plus™ Simulation: Flash Drum Examples. 1.1 Aspen: An Introduction. 1.2 Getting Started with Aspen Plus Simulation 1.3 Stepwise Aspen Plus Simulation of Flash Drums. 1.3.1 Built-in Flash Drum Models. 1.3.2 Simulation of a Flash Drum. 1.3.3 Computation of Bubble Point Temperature. 1.3.4 Computation of Dew Point Temperature 1.3.5 T-xy and P-xy Diagrams of a Binary Mixture Summary and Conclusions. Problems	**6**
Unit 2	**Aspen Plus Simulation of Reactor Models.**	
	2.1 Built-in Reactor Models 2.2 Aspen Plus Simulation of a RStoic Model 2.3 Aspen Plus Simulation of a RCSTR Model 2.4 Aspen Plus Simulation of a RPlug Model 2.5 Aspen Plus Simulation of a RPi Model using LHHW Kinetics. Problems.	**6**
Unit 3	**Aspen Plus Simulation of Distillation Models**	
	3.1 Built-in Distillation Models 3.2 Aspen Plus Simulation of the Binary Distillation Columns 3.2.1 Simulation of a DSTWU Model 3.2.2 Simulation of a RadFrac Model. 3.3 Aspen Plus Simulation of the Multicomponent Distillation Columns 3.3.1 Simulation of a RadFrac Model 3.3.2 Simulation of a PetroFrac Model 3.4 Simulation and Analysis of an Absorption Column..... 3.5 Optimization using Aspen Plus..... Problems	**6**
Section – II		
Unit 4	**Chemical Plant Simulation using Aspen Plus**	
	4. Aspen Plus™ Simulation of Chemical Plants. 4.1 Introduction..... 4.2 Aspen Plus Simulation of a Distillation Train 4.3 Aspen Plus Simulation of a Vinyl Chloride Monomer (VCM) Production Unit	**6**
Unit 5	**Dynamics and Control using Aspen Dynamics**	
	5. Dynamics and Control of Flow-driven Processes. 5.1 Introduction. 5.2 Dynamics and Control of a Continuous Stirred Tank Reactor (CSTR) 5.3 Dynamics and Control of a Binary Distillation Column Problem	**6**
Unit 6	**Dynamics and Control of Pressure-driven Processes**	
	6.1 Introduction..... 6.2 Dynamics and Control of a Reactive Distillation (RD) Problem	**6**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	2	3							2	2		1	1	1
CO2	1	2	2	2	2						2		1		
CO3	1	1					2				2		1		1
CO4	1		1	2							2		1	1	1
CO5	1	2	2	2	2						2		1	1	
CO6		1			2		2	2	2		2		1		

References:

Text Books	
1	
Reference Books	
1	Amiya K. Jana, "Process Simulation and Control using Aspen™", Eastern Economy Edition $_{P}H_{I}$.
2	Al-Malah, K.I.M (2016),"ASPEN PLUS® Chemical Engineering Applications", Wiley
3	Schefflan, R. (2016)."Teach Yourself the Basics of Aspen Plus", AIChE, Wiley.
Web Links	
1	

CHE-H-601- PRO MAX

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	4 hrs per week	**ISE**	**:**	40 Marks
Credits	**:**	4	**ESE**	**:**	60 Marks
Practical	**:**	--	**ISA**	**:**	25 Marks
Credits	**:**	1	**POE**	**:**	--
Total Credits	**:**	5	**Total Marks**	**:**	125 Marks

Course Objectives: The objective of the course is to

1. To familiarize the student in introducing and exploring Promax software in natural gas processing.
2. To enable the student on how to approach for solving Engineering problems using simulation tools in crude oil refining.
3. To prepare the students to use Promax in their project works.

