

INSTITUTE OF CHEMICAL TECHNOLOGY
(Deemed to be University under section 3 of the UGC Act 1956)

DEPARTMENT OF OILS, OLEOCHEMICALS & SURFACTANTS

Detailed Syllabus for Third Year B. Tech

Sr. No.		Hrs
1.	CET 1406 - Chemical Engineering Operations (50 marks) 3hr./week	
	Distillation: Fundamentals of vapour liquid equilibrium; boiling point and dew point curves, T X Y diagram, performance evaluation of distillation columns such as: Flash; differential and steam distillation, and batch distillation.	
	Crystallisation: Phase diagram (temp/solubility relationship), evaporative and cooling crystallization, Introduction to different types of crystallizers and their design considerations.	
	Filtration: Mechanism of filtration, basic equation, constant volume, constant pressure filtration, rate expressions with cake and filter cloth resistances, compressible and incompressible cakes, Introduction to various types of filters and their design considerations.	
	Drying: Drying mechanism, drying rate curves, estimation of drying time and Types of dryers and introduction to design aspects of some of the dryers	
	Liquid-Liquid Extraction: Solvent selections, staged calculations, types of extraction equipment introduction to their design considerations.	
	Reference Books <ul style="list-style-type: none"> • Unit Operations of Chemical Engineering, McCabe W. L., Smith J.C., Harriot P. • Chemical Engineering vol. 1 - 7 Coulson Richardson • Principles of Mass Transfer and Separation Processes, Dutta, B.K. • Fundamentals of Modelling and Separation Processes, Holland C.D. • Fundamentals of Multicomponent Distillation, Holland C.D. • Distillation, Kister H.Z. • Mass Transfer Operations, Treybal R.E. • Mass Transfer Sherwood T.K. • Separation Processes, King J. C. 	
2.	CET 1212 - Chemical Reaction Engineering (50 marks) 3hr./week	
	Kinetics of homogeneous reactions, Interpretation of batch reactor	

	data, Single ideal reactors, Design for single and multiple reactions, Temperature and pressure effects Non ideal flow, Micro and macromixing of fluids.	
	Homogeneous and Heterogeneous Catalysis, Kinetics of Solid Catalyzed Reactions. Design of gas - solid catalytic reactors	
	Reference Books	
3.	OLT 1104 - Technology of Edible Fat Production (50 marks) 3hr./week	
	Processes and plants employed for refining, bleaching, deodorization, hydrogenation and winterization of oils or edible purposes,	7
	manufacture and evaluation of auxiliary materials such as activated earth and carbon, Ni catalysis and hydrogen	5
	newer techniques of refining of oils and fats	4
	manufacture of butter, margarine an ghee, Vanaspati, bakery and confectionery fats and fatty foods	4
	composition and properties of these spoilage during storage of fats, and fat products, protection against auto oxidation	5
	Reference Books: <ul style="list-style-type: none"> • Baileys industrial oil and fat products by Daniel Swern,, Wiley Interscience publication (1979) • Chemistry and technology of oils and fats by Prof. M. M. Chakrabarti, allied publishers (2003) • Treatise on fats, fatty acids and oleochemicals by O. P. Narula Vol. I & II, Industrial Consultants (India), (1994) • Natural fatty acids and their sources by E. H. Pryde • Hydrogenation of fats and oils by H. Patterson, Applied Science publishers (1983) 	
4.	OLT 1105 Technology of Oil and Fat Production	
	Natural sources of oils and fats, domestic and world production, trade and marketing of oilseeds and oils. Newer sources of oils and fats	4
	Storage, sampling, grading, cleaning, crushing, and heat treatment of oilseeds	5
	Mechanical expression, solvent extraction, rendering and other methods of recovering oils and fats. Economic aspects of these processes.	7
	Specific methods for the production of palm oil, palm kernel oil and rice bran oil.	2
	technical refining of oils for industrial uses, detoxification and technical products from oil cakes, edible products from oil meals,	6

