Sant Gadge Baba Amravati University, Amravati

Department of Chemical Technology

Programme Outcomes, Programme Specific Outcomes and Course Outcomes

key indicator 2.6 : Students Performance and Learning Outcomes

KI 2.6.1 : The institution has stated learning outcomes (generic and programme specific)/graduate attributes which are integrated into the assessment process and widely publicized through the website and other documents. Upload COs for all courses

CO's (Course outcomes) of the courses: It is required to be approved by the competent authority of the University . The following Cos are proposed as per the syllabus .

Name of the Department:-	Department of Chemical Technology
Name of the Program:-	B.Tech Chemical Technology (Food, Pulp & Paper, Oil & Paint, Petrochemical)
PSO of the Program:-	1. Students shall have competency to shoulder responsibility in manufacturing process in food, petrochemical, pulp & paper, oil & paint and other chemical industries 2. Students shall have ability to undertake laboratory analysis and testing of chemical products for quality control 3. Students shall have knowledge for making equipment specification and installation for industrial project 4. Students shall have skills to develop and introduce innovation in industrial processing
PO of the Program:-	1. Students shall be well aware of fundamental principles of chemical engineering and designing & calculating methods for chemical process 2. Students shall gain knowledge about applications of chemical engineering

	theories in various product manufacturing processes 3. Students shall develop competency to handle modern process instruments & control systems for analytical skills, project and equipment design 4. Student shall have ability for critical thinking, social responsibility, high professional ethics, effective communication skill, social responsibility and environmental awareness

Name of the Department:-	Department of Chemical Technology
Name of the Program:-	M.Tech Chemical Technology (Membrane & Separation)
PSO of the Program:-	1. Students shall have competency to design optimal downstream processing in chemical, biotech and pharma industry 2. Students shall have knowledge and skills to undertake energy audit and material selection for process industry 3. Students shall have ability to develop product for various separation application based on advance separation technologies for chemical industry
PO of the Program:-	1. Students shall have advance knowledge of chemical engineering and technology with inter-disciplinary approach

	2. Students shall gained the advance practical and research skill in the field of separation technology 3. Students shall develop skills in the field of process and equipment design for chemical industry 4. Student shall have ability for critical thinking, social responsibility, high professional ethics, effective communication skill, social responsibility and environmental awareness

S.No.	Name of the course (Papers)	Course Outcome
1	APPLIED INORGANIC CHEMISTRY	Concept of atomic structure, related various theories and principles. Knowledge with respect to water and various treatments of wate Utilization of engineering materials towards different application The principles involved in corrosion control.
2	ENGINEERING PHYSICS	Students shall have knowledge in - Electromagnetic phenomena and wave propagation, Interferometric techniques in metrology, communication Application of quantum physics to optical & electrical phenomen Application of lasers and Fiber Optics in Engineering and Technology Conducting, superconducting and dielectric materials Semi conducting and new engineering materials Physics of Modern engineering materials Application of ultrasonics, acoustics
3	ENGINEERING MATHEMATICS	to identify algebraic problems from practical areas - to solve differential equations of certain types, including system of to understand maxima and minima concept. semesters. differential equations that they might encounter in the same or higher - to understand double and triple integration and enable them t handle integrals of higher orders.
4	COMPUTER PROGRAMMING	To learn the basic concepts of computing. To know the methodology of problem solving. To develop skills in programming using C language.
5	MECHANICAL TECHNOLOGY	On completion of the course the students expected, to understa the manufacturing process, metals and alloys, to basic principles casting, patterns, mould making and its technology, to understar theory of metal cutting, speed transmission and motion, to speci identify and classify operators of Lathe, Drill and grinding., to

