

## M. Tech. (Oils, Oleochemicals and Surfactant Technology)

### Semester I

Sr. No.		Course Code	Subjects	Hours/ week (L + T)	Marks	Credits
1	Core I	PYT 2106	Physical Methods of Analysis (Common)	2+1	50	3
2	Core II	OLT 2101	Advance Chemistry of Fats and Oleochemicals	2+1	50	3
3	Core III	FDT 2003	Advances in Nutrition	2+1	50	3
4	Elective I	PHT2101	Research Methodology (Common)	2+1	50	3
5	Elective II	OLT 2501 BST 2106	Nanotechnology and its Applications Intellectual Property Rights (Common)	2+1	50	3
6	Practical	OLP 2601	Oil Tech Lab. I	6	50	3
7	Seminar	OLP 2602	Seminar and Critical Review	6	50	3
8	Project I	OLP 2603	Research-I	12	100	6
<b>TOTAL</b>				<b>39</b>	<b>450</b>	<b>27</b>

### Semester -II

Sr. No		Subject Code	Subjects	Hours/ week (L + T)	Marks	Credits
1	Core I	OLT 2201	Technology of High Fat Products and Nutraceuticals	2+1	50	3
2	Core II	PFT 2009	Technology and Science of Essential Oils	2+1	50	3
3	Core III	OLT 2301	Surface Active Agents	2+1	50	3
4	Elective I	PFT 2108	Application of Fragrance and Flavours	2+1	50	3
		OLT 2103	Technology of Perfumery Chemicals	2+1	50	3
5	Elective II	OLT 2102	Chemistry and Technology of Castor and Non-conventional Oils	2+1	50	3
		OLT 2	Technology of Fine Chemicals	2+1	50	3
6	Practical	OLP 2604	Oil Tech Lab. II	6	50	3
7	Project II	OLP 2605	Research II	18	150	9
<b>TOTAL</b>				<b>39</b>	<b>450</b>	<b>27</b>

### Semester III

<b>Sr. No.</b>		<b>Course Code</b>	<b>Subjects</b>	<b>Hours/ week (L + T)</b>	<b>Marks</b>	<b>Credits</b>
1	In-plant Training	OLP 2606	In-plant/Industrial Training	<b>40 (15 weeks)</b>	<b>450</b>	<b>30</b>
<b>TOTAL</b>				<b>40</b>	<b>450</b>	<b>30</b>

### Semester IV

<b>Sr. No.</b>		<b>Course Code</b>	<b>Subjects</b>	<b>Hours/ week (L + T)</b>	<b>Marks</b>	<b>Credits</b>
1	Project III	OLP 2607	Research Thesis and Open Defence	<b>40</b>	<b>450</b>	<b>30</b>
<b>TOTAL</b>				<b>40</b>	<b>450</b>	<b>30</b>

Semester III and IV Evaluation will be conducted at the end of IV Semester.

<b>Code &amp; Title of the Course</b>	<b>Core I: PYT 2106 Physical Methods of Analysis</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	I

<b>Sr. No.</b>	<b>Topic</b>	<b>Hrs.</b>
1	<b>Fourier Transform Infrared Spectroscopy:</b> Molecular vibrations, frequency shifts associated with structural changes, basic theory of FTIR spectroscopy, interferogram, digitization of interferogram, data points collection, instrumentation and advantages of FTIR spectrophotometry, qualitative and quantitative analysis using infrared spectrophotometry	5
2	<b>Ultraviolet and visible spectrophotometry:</b> Electronic transitions, spectrum, shift of bands with solvents, isolated double bonds, conjugated dienes, carbonyl compounds, aromatic and hetero-aromatic compounds, application in pollution control and chemical industry	5
2	<b>Nuclear Magnetic Resonance:</b> Basic principles of NMR phenomenon, relaxation processes, spin-spin interaction, chemical shifts, interpretation of NMFR spectra, correlation - hydrogen bonds to carbon and other nuclei, instrumentation, continuous and pulsed NMR, carbon-13 NMR.	5
4	<b>X-ray Diffraction:</b> Crystal geometry and structural determination, Bragg's law of X-ray diffraction, powder method, X-ray spectrometers - wide and small angle diffractometers, chemical analysis by X-ray diffraction	2
5	<b>Particle size analysis:</b> Particle size, sampling, conventional techniques of particle size measurement, light scattering, particle size measurement by light scattering techniques, dynamic light scattering (DLS), fibre-optic dynamic light scattering (FDLS)	5
6	<b>Chromatography:</b> Basic theory of separation, efficiency, resolution, liquid chromatography, high performance liquid chromatography (HPLC), gas chromatography - columns and detectors, qualitative and quantitative analysis	5
7	<b>Mass Spectroscopy:</b> Basic principles, ionization of a molecule on electron impact, fragmentation processes in organic compounds, interpretation of mass spectra, molecular weight, molecular formula, instrumentation - different types of ionization sources and magnetic analysers	3

