Format K1

Maharashtra State Board of Technical Education, Mumbai

TEACHING PLAN (TP)

Academic Year: **2025-26 (Even)**

Institute Code and Name: 0078- K. K. Wagh Polytechnic, Nashik **Semester**: Second

Programme and Code: Chemical Engineering (CH) **Course Index:** 204

Course and Code: Fundamentals of Chemical Engineering and Materials(FCEM) (312341)

Name of Faculty: Dr. P. S. Bhandari **Class: FYCH**

INDUSTRY / EMPLOYER EXPECTED OUTCOME

Chemical engineering student will be conversant with terminologies used and duties of chemical engineer.

Course Outcomes (COs):

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO203.1	Enumerate the role & responsibility of a chemical engineer.
CO203.2	Use different safety norms, symbols for performing various safe operations/processes in given Chemical industry
CO203.3	Prepare the solution of given molarity/molality/normality for chemical reaction.
CO203.4	Select the relevant unit operations and unit processes for a given chemical industry.
CO203.5	Select suitable material for construction for relevant chemical process.

Teaching Learning outcome(TLO):

TLO 1.1	Provide an overview and evolution of chemical engineering.
TLO 1.2	Apply broad criteria for the classification of types of chemicals and chemical industries.
TLO 1.3	Choose nature of the job to be performed by a chemical engineer.
TLO 2.1	Develop Safety consciousness by explaining the importance of safety.
TLO 2.2	Use GHS and NFPA symbols for hazard identification.
TLO 2.3	Select the appropriate type of fire extinguisher for given class of fire.
TLO 2.4	Select appropriate PPE for given situation.
TLO 2.5	Select the relevant First aid methods.
TLO 3.1	Provide chemical engineering perspectives about properties of solutions.
TLO 3.2	Prepare solution of known concentration/composition.

TLO 3.3	Explain the concept of pH, electrical conductivity and its measurement.
TLO 3.4	Calculate the density/Specific gravity of given solution and its relation with composition of solution.
TLO 3.5	Equip the chemical engineer with basic skills related to solution preparation.
TLO 4.1	Identify the type of unit operations.
TLO 4.2	Identify the mechanical operation in a given situation.
TLO 4.3	Explain the concept of fluid flow operations and equipment used.
TLO 4.4	Describe concept and application of different Heat and Mass transfer operations.
TLO 4.5	Provide overview about different unit processes used in chemical process industries
TLO 5.1	Explain different properties of engineering material
TLO 5.2	Enlist the criteria for selection of material used in process industries.
TLO 5.3	Provide overview about common materials of construction used and their typical applications

. SUGGESTED COS - POS MATRIX FORM

CO	**Programme Outcomes (POs)**							**Programme Specific Outcomes (PSOs)**	
	PO-1 Basic and Discipline Specific Knowledge	**PO-2 Problem Analysis**	**PO-3 Design/ Development of Solutions**	**PO-4 Engineering Tools**	**PO-5 Engineering Practices for Sustainability**	**PO- 6 Project Management**	**PO - 7 Life Long Learning**	**PSO- 1**	**PSO- 2**
CO1	03	03	02	01	03	03	02	03	03
CO2	03	03	01	-	01	02	02	03	03
CO3	03	01	-	02	01	-	01	03	03
CO4	03	03	02	-	02	01	01	03	03
CO5	02	01	01	-	01	01	01	03	03
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level									