	synthetic fatty material.	
	Antinutritional constituents of oilseeds. General methods of upgrading and utilization of oils, oil cakes and other products.	4
	Protein concentrates and isolates from oil meal	2
	<p>Reference Books:</p> <ul style="list-style-type: none"> • Bailey's Industrial Oil and Fat Products Volume I to V by Daniel Swern, A Wiley Interscience Publication (1979) • Palm oil by F. D. Gunstone, John Wiley and Sons (1987) • Oils and Fats Manual (Vol. I & II) by A. Karleskind and J. P. Wolff, Lavoisier Publishing (1996) • Oils, Fats and fatty foods by K. A. Williams, J. A. Churchill Ltd. (1966) • Journal of American Oil Chemists' Society, International News on Fats, Oils and Related Materials, Lipids. • Treatise on fats, fatty acids and oleochemicals by O. P. Narula, Vol I & II, Industrial Consultants (India), (1994) • Recent advances in chemistry and technology of fats and oils by R. J. Hamilton, Elsevier Applied Science (1987) 	
5.	OLT 1106 Cosmetics Science I	
	Common ingredients used in cosmetics, surfactants, additives, antioxidants, preservatives. Equipments, plants and machinery used for manufacture.	10
	Formulations of creams, hair care products, nail polish, lipsticks. Stability tests and product specifications	10
	Concept of product design, labeling, claiming and claim support understanding of current needs, translation of current needs to products	10
	<p>Reference Books:</p> <ul style="list-style-type: none"> • Modern Cosmetics by Thomssen, Universal Publishing Corporation (1951) • Formulations and functions of cosmetics by Jellinek, Wiley Interscience (1970) • Chemistry and manufacture of cosmetics by Denavarre, Grosse farm 	
6.	OLT 1107 Chemistry of Oils and Lipids	
	Glyceride Synthesis, acylation procedures, introduction and removal of	10

	protecting groups, 1-monoglycerides, 2-monoglycerides, 1,2-diglycerides, 1,3-diglycerides, triglycerides, optically active glycerides, phosphoglyceride synthesis.	
	Advanced methods of analysis of oils: Harmonization of standard methods. Chromatography of oils, fats and derivatives. Packed column gas chromatography. WCOT (capillary) GLC. Mass spectrometry of triglycerides and related compounds. Thin layer chromatography, High performance liquid chromatography. Stereospecific analysis of triacyl glycerols. Application of wide line NMR in the oils and fats industry. NMR (high resolution) finger printing	20
	<p>Reference Books:</p> <ul style="list-style-type: none"> • <u>Chemical constitutions of natural fats</u> by T.P. Hilditch and P.N. Williams 4th ed., Chapman and Hall (1964) • Baileys industrial oil and fat products by Daniel Swern, Wiley Interscience publication (1979) • Chemistry and technology of oils and fats by Prof. M. M. Chakrabarti, Allied publishers (2003) • Analysis of fats and oils by Mehlenbacher V. C., Garrardpren (1960) • Nontraditional oilseeds and oils by N. V. Bringi, Oxford and IBH Co. Pvt. Ltd. (1989) • Fatty Acid by K. S. Markely, Interscience publishers (1968) • Treatise on fats , fatty acids and oleochemicals by O. P. Narula, Vol I & II, Industrial Consultants (India), (1994) • Natural fatty acids and their sources by E. H. Pryde 	
7.	CET 1713 Instrumentation and process Control (50 marks) 3hr./week	
	Principles of measurement, principles of transductions., Measurement of pressure; Temperature Level and flow measuring devices, composition measurements, selection of sensors, Electrical/Electronic/PLC control systems	
	Introduction to system dynamics, concept of dynamic response, linear systems, First, second and higher order system, systems with dead time definition of terms such as transfer function, time constant, gain of the process with practical examples. Response of the process to standard inputs.	
	Introduction to process control: set point, disturbance, closed loop and open loop control, feedback and feed forward configurations, types of controllers, Poles and zeros of the transfer functions. The effects of	