#### Reference books:

- 1) Fundamentals of Molecular Spectroscopy - C. Banwell and E. McCash
- 2) Instrumental Methods of Analysis - H. H. Willard, I. M. Merritt and J. A. Dean
- 3) Dye Lasers - F. P. Schafer
- 4) Infrared Spectra of Complex Molecules - L. J. Bellamy
- 5) Fundamentals of Surface and Thin Film Analysis - L. C. Feldman and J. W. Mayer
- 6) X-ray Structure Determination - G. H. Stout and I. H. Jensen
- 7) High Resolution NMR Spectroscopy - E. D. Becker
- 8) Nuclear Magnetic Resonance Spectroscopy—RXHarris
- 9) Physical Methods - R. S. Drago
- 10) Advances in Electrochemical Science and Engineering - I. I. Gerischer and C. W. Tobias (eds.)

#### Course outcome

- 1) Planning and programming of chromatographic methods for characterization of materials
- 2) Testing and validating of various oleochemicals by instrumental analysis

- 3) Applications of various instruments in allied field.
- 4) The ability to Interpret data of various analytical techniques and hence to establish structure property relationships.

	<b>Course Code: OLT 2101</b>	<b>Course Title: OLT 2101 Advance Chemistry of fats and oleochemicals (Marks 50)</b>	<b>Credits = 3</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: I</b>	<b>Total contact hours: 30+15</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Description of relevance of this course in the M. Tech. (OOST) Programme</b>					
Students will understand the advance chemistry of Oils, derivatisations leading to formation of oleochemicals, the reaction mechanism, physical and chemical properties of oils and fatty acids. They will be able to explain the diverse applications of oils and oleochemicals in industries such as food, cosmetics, specialty and platform chemicals, biolubricants, perfume and flavors etc. according to the chemistry involved.					
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hours</b>
1	General introduction to oils, fats, waxes and essential oils: principal sources, classification and composition, Statistics of production of oil bearing materials; Fatty acids: Nomenclature and classification. Physical properties of fatty acids and their esters.				3
2	Overall introduction of Oleochemical industries, fatty acid synthesis using Fat Splitting/ hydrolysis, Soaps by Neutralization/saponification, formation of metallic soaps, acylation, Fatty acid methyl esters and other esters using Esterification, Interesterification/ Transesterification, synthesis of fatty amines and fatty alcohols using various routes				9
3	Glyceride Synthesis, acylation procedures, introduction and removal of protecting groups, optically active glycerides, phosphoglyceride synthesis, Metathesis, Epoxidation, Hydroxylation, Ozonolysis. Estolide synthesis, Autoxidation and rancidity, Mechanism of rancidification,				9
4	Classification of oil on the basis of drying characteristics, Thermal and Oxidative Polymerization, Coconut/Castor oil in short oil alkyds, Soyabean/ Sunflower/ Safflower in medium oil alkyds, DCO/ Linseed/ Tung oil in long oil alkyds, Formulation synthesis, Manufacturing, Set up & Characterization, Dimer Acids in reactive and nonreactive polyamides, Brief idea of paint industry				9
<b>List of Text Books/ Reference Books</b>					
1	The Chemistry of Oils and Fats: Sources, Composition, Properties and Uses, Frank D. Gunstone, Blackwell Publishing Ltd, UK (2004)				
2	Fatty Acids in Industry, R. W. Johnson, and E. Fritz, eds., Marcel Dekker, Inc., New York, (1989).				
3	Bailey's Industrial Oil and Fat Products, Sixth Edition Vol. 1: Edible Oil and Fat Products: Chemistry, Properties, and Health Effects, Ed. Fereidoon Shahidi, John Wiley & Sons, Inc., Wiley Interscience Publication (2005).				
4	Fatty Acid and Lipid Chemistry, F. D. Gunstone, Blackie Academic and Professional, London, U.K. (1996).				
5	Oils and Fats Manual, Eds. A. Karleskind and J.-P. Wolff, Vols. I and II, Intercept Ltd., Andover, U.K. (1996).				