Unit No. (Hrs.)	CO	TLO	Title/Topic Details/COs	Plan (From -to & No. of Lect.)	Actual Exe. (From to & No. of Lectures)	Teaching Media/ Methods	Remark
Unit I Introduction to Chemical Engineering							
I (06)	CO1	TLO1.1	1.1 Chemical Engineering: History & evolution in India (Brief review about ancient, pre & post-independence chemical industry in India Contribution of Nagarjuna, Contribution of P.C. Ray - The father of Indian Chemical Industry) (IKS) - Chemistry Vs Chemical Engineering(03)	15/12/25 to 18/12/25			
		TLO1.2	1.1 Classification of chemical industry on the basis of: i. Type of chemical manufactured (Bulk, fine and specialty chemical) Difference between bulk, fine and specialty chemicals. ii. ii. Type of product manufactured (Pharmaceutical, Paint industry, fertilizer industry, Chlor- alkali. Polymer, Paper & Pulp, industry, etc.) (02)	19/12/25 to 22/12/25			
		TLO1.3	1.2 Job roles and job opportunities available to chemical engineers (02) **(Beyond Syllabus topic: 12 Principles of Green Chemistry)**	24/12/25 to 25/12/25			1 extra lecture

Unit No. (Hrs.)	CO	TLO	Title/Topic Details/COs	Plan (From -to & No. of Lect.)	Actual Exe. (From to & No. of Lectures)	Teaching Media/ Methods	Remark
Unit II Safety in Chemical Industry							
II (05)	CO2	TLO2.1	2.1 Safety: Importance of Safety in a Chemical laboratory and Standard Safety Instructions (01)	26/12/25			
		TLO2.2	2.2 Hazard and Hazard communication: GHS Hazards symbols for Biohazard, Toxic, Corrosive, Environment, oxidizer & Flammable material. Understand and interpret the hazard as per National Fire Protection Association(NFPA) hazard diamond (02).	29/12/25 to 31/12/25			
II (05)	CO2	TLO2.3	2.3 Fire: Definition of fire, fire triangle, classification of fire and standard method of using fire extinguisher (02).	01/01/26 to 02/02/26			
		TLO2.4	2.4 PPEs used in chemical laboratories. (Apron, Helmet, Face Shield, Safety Goggle, Ear Plug, Ear Muff, Hand Gloves, Safety Shoes) (02).	05/01/26 to 07/01/26			
		TLO2.5	2.5 First aid measures in chemical laboratory: First aid measures in case of eye injury, burn, skin contact and inhalation of toxic fumes (01)	08/01/26 to 09/01/26			1 extra
Unit III Basic Properties of Solution and Chemical Calculation							
III (12)	CO3	TLO3.1	3.1 Commonly used physical properties of solutions. Concepts/definition and applications. Examples of instruments used for measurement(01)	12/01/26			

Unit No. (Hrs.)	CO	TLO	Title/Topic Details/COs	Plan (From -to & No. of Lect.)	Actual Exe. (From to & No. of Lectures)	Teaching Media/ Methods	Remark
		TLO3.2	3.2 Basic chemical calculations: Concentration & methods of expressing concentration of solutions such as strength(g/l), Molarity, Molality and Normality. Numerical based on topic (04)	14/01/26 to 23/01/26			Revision
		TLO3.3	3.3 Composition of mixture on weight basis (wt%) & mole basis (mol %) basic numericals (03).	30/01/26 to 04/02/26			
		TLO3.4	3.4 pH & pH scale, density, specific gravity, viscosity, electrical conductivity, solubility, Partial pressure and vapour pressure, Dry bulb Temperature and Wet Bulb temperature (03).	30/01/26 to 04/02/26			
		TLO3.5	3.5 Specific gravity measurement using a specific gravity bottle and hydrometer (02)	05/02/26 to 09/02/26			extra for revision
Unit IV – Unit Operations and Unit Processes							
V (12)	CO4	TLO4.1	4.1 Unit Operations: Definition and classifications Symbols as per IS3232 (02).	11/02/26 to 12/02/26			
		TLO4.2	4.2 Introduction to Mechanical operation & equipment's used (example only) Size reduction, Size separation -Screen Filtration, Sedimentation & mixing (04).	13/02/26 to 19/02/26			
		TLO4.3	4.3 Concept of Fluid Flow Operation and equipment’s used for transportation of fluids (Examples only) (01).	20/02/26			