		understand various joining processing and operations like Weldi Soldering and Brazing.
6	APPLIED PHYSICAL CHEMISTRY	
7	ELECTRICAL ENGINEERING	To expose the students to the analysis of electric and magnetic circuits, performance characteristics of D.C. machines, A.C. machines andtransformers and to give awareness of the basics o Control System engineering
8	ENGINEERING MECHANICS	Students will be able to understand resolution and composition forces, condition of equilibrium and various types of supports, calculation of work, power and energyand efficiency of machines
9	ENGINEERING DRAWING	To develop in students graphic skills for communication of concepts, ideasand design of engineering products and expose them to existing nationalstandards related to technical drawings
10	Applied Organic Chemistry	Student will have knowledge about preparation, properties and applications of aromatic hydrocarbons, hetrocyclic compounds, alcohols, phenols, acids and esters, amines and their derivatives Student will be bale to understand chemistry required in chemic process such as nitration, sulphonation, halogenations, polymeriasation and carbohydreates
11	Applied Physical Chemistry II	Students will have understanding of ion transport in electrolytes viscosity measurement , polymeric structure thermodynamic law they will have knowledge on photo chemistry and advance analytical techniques for measurement and analysis they will understand chemical equilibrium and analysis and method of adsorption and use of catalysis in chemical processes
12	Strength of Materials	Student will be well aware of mechanical properties and relation between stress ans strain of different materials, will be able to calculate force and bending moment of beams and support system, stress in solid and hollow circular shaft and power transmission by shafts
13	Applied Thermodynamics	To understand the fundamentals of various thermodynamic syst and devices • To analyze the performance and understand the applications of thermodynamic systems • To understand applications and working of Boilers and Steam Engines, IC engine and Air compressors.
14	Process Calculations	1. Understand the concept of basic chemical calculatio 2. Understand the concept and application of theory proportions 3. Determine the humidity with/without usi psychrometric chart. 4. Make the material balance over unit operations a processes.

		5. Make the energy balance over unit operations a processes. 6. Solve the problem of fuels and combustion.
15	Environmental Studies	
16	Engineering Mathematics II	Students will be able to demonstrate computational skills for solving problems using partial differential equations, complex numbers, numerical analysis they will gain knowledge on optimiosation concept, probability a statistics with applications
17	Food Technology – I	Students will have knowledge about food chemistry including water in food, carbohydrates, lipids, proteins, fruits and vegetables, meat, fish and poultry, milk and milk products they will be well aware of classification, structure and chemical composition of these products
	Pulp & Paper Technology I	Comprensive knowledge about chemistry of wood and pulp of paper materials such as wood understanding fiber morphology, cellulose chemistry and structu and properties of lignin
	Oil & Paint Technology – I	
	Petrochemical Technology – I	Students will have knowledge about chemistry of petroleum hydrocarbon including drilling and exploration of crude oil, hydrocarbon composition of petroleum and its products they will be aware of modern techniques used for product analys and molecular structure using NMR spectroscopy they will be knowledgeable with reactions of hydrocarbons such cracking, pyrolysis, reforming, isomerisation, hydrogenation, etc. students will have introductory knowledge of new and future energy sources
18	Machine Design & Drawing	The prime objective of this course is to introduce design as a process and as a final product; to understand fundamentals production process. Basic contents are: 1) Introduction to the design assignment, their aims and objectives, scope, special emphasis and limitation. Application of design standards for the proposed design safety. 2) Planning and design data collection, design analysis, and design synthesis. 3) Major designs the parts modification in the existing part for better result and efficiency.
19	Material Science & Engineering	Understanding crystal and non crystal structure and correlation o mechanical properties meta properties of steel and cast irons Understanding molecular structure and properties of polymers fo slection of material life and performance improvement of metals from corrosion

20	Fluid Flow Operation	1. Understand the knowledge of fluid flow, flu properties and type of fluid 2. Understand the concept of dimensional analysis 3. Select the agitators for mixing operations and able calculate the power required for mixing. 4. Understand the concept and applications of Bernoul theorem, 5. Understand the principle, working and application different flow meter 6. Understand the principle, working and application different fluid flow machinery. 7. Calculate the pressure drop across packed bed a minimum fluidization velocity in fluidized be understand the concept of two phase flow.
21	Environmental Studies	Knowledge about social issues and environment, human population and environment , sustainable development, climate change, renewable and nonrenewable sources, eco systems including food chain, biodiversity and its conservation , env. Pollution, waste management and disaster manmagement
22	Heat Transfer	1. Understand the concept and mechanism of he transfer by conduction, convection and Radiation. 2. Obtain the numerical solution of Conducti Convection and Radiation Problem. 3. Design and analyze the heat exchange and evaporato 4. Determine the heat transfer through submerged c and jacketed vessel 5. Understand the concept of boiling and evaporation. 6. Understand the various fundamental laws of radiati