#### **Course Outcomes (students will be .....**

1. To analyse and characterize oils, and diverse Oleochemicals (K4)
2. Will be able to apply the knowledge of the Chemistry of oils in synthesis of oleochemical derivatives such as fatty acids, fatty esters, fatty amines and fatty alcohols (K3)
3. Highlight the function and mechanism of polymerization and alkyd, polyamide resins etc. (K4)
4. Formulation and developing new products in foods, beverages, cosmetics, lubricants, soaps, detergents, polymers, surface coatings etc. (K6)

<b>Code &amp; Title of the Course</b>	<b>Core III: FDT 2003 Advances in Nutrition</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	I

<b>Sr. No.</b>	<b>Topic</b>	<b>Hrs.</b>
1	Recent advances in biochemistry of food metabolism and nutritional aspects of foods; Nutritional requirements of special group of people such as aged, infants, pregnant & lactating mothers, patients etc.	10
2	Therapeutic nutrition & formulation of special dietary foods; Relation of food and diseases; Deficiencies of essential nutrients; Assessment of nutritional status & RDA; Effect of processing on nutrients; Functional foods and nutraceuticals with attributes to control cardiovascular diseases, cancer, obesity, ageing etc.	10
3	Food components and nutrients affecting immune systems, behaviour and performance; Functional aspects of dietary fibre, amino acids & peptides, lactic acid bacteria, antioxidants, vitamins, fatty acids etc.	10

### Course Outcome

1. Will be able to analyse the biochemistry of food metabolism and nutritional aspects of foods (K4)
2. Will be able to demonstrate appropriate therapeutic nutrition & formulation of special dietary foods; Relation of food and diseases (K3)
3. Assessment of nutritional status & Effect of processing on nutrients (K5)
4. Will be able to formulate functional foods and nutraceuticals (K6)
5. To differentiate and characterize Food components and nutrients (K4)

### Reference books:

1. Advances in food and nutrition research by Steve L. Taylor
2. Human nutrition by Alfin-Slater, 1979,
3. Human nutrition by Burton, BT, 1976,
4. Food, Nutrition and Diet Therapy by Krause and Mahan 1996,
5. Modern Nutrition in Health & Disease by Young & Shils.

<b>Code &amp; Title of the Course</b>	<b>Elective I: PHT2101:Research Methodology</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	I

Sr. No.	Topic	Lecture hr/week
1.	Meaning of Research, Purpose of Research, Types of Research (Educational, Clinical, Experimental, Historical, Descriptive, Basic applied and Patent Oriented Research) – Objective of research-	3 hrs
2.	Literature survey – Use of Library, Books, & Journals – Medline – Internet, getting patents and reprints of articles as sources for literature survey Methods and tools used in Research	3hrs
3.	The Research Report / Paper writing / thesis writing Results – tables, Graphs, Figures, and statistical presentation	3hrs
4.	Discussion – Support or non- support of hypothesis – practical & theoretical implications, conclusions Acknowledgements References Errata Importance of spell check for Entire project Use of footnotes	3hrs
5.	Selecting a problem and preparing research proposal for different types of research mentioned above.	3hrs
6.	Presentation: Skills and Execution	3hrs
7.	Protection of patents and trademarks, Designs and copyrights	3hrs
8.	Sources for procurement of Research Grants Industrial-Institution Interaction	3hrs