Course Outcomes:

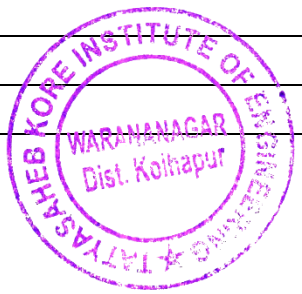
COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	To understand programming & simulation for engineering problems in natural gas processing.	Understand
CO2	Able to find importance of this software for crude oil refining problem.	Remember
CO3	Able to write basic Chemical Engineering problems in Promax & to use in research by simulation work.	Apply
CO4	Able to connect advance trends in Promax in chemical engineering fields.	Understand

Description:

About the course:

ProMax is a powerful process simulation package developed by Bryan Research and Engineering, Inc. (BR&E). It is used extensively by engineering companies, operating companies, academic institutions and government agencies to design and optimize their process facilities. By learning process simulation on the ProMax software package, students gain experience on a leading-edge software tool and acquire skills relevant to a variety of industries and employers. The academic exercises contained here are designed to assist instructors in teaching the practical aspects of process simulation. Detailed instructions and screenshots help students navigate the software so that students can progress through the exercises independently. Case studies are selected to give a realistic idea of how process simulation is used in industry and are easily related to engineering course content.

Prerequisites	1:	Basic Chemical Engineering knowledge.
	2:	Basic Mathematical concepts.
	3:	Thermodynamic properties.



Section -I		
Unit 1	**Introduction**	
	Introduction and background information about process simulation by ProMax	**6**
Unit 2	**Overview of Natural Gas Processing**	
	Collection and Pre-Processing, Gas Treating, Acid Gas Removal, Glycol Dehydration, Sulfur Recovery, Gas Processing.	**6**
Unit 3	**Overview of Crude Oil Refining**	
	Crude Oil Characterization, Crude Distillation, Crude Treating & Upgrading Units, Refinery Auxiliary Units.	**6**
Section – II		
Unit 4	**Overview**	
	Interface, ProMax Menu, ProMax Shapes, Project Viewer, Content Color Convention, Building Your Simulation, Defining Environments, Drawing the Flowsheet. Defining an Oil, Defining Streams/Blocks, Multiple Flowsheets, Exporting/Appending Flowsheets. Excel Interactions, ProMax Report	**6**
Unit 5	**Using the Scenario Tool in ProMax**	
	Available Analyses in ProMax, Using a Simple Specifier in ProMax, Using a Simple Solver in ProMax, Property Stencil, Writing the Simple Solver Expression.	**6**
Unit 6	**ProMax Foundations Exercises**	
	Simple Gas Plant,Simple Sour Water Stripper, Simple MDEA Sweetening Unit, Export/Append Flowsheet, Multiple Flowsheets, Glycol Dehydration Unit Three Bed Claus Unit , Hydrogenation Reactor, Pipeline Simulation,	**6**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1		1		1	3							1	1		
CO2		1		1	3							1	1		
CO3		1		1	3							1	1		
CO4		1		1	3							1	1		

References:

Text Books	
1	
Reference Books	
1	
Web Links	
1	https://www.bre.com/Default.aspx
2	https://www.bre.com/Support-Technical-Articles.aspx

CHE-H-701- PDMS AVIVA

Teaching Scheme			Evaluation Scheme		
Lectures	**:**	4 hrs per week	**ISE**	**:**	40 Marks
Credits	**:**	4	**ESE**	**:**	60 Marks
Practical	**:**	--	**ISA**	**:**	25 Marks
Credits	**:**	1	**POE**	**:**	--
Total Credits	**:**	5	**Total Marks**	**:**	125 Marks

Course Objectives: The objective of the course is to

- To familiarize the student in introducing and exploring PDMS software.
- To enable the student on how to approach for solving Engineering problems using simulation tools.
- To prepare the students to use PDMS in their project works.

Course Outcomes:

Cos	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Able to express programming & simulation for engineering problems.	Understand
CO2	Able to find importance of this software for Lab Experimentation.	Remember
CO3	Able to write basic Chemical Engineering problems in PDMS & to use in research by simulation work.	Apply
CO4	Able to connect advance trends in PDMS in chemical engineering fields.	Understand

Description:

- This is basic introduction of Plant design by using PDMS software and its use in chemical engineering field.
- PDMS (Plant Design Management System) as it is known in the 3D CAD industry, is a customizable, multi-user and multi-discipline, engineer controlled design software package for engineering, design and construction projects in offshore and onshore

Prerequisites	1:	Basic Chemical Equipment design concepts
	2:	Strength of material concepts