23	Mechanical Operation	1. Perform the size reduction and screening operation industry 2. Understand the principle, construction and working various classifier and thickners used for so separation. 3. Select the suitable transportation system for differe types of solids. 4. Understand the principle construction and working various filtration equipments for solid separation fo liquid. 5. Understand the principle of centrifuges and cyclone 6. Understand the adsorption mechanism a application of adsorption.
24	Chem.Engg. Thermodynamics	Understanding of concept of thermodynamics, thermodynamic laws calculation of work done, free enrgy and heat changes Understanding vapor liquid equilibrium for binary, ternary syster and its applications in chemical reasctions Understanding chemical equlillibrium, feasibility of reactions for manufacture of chemical products
25	Sp.Tech (II)-Food Tech	student will be well versed with isolation of enzymes, photosysnthesis, digestion and metabolism of carbohydrates they will be knowledgable about assay of vitamin, minerals and v be able to understand energy requirement of individual, loss of nutrients during processing, enrichment and fortification of food toxic compounds students will have knowledge about techniques of biochemical analysis using modern instruments
	Pulp & Paper Tech	Detail knowledge of pulping processes such as mechanical pulpir semichemical pulping and semi mechanical pulping understanding comparative pulping methods such as sulfite pulping, alkaline pulping
	Oil & Paint Tech	Awareness about chemistry and biochemistry of oils and fats and there effects on metabolism of human being
	Petro Chem Tech.	Students will have knowledge about petroleum refining industry India, industrial practice of various conversion process such as catalytic cracking, coking, solvnt extraction, petroleum speciality products

		they will be well acqanted with various safety aspects of refinery and will develop skill for testing methods
26	Open Elective – I (Economics & Managment)	Understanding types of demand and its analysis for forecasting Knowledge about calculation of economic viability of projects Understanding markets assessment and survey awareness about business and finanace of chemical industry
27	Communication Skill	Development of communication-written and verbal skills preparation of technical reports, business correspondence
28	Process Equipment Des.&Drg	1. Understand the material behavior under stresses a theories of failures. 2. Design and fabricates atmospheric and pressure ves 3. Design high pressure vessel, agitated vessel, t column etc. 4. Select support system for various process equipmen 5. Prepare the working drawing for various equipment 6. Design and understand the layout of piping system.
29	Computer Programming & Application	Application of numerical solution with differential/ linear equatio for various chemical operation such as heat transfer, fluid mechanics, reaction engineering understanding optimization techniques writing and testing of programs in C lang. for problems in chemic engineering
30	Instrumentation & Control	1. Understand the importance of instrumentation a control in chemical process industries. 2. Understand the static and dynamic characteristics measuring instruments 3. Understand the principle construction and working Temperature, Pressure, Flow, Level and pH measuri instruments 4. Understand an instruments use for compositi analysis. 5. Understand the characteristics and application control valves. 6. Understand dynamic behavior of various process

		7. Design of controllers 8. Determine the stability of control system
31	Sp.Tech (III)-Food Tech	Student will have knowledge about food preservation, control f microorganism, sterilization techniques, immunological methods they will have knowledge about freeze drying, dehydration, and safety of food products such as breads, cheese, yogurt, etc.
	Pulp & Paper Tech	Knowledge on pulp washing, bleaching and recovery of spent chemical used in pulping process understanding importamce of recovery of chemicals in different pulping process Comprensive knowledge on multistage bleaching and environmental aspects of bleaching chemicals
	Oil & Paint Tech	comprensive picture of the oil industry, oparticuraly as to the reasons and basis for many diverse operations which are carried out in processes
	Petro Chem Tech.	Students will have skill of calculation in process like distillation, computation of properties of petroleum fraction, flash equllibriu calculation in petroleum refinery they will have knowledge of energy balance azeotropic and extractive distillation along with numerical method for designing heat exchanger and fluid dynamics
32	Open Elective – II (Chemical Technology)	Detailed understanding of kinetics and mechanism of various chemical processes used in manufacturinmg chemicals such as nitration, sulfonation and sulfation, hydrogenation, halogentaior oxidation techniques of waste water treatment study of manufacturing processes for industrial gases, acid, mari chemicals, fertilizers and electrochmeicals
33	Mass Transfer	1. Students will be able to design the chemical process equipments based on specific chemical process 2. Students will develop competency to optimize downstream processes used in manufacturing of various products 3. Students will have skills to analyze sets of the process, do computational and modeling work.
34	Chemical Reaction Engneering. I	1. Understand the kinetics of homogeneous reaction