### Course outcomes

Course Outcome	
1	To access some basic concepts of research and its methodologies (K5)
2	To analyse appropriate research topics. (K4)
3	To write a research report and research proposal (K6)
4	To evaluate research presentation (K5)

<b>Code &amp; Title of the Course</b>	<b>OLT 2104 Elective I: Chemistry and Technology of Castor and Non-conventional Oils</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	II

<b>Sr. No.</b>	<b>Topic</b>	<b>Hrs.</b>
1	Castor oil Specifications: Lubricants, Medicinal, Cosmetics, Industrial – Processing, Formulation and Testing	4
2	1) DCO- Synthesis, role as Drying oil in synthesis of different polymers 2) Alkali Fusion : Manufacturing and Purification of Sebacic acid and 2- octanol use as Plasticizer (e.g. DOP) Influence of Reaction variables ( Molar Ratio, P,T) Polyester Lubricants based on Sebacic acid, undecylenic acid, nylon11, nylon 6, 10 Manufacturing and Application. 3) Pyrolysis: Undecylenic Acid, Heptaldehyde, manufacturing, reactor design, use of solven and catalysis, Nylon 11, Zn/Cu unde Cynate, Metallic soap – skin Ointment, Heptaldehyde: perfumery and flavour derivatives 4) Hydrogenated castor oil: use as wax, antisaggingagent, M.G, use in high temp. greases, Alkoxyated/ ethoxyated castor oil: as emulsifiers, wetting agents, HLB balance and degree of ethoxylation using lubricants, cutting/ rolling oils. 5) Castor oil based urethanes – synthesis and uses in paints/urethanes foam Miscellaneous derivatives: (Dimer acids leather softeners.) , HCO, ECO, Sulphated castor oil Manufacturing, Derivatisation, Applications	10
3	Mango kernel fats: Processing as Confectionary fats, Solvent Extraction, F.A./ Glyceride Composition, Characteristics, Lipid Associates, minor constituents and Applications of Karanja, Neem, Mahwah, Sal, Niger, Kusum, Rubber seed, Palash, Jojoba, Jatropa, Khakan, Kokum etc.	10
4	Worldwide Lesser known new varieties-Cuphea, Crambe, Medowfoam, Calendula, lesquerilla, vernonia galmensis, Euphorbia legascae, Camelina etc. Genetic Modified Crops	6

#### Course Outcome

1. To analyse different aspects of processing of non-conventional oils (K4)
2. To apply various specifications of castor oil and its derivatives in different industries (K3)
3. To infer about recent developments in castor oil and non conventional oils (K4)
4. Will be able to characterize different minor non-triglyceride constituents of non-conventional oils (K4)
5. To evaluate global research in developing seed varieties with specific fatty acid composition (K5)

<b>Code &amp; Title of the Course</b>	<b>Elective II OLT 2501: Nanotechnology and its Applications</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	I

<b>OLT 2501(Elective-II): Nanotechnology and its Applications</b>	Time (h)
Introduction to Nanotechnology: History, Definitions, Basic Properties	1
Fundamentals of nanomaterials: Structure of atom, Bonding in atoms: ionic, covalent, metallic, intermolecular forces, bonding energy, Crystal structure, polycrystalline, Fundamentals of quantum theory, Classification of nanomaterials	3
Synthesis of Nanomaterials, Top-down approach, Bottom-up approach	4
Nanomaterials: Carbon based nanomaterials, Metal based nanomaterials, Composites, Polymeric nanomaterials	6
Characterization of Nanoparticles: SEM, TEM, STEM, FIM, AFM, DSC, TGA, Zeta Sizer, Analysis of Data	9
Applications of Nanomaterials: General applications, Cosmetics applications, Environmental applications, Foods and oils applications, Materials applications, Pharmaceutical applications	7
<b>Reference Books</b> <ul style="list-style-type: none"> <li>Lindsay, S. Introduction to Nanoscience; Pap/Cdredition.; Oxford University Press: Oxford, 2009.</li> <li>Gogotsi, Y. Nanomaterials Handbook; 1st edition.; CRC Press, 2006.</li> <li>Kelsall, R.; Hamley, I. W.; Geoghegan, M. Nanoscale Science and Technology; 1st edition.; Wiley: Chichester, England ; Hoboken, NJ, 2005.</li> <li>Poole, C. P.; Owens, F. J. Introduction to Nanotechnology; John Wiley &amp; Sons, 2003.</li> </ul>	