Unit No. (Hrs.)	CO	TLO	Title/Topic Details/COs	Plan (From -to & No. of Lect.)	Actual Exe. (From to & No. of Lectures)	Teaching Media/ Methods	Remark
		TLO4.4	4.4 Heat and Mass Transfer Operation: Modes of heat transfer operation, Evaporation, Gas absorption, Extraction. Distillation, Drying, Crystallization (05).	23/02/26 to 02/03/26			2 extra
		TLO4.5	4.5 Unit Processes: Brief information & application of unit processes like Sulphonation, Oxidation, Reduction, Hydrogenation, Saponification, Esterification, Nitration, Halogenation and Cracking/pyrolysis (03).	04/03/25 to 06/03/25			2 extra for revision
Unit V Material of Construction for Chemical Process Industries							
V (10)	CO5	TLO5.1	5.1 Important Properties of material such as ductility, malleability, tensile strength, corrosion resistance, stress strain curve, allowable or permissible stress and factor of safety (04).	09/03/26 to 13/03/25			
		TLO5.2	5.2 Criteria for selecting material of construction (01).	16/03/25			
		TLO5.3	5.3 Description and applications of following material of constructions used in process industries Carbon Steel, Stainless Steel, Titanium, Hastelloy Polymeric materials like Polypropylene, teflon(PTFE), Low density polyethylene, high density polyethylene, FRP (05).	18/03/26 to 25/03/26			

References:

S.N.	Title of Book	Author	Publication
1	Introduction to Chemical Engineering	Ghosal S. K., Sanyal Shyamal K, Datta S.	Tata McGraw Hill Publications; 2006; ISBN: 0-07-460140-7
2	Fundamentals of Chemical Engineering	S.N. Saha	Dhanpat Rai Publishing Company, New Delhi, 2012, ISBN:81-87433-55-8
3	IS 3232:Recommendations on Graphical Symbols for Process Flow Diagrams, Piping and Instrumentation	Bureau of Indian Standards	Bureau of Indian Standards , Second Edition,1999
4	Unit Operations of Chemical Engineering	McCabe, W. L. Smith, Harriott	McGraw Hill International; 2010; ISBN: 007-124710-6
5	Unit Processes in Organic Synthesis	P. H. Groggins	McGraw-Hill, New York
6	Safety Legislations in Chemical Handling and Industries	S.S.Mankar	Revised edition 2004 Published by Jyoti Mankar , New Panvel- 401206
7	Engineering Chemistry	P.C.Jain, Monika Jain	Dhanpat Rai Publishing Company ISBN 978-93521600
8	A Textbook of Organic Chemistry	Arun Bahl and B.S.Bahl	S.Chand ISBN -978-9352531967
9	Process Equipment Design	M.V.Joshi, V.V.Mahajani	MacMillan India Ltd. ISBN 0333924185

2. Learning websites and Portal:

S.N	Link / Portal & Description
1	https://pubs.acs.org/doi/10.1021/ba-1980-0190.ch013 A History of Chemical Technology and Chemical Engineering in India (IKS)
2	https://www.cdc.gov/niosh/npg/ Niosh Pocket Guide To Chemical Hazards
3	https://www.aiche.org/sites/default/files/cep/20181249.pdf India's expanding Chemical Industry by J.B. Joshi and Ravi Raghvan (Chemical Engineering Progress
4	https://www.protank.com/sulfuric-acid#:~:text=Sulfuric%20Acid%20Storage%20Tanks%20are,stored%20out%2 Material of construction for storage of chemicals
5	https://www.ddpsinc.com/blog/material-of-construction-options-for-chemical-process-plants Material of Construction Options for Chemical Process Plants

S.N	Link / Portal & Description
6	https://www.hse.gov.uk/comah/sragtech/techmeasmaterial.html Corrosion and selection of material
7	https://archive.org/details/gov.in.is.3232.1999 IS3232 :Recommendations On Graphical Symbols For Process Flow Diagrams, Piping And Instrumentation
8	https://chemicals.gov.in/ Ministry of Chemicals and Fertilizers

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CC: Course file –FCEM (312341)