		2. Interpret batch reactor data to determine the kinet of homogeneous reaction 3. Design the industrial reactor using kinetic data Determine the size and type of reactor. 4. Compare the size of various single and multiple ide reactor system along with recycle reactor 5. Understand the kinetics and design for multip reactions. 6. Understand the effect of temperature and pressure conversion.
35	Sp.Tech (IV)- Food Tech	students will have knowledge about food processing using variou unit operation and process technology of creals, legumes and oil seeds they will be well versed of process technology of baking and bak products, tea and coffee and special foods such as weaning and baby food with quality food management
	Pulp & Paper Tech	Detail knowledge on equipments used in stock preparations, understanding internal sizing of papers, role of additives and the applications dyeing of paper and knowledge of skill measuring
	Oil & Paint Tech	Awareness about technology of source, detergents and allied products of oils and fats which are important for industrial and daily applications in day to day life
	Petro Chem Tech.	Subject enriched the students about petroleum refining and design aspect related to various processes carried out in refining.
36	Professional Elective – I (Industrial waste treatment)	Knowledge about different types of pollution and there impact o human being Awareness about standards and norms of pollution limits Extensive knowledge on various waste ttreatmets and methods and technologies for industries like paper, food, sugar, fertilizer, etc.
37	Sp.Tech (V) : Food Tech	Students will have indepth knowledge about food processing technology of fruits and vegetables, aqatic foods and beverages they will have detailed information about different types of pacakign for specific products and testing of packing materials they will have knowledge about food adultation and laws and AGMARK standards
	Pulp & Paper Tech	Detailed knowledge about paper and paper board manufacturing process, understanding operation of machines such as cylinder

		mould machine, Fourdernier machines, drying machine in paper manufacturing technology
	Oil & Paint Tech	Achievment of comprenhsive overview of the surface coating industry, formulation of paints for domestic and industrial use
	Petro Chem Tech.	• Subject enriched the students about the petrochemi and its synthesis.
38	Sp.Tech (VI) : Food Tech	student will have knowledge about fermetaion technology for manufacture of alcohol, beverages, antibiotics along with designing and operation of fermentor they will have detaled information about waste treatment and immobilization of enzyme for industrial application
	Pulp & Paper Tech	Detail knowledge and skill of testing of papers for various properties, surface treatment of paper for different applications knowledge about energy conservation and capacity utilization in paper industry development of hand made paper and speciality papers
	Oil & Paint Tech	Awareness about technology of fat based and allied products fro oils & fats which are important industrial as well as domestic applications in day to day life
	Petro Chem Tech.	• Subject enriched the students about the complete analy of petrochemical processes.
39	Chemical Reaction Engneering. II	1. Understand the basic aspects of non ideal flow 2. Determine the conversion in non ideal reactor usi tracer information. 3. Develop the rate equation for heterogeneous reactio 4. Design the reactor for fluid-fluid reactions 5. Design the reactor for fluid particle reaction 6. Design reactors for solid catalyzed reactions
40	Plant design & Project Engg.	1. Understand the concept of process desi and development 2. Make the specification sheet of equipme 3. Understand the importance of HAZ study.

		4. Understand the importance of auxiliari and utilities of process 5. Perform estimation of equipment co project cost and product cost 6. Determine the profit loss and depreciati cost Understand the CPM/PERT method for project scheduling
41	Professional Elective – II (Biochmeical Engineering)	- Design biological processes and equipments used in manufacturing industrial products - Optimize process using optimization knowledge - Recommend different path of manufacturing product replacing conventional methods