#### Course Outcome

- Will be able to analyse properties with different methods of characterization of matter at nano-Scale (K4)
- Demonstrate the methods of synthesis of nano-materials (K3)
- Able to evaluate utility nano-materials for given applications (K5)
- Utilize the knowledge of nano-materials for developing applications of chemical industry (K3)

<b>Code &amp; Title of the Course</b>	<b>OLP 2601 Oil Tech Lab. I Advance Analysis of Oilseeds, Oils, and Oleochemicals</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	6 (Total contact hours:90)
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	I

Sr. No.	Topic (subtopics)	Hrs
1	Analysis of oilseeds, and cakes	6
2	Analysis of Oils and Fats: Acid value, Iodine value, Saponification value, Hydroxyl value, Peroxide value, anisidine value, unsap matter, Titer value,	24
3	Determination of physical and chemical characteristics of Vanaspati, margarine, ghee and waxes	12
4	To detect castor oil and soyabean oil mixture using TLC, Detection of adulteration oils/ Identification of Oils in mixtures	6



<b>5</b>	Analysis of mixture of fatty acids. fatty acid composition by GLC analysis	<b>08</b>
<b>6</b>	Auto-oxidation and rancidity (estimation)	<b>6</b>
<b>7</b>	Analysis of crude and pure glycerine	<b>6</b>
<b>8</b>	Analysis of Soaps surfactants and detergents: determination of surface tension, interfacial tension, and CMC, Testing of TFM of soap, % active matter of detergents, Two phase titration, amine value of nitrogen derivatives, Molecular weight of surfactants, Separation of mixtures of surfactants: ion exchange, silica/ alumina columns/ TLC	<b>22</b>

### **Course Outcomes**

- 1) Interpret the analytical numbers in testing of oils and fatty acids, adulteration of oils.
- 2) Apply and infer the physical and chemical testing of oils, fatty acids and Oleochemicals
- 3) Develop the instrumental techniques for analysis of oils, fatty acids, surfactants and Oleochemicals
- 4) Evaluation and testing of soaps, surfactants and detergents, waxes, glycerine and nitrogen derivatives

## M. Tech. Semester II

<b>Code &amp; Title of the Course</b>	<b>Core I: OLT 2102 Technology of High Fat Products and Nutraceuticals</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	II
<b>Description of relevance of this course in the M. Tech. (OOST) and M. Tech. (Food Tech.) Programme</b>	
Students will understand the manufacture and use of oil and fat and their Tailor made High Fat products as food products. Students will understand the micronutrients in oils and fats and will be able to explain the methods of separation and applications of it.	

Sr. No.	Topic	Hrs
1	Refining processes: Basic of Degumming, refining, bleaching, deodorization process : chemistry , mechanism, column,	5
2	Advances of Degumming, refining, bleaching, deodorization process	4
3	Manufacture of butter, margarine, ghee, Vanaspati, bakery and confectionery fats and fatty foods, Engineering and commercial bottleneck in supercritical fluid extraction	9
4	Introduction to nutraceuticals: definitions, synonymous terms, claims for a compound as neutraceutical, regulatory issues.	4
5	Study of Properties, structure and functions of various Nutraceuticals, such as carotene, lycopene, omega fatty acids, phytosterols etc, formulation of functional food, stability, analysis.	4
6	Food as remedies, Anti-nutritional Factors present in Foods, Nutritional Genomics Nutraceutical Industry and Market Information	4