	controller action on process response: offset, closed-loop gain, controller gain effect of controller parameters. Stability Analysis Design of controllers using criteria such as quarter decay, ISE, IAE, ITAE Design of controllers using open loop response, Zigler-Nichols approach, experimental determination of process model.	
	Introduction of frequency response technique, Design of controllers using frequency response technique, analysis of the systems for stability, Bode and Nyquist stability criterion.	5
	Multiple loop control systems, cascade control design, ratio control, feed forward control designs	4
	Introduction to multivariable control system, identification of interaction, design of controllers in interactions, elimination of interactions Control strategies for common industrial processes such distillation, heat exchangers, etc. Control strategies for Batch processes	7
	<p>Reference Books:</p> <ul style="list-style-type: none"> • Chemical Process Control An Introduction to Theory and Practice, Stephanopolous G. • Instrumentation in Process Industries, Liptak B.G. • Process Control Systems Shinsky F.G. • Process Systems Analysis and Control, Coughanour and Koppel • Process Modelling, Simulation, and Control for Chemical Engineers, Luyben <p>Principles and Practice of Automatic Process Control, Smith C.A., Corripio A.B.</p>	5
	OLT 1110 Technology of Oleochemicals (50 marks) 3hr./week	
	Fatty acids, theory and practice of fat splitting, and purification of products	5
	Separation of fats and fatty acids	4
	Miscellaneous applications of these in food, pharmaceutical, textile, plastic, leather and other industries	7
	Glycerine: Processes for treatment of sweet water and spent soap lye, Manufacture of glycerine from natural sources. Synthetic glycerin, grades of glycerin, properties and utilization of glycerin	5
	Miscellaneous fat-based produced: Manufacture and utilization of nitrogen, phosphorous and sulfate containing products	5
	Products obtained by interesterification, hydrogenation, oxidation and pyrolysis. Metallic soaps	4
	Reference Books	

	<ul style="list-style-type: none"> • Glycerin, Key cosmetic ingredient by Eric Jugermann, Marcel Dekker Inc., (1991) • Treatise on fats, fatty acids and oleochemicals by O. P. Narula, Industrial Consultants (India), Vo. I & II (1994) • Recent advances in chemistry and technology of fats and oils by R. J. Hamilton, Elsevier Applied Science (1987) • Natural fatty acids and their sources by E. H. Pryde • Fatty Acids by Markley K. S. Vol. I to IV, Robert E. Krieger publishing Co. (1973) • Fatty acids in industry by R. W. Johnson, Marcel Dekker Inc. (1989) • Fats, Oleochemicals and surfactants challenges in 21st Century by V. V. S. Mani and A. D. Shitole, Oxford and IBH Publishing Co. Pvt. Ltd. (1997) • Manufacture of soaps, other detergents and glycerin by E. Woollatt, John Wiley and Sons (1985) 	
11.	OLT 1111 Technology of Perfumery Chemicals	
	Study of reactions like hydrogenation, oxidation, reduction, epoxidation, hydrolysis, esterification, aldol condensation for perfumery chemicals etc.	5
	Preparation of terpeneless and sesqui terpenless oils. Technology of preparation for alcohols, esters, aldehydes, ketones	5
	Synthetic geraniol, geraniol esters, synthesis of terpene alcohols and their esters. Citronellol and their esters. Synthetic citroleool chemical route. Chemical synthesis of citronellol esters. Alpha terpeneol: chemical synthesis. Terpenyl acetate and other esters. Linalool nerol, menthol: chemical synthesis and their esters. Synthesis if vanillin, heliotropin, terpene ketone, ionones, methyl ionones, janmon, benzyl acetate, acetophenone, terpene aldehydes, citral	20
12.	OLT 1112 (Elective-I): Nanotechnology and Its Innovations in Chemical Industry	
	Introduction to Nanomaterials, Historical Evolution of Nanotech, Definitions, Properties,	2
	Types of Nanomaterials, Fullerenes, Carbon Nanotubes, Nanowires, Nanocones, Haeckelites	6
	Physics at Nanosize: Quantum Effects, Brownian Motion, Surface Forces, Self Assembly, Top-down Production, Bottom-up Production	6
	Production Methods of Carbon Nanomaterials: Carbon Arc Discharge, Laser Vaporization Technique, Chemical Vapor Deposition, Electrolysis	2
	Innovations of Nanotechnology in:	8

	Refineries, Production of Biofuel, Edible Oils, Cosmetics Food and Packaging Industry, Pharmaceuticals.	
	Innovations of Nanotechnology in: Textiles, Polymers, Paints and Dyes and General Applications	2
	Characterization Methods: Operational principle, Construction and Data Analysis of SEM, TEM, STM, AFM, DSC, TGA	4
	Reference Books <ul style="list-style-type: none"> • Nanomaterials Handbook, Yury Gogotsi • Introduction to Nanotechnology, Charles Poole and Frank Owens • Nanoscale Science and Technology, Robert Kelsall, Ian Hamley and Mark Geoghegan S. Chand's Applied Chemistry, S.S. Dara and S.D. Shete	