Section -I		
Unit 1	**History of PDMS**	
	Introduction to Piping and PDMS: PDMS database, PDMS login, PDMS Modules, PDMS usage and application, History of PDMS,PDMS Working hierarchy, PDMS Administrator, PDMS Designer, PDMS Engineer – roles PDMS ,GUI Introduction, PDMS Mouse button operations and shortcut Keys, PDMS Methodology of working, Advantages PDMS.	**6**
Unit 2	**Basics for PDMS**	
	Introduction of Plant design, Legend Sheet, P & ID reading, PMS(Piping Materials Specification) ,Parts of Piping Design: Material, Layout/Area and Stress Analysis ,Plot Plan	**6**
Unit 3	**Detailing of Block Diagram to P&ID**	
	Equipment Modelling, Creating Primitives/Nozzles Orienting and Dimensions ,Primitives / Nozzles, Modifying Primitives/Nozzles	**6**
Section – II		
Unit 4	**Pipe work Modelling**	
	Pipe work Modelling, Pipe Routing, Adding/Modifying Components Supports	**6**
Unit 5	**Structural Modeling**	
	Structural Modeling Creating/Modifying Columns & Beams Adding walls and floors Adding panels	**6**
Unit 6	**Drafting**	
	Introduction to Drafting Dimensioning Labelling Tagging Clash checking. **Recent Trends In PDMS** Concept of industry 4.0 and digital transformation, Use of Cloud technology.	**6**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1		2	2	2	2								2		
CO2		2	2	2	2								2	2	
CO3	2	2	2	2	2								2	2	
CO4			2	2	2										

References:

Text Books	
1	
Reference Books	
1	
Web Links	
1	

CHE-H-801: PROCESS SIMULATION USING UNISIM (DESIGN SOFTWARE)

Teaching Scheme			**Evaluation Scheme**		
Lectures	**:**	4 hrs per week	**ISE**	**:**	40 Marks
Credits	**:**	4	**ESE**	**:**	60 Marks
Practical	**:**	--	**ISA**	**:**	25 Marks
Credits	**:**	1	**POE**	**:**	--
Total Credits	**:**	5	**Total Marks**	**:**	125 Marks

Course Objectives: The objective of the course is to

1. To introduce the student's basic concept in streams, material and energy balance.
2. To introduce the different terminologies for the simulation.
3. To solve processes from the chemical industries.

Course Outcomes:

Cos	At the end of successful completion of the course the studentwill be able to	Blooms Taxonomy
CO1	Implement basic engineering knowledge to formulate process streams.	Understand
CO2	Understand a chemical processes unit operations	Create
CO3	Plan and Execute chemical processes problems	Analyze
CO4	Use commercial simulation in process industry	Evaluate

Description:

To formulate process streams, unit operation, components, process parameters, material & energy balance, implement and execute a chemical process.

Prerequisites	1:	Knowledge of process calculations, material and energy balance
	2:	Knowledge of chemistry, applied math's , physics
	3:	Chemical Engineering Thermodynamics-I, Chemical Unit operations, etc.

Section – I		
Unit 1	**Introduction:**	
	1.1 Create a unit set. 1.2 Choose a property package. 1.3 Select the components. 1.4 Create and specify the feed streams. 1.5 Install and define the unit operations prior to the column. 1.6 Install and define the column.	**6**
Unit 2	**Steady State Simulation:**	
	2.1 Logical – Balance, Adjust & UniSim Design Spreadsheet 2.2 Flow sheet Function	**6**
Unit 3	**Dynamic Simulation:**	
	3.1 Modifying the Steady State Flowsheet 3.2 Using the Dynamics Assistant	**6**
Section – II		
Unit 4	**Chemicals Tutorial:**	
	4.1 Introduction 4.2 Steady State Simulation 4.3 Dynamic Simulation	**6**
Unit 5	**Refining Tutorial:**	
	5.1 Introduction 5.2 Steady State Simulation 5.3 Dynamic Simulation	**6**
Unit 6	**UniSim Design Applications:**	
	6.1 Acid Gas Sweetening with DEA – Steady State Modeling, Optional Amines Package 6.2 Atmospheric Crude Tower – Steady State Modeling, Oil Characterization	**6**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1			1										2
CO2	3	2		1									2		
CO3				2	3									3	
CO4	1		2	1											1

References:

Text Books	
1	
Reference Books	
1	UniSim® Design, Tutorials and Applications, Honeywell 2010
Web Links	
1	https://www.academia.edu/11680327/UniSim_Design_Tutorials_and_Applications

Member Secretary
Board of Studies

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Board of Studies

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T.K.I.E.T, Warananagar

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T.K.I.E.T, Warananagar

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