### Course Outcomes

1. Able to categories and demonstrate the use of oils and fats as food products (K4)
2. Able to develop refining processes of oils and fats as cooking/salad oil (K6)
3. Will be able to select different fats for food products (K5)
4. Ensure customer safety to analysis of nutraceutical constituents and apply them in light of regulatory requirements (K5)
5. Applications, properties and functions of nutraceuticals (K3)

<b>Course Code: PFT 2109</b>	<b>Chemistry and Technology of Essential Oils (Marks 50)</b>	<b>Credits = 3</b>		
		<b>L</b>	<b>T</b>	<b>P</b>
<b>Semester: II</b>	<b>Total contact hours: 30</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Description of relevance of this course in the M. Tech. (Oils) Programme</b>				

Students will understand the chemistry behind the essential oils, aroma chemicals, properties etc. They will be able to explain its applications in beverages, flavor industry, fragrance industry, aromatherapy etc. according to the chemistry involved.

	<b>Course Contents (Topics and subtopics)</b>	<b>Hours</b>
1	Introduction to essential oils and comparison with other oils. Raw materials, processing, purification and isolation of essential oil	5
2	Conventional and advance methods of production of essential oils	5
3	Synthetic Aroma chemicals and aromatherapy	5
4	Physicochemical and sensory Analysis and quality control in industry	5
5	Detail study of selected essential oils related to production, isolation, applications etc. (lemongrass oil, citronella oil, rose oil, turpentine oil, mint oil, sandalwood oil etc),	5
6	Applications in soaps, detergents, cosmetics industry etc.	5
<b>List of Text Books/ Reference Books</b>		
1	The chemistry of essential oils – D. G. Williams	
2	Essential oils (Vol. I to VI) by Guenther E.	
3	Perfume and flavour materials of natural origin by Arctander S.	
4	Perfume, Cosmetics and Soap by Poucher W., Chapman and Hall ltd., (1959)	
5	Perfumes, Soaps detergents and Cosmetics by S. C. Bhatia, CBC Publishers and Distributors (2001)	

#### Course Outcomes

1. Will be able to design production process of essential oils (K6)
2. To analyse essential oils and aroma chemicals by Quality control tests (K4)
3. Evaluate Physicochemical and sensory properties of essential oils and aroma chemicals (K5)
4. Will be able to synthesise of aroma chemicals (K6)
5. To find out the applications essential oil in foods, beverages, cosmetics formulations, aroma therapy, soaps, detergents etc. (K3)

<b>Code &amp; Title of the Course</b>	<b>Core IV: OLT 2301 Surface Active Agents</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	II

<b>Sr. No.</b>	<b>Topic</b>	<b>Hrs.</b>
1	Recent developments of surfactant technology, Surface activity properties of anionic, cationic, nonionic and ampholytic surfactants including biosurfactants in aqueous & non aqueous media, Physicochemical aspects of micellization, solubilization, wetting, leveling, foaming, emulsification, dispersion, detergency etc.	5
2	Methods of synthesis and commercial manufacturing processes of following Surfactants: Sulphonates and Sulphates (SLS, LABS, FAMES, AOS etc), Paraffin	12

	sulphonates, Phosphate Esters, Sulphosuccinates, protein based surfactants, Ethoxylates and Propoxylates, Polyglycosides, Sucrose Ester, Alkanolamides, Sorbitan Esters, Aliphatic, Cycloaliphatic and Aromatic Quaternaries, Amine Oxides, Betaines	
3	Brief account of Surface activity properties and Synthesis of Specialty surfactants like Silicone surfactants, Cleavable surfactants, Gemini surfactants, Fluorinated surfactants, Polymeric surfactants, Formulation and Manufacture of Spray Dried Powdered Detergents	8
4	Concept of HLB and other related terms, deterative system, micro emulsion, multiple emulsion system, nanoemulsion system, biological properties of surfactants, Dermatological activity, toxicity, bactericidal effects, biodegradation, modern analytical techniques and specifications of surfactants	5

### List of Recommended Text Books/ Reference Books:

- Synthetic Detergents, Davidson, A. S.; Milwidsky, B. 7<sup>th</sup> Ed. John Wiley and Sons, New York, (1987).
- Handbook of Surfactants, Porter, M. R., Springer Science and Business Media (1993).
- Surfactants in Consumer Products: Theory, Technology and Applications, Ed. J. Falbe, Springer-Verlag, Berlin (1987).
- Industrial Applications of Surfactants-II, D. R. Karsa, Royal society of Chemistry (1990).
- Bailey's Industrial Oil and Fat Products, D. Swern, ed., Vol. I (1979), Vol. 2 (1982), 4<sup>th</sup> ed., John Wiley & Sons, Inc., New York,.
- Bailey's Industrial Oil and Fat Products, Sixth Edition Vol. 6: Industrial and Nonedible Products from Oils and Fats, Ed. Fereidoon Shahidi, Wiley Interscience Publication (2005).
- Fatty Acids in Industry, R. W. Johnson, and E. Fritz, eds., Marcel Dekker, Inc., New York, (1989).
- Richard M.; Marilyn E. K.; Pashley. Applied Colloid and Surface Chemistry, *John Wiley and Sons Ltd*, Chichester, UK (2004).
- James, R.; Carlos, K. J.; Montilla, L.; Pandey, S.; Shah, D. O. Handbook of Applied Surface and Colloid Chemistry, *John Wiley and Sons Ltd*, Chichester, UK (2002).

### Course Outcomes

1. Analyse and characterize Surfactants (K4)
2. Will be able to synthesize , conceptualize anionic, nonionic, cationic and amphoteric surfactants (K6)
3. Will be able to develop the formulation using surfactants (K5)
4. Demonstrate molecular aggregations and phase behaviour of surfactants using instrumental analysis (K3)
5. Ability to correlate the quantitative surface activity relationships (K5)
6. Interpret the role of surfactants as specialty and high performance chemicals and their role in diverse industries (K5)

<b>M. Tech.</b>	<b>Course Code: OLP 2604</b>	<b>Course Title: Oil Tech Lab. II -Processing of Oils and Oleochemicals (Marks 50)</b>	<b>Credits = 3</b>		
	<b>Semester: II</b>		<b>Total contact hours: 90</b>	<b>L</b>	<b>T</b>
			<b>0</b>	<b>0</b>	<b>6</b>
<b>Description of relevance of this course in the M. Tech. (Oils) Programme</b>					
Students will understand the production methods of oils, oleochemicals, surfactants and personal care products.					
	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hours</b>
1	Hydraulic expelling, Solvent extraction and separation of oils and fats				8
2	Aqueous extraction, Liquid liquid extraction for deacidification				8
3	Miscella refining and double solvent refining				8
4	High pressure fat splitting, fatty acid distillation				12
5	Saponification of Oils, Soap formulation and Plodder Processing				12
6	Synthesis various anionic, cationic, nonionic and amphoteric surfactants				12
7	Formulation and Processing of Detergent Powder by combined absorption and neutralisation mode				12
8	Purification of wax				4
9	Formulation and Processing of different Skin and Hair Care Products				14
<b>List of Text Books/ Reference Books</b>					
1	Treatise on fats, fatty acids and oleochemicals by O. P. Narula, Industrial Consultants (India), Vo. I & II (1994)				
3	Fats, Oleochemicals and surfactants challenges in 21 <sup>st</sup> Century by V. V. S. Mani and A. D. Shitole, Oxford and IBH Publishing Co. Pvt. Ltd. (1997)				

### Course Outcome

- 1) Demonstrate basics of Oil extraction by means of hydraulic expelling, solvent extraction and aqueous extraction
- 2) Apply and infer physical deacidification and the miscella refining
- 3) Evaluate the techniques of preparation and purification of fatty acids
- 4) Formulation of soaps and detergents

### Assessment Methods:

1. Unit Test
2. Assignment
3. Seminar
4. Mid Sem and End Sem Examinations

Literature survey including review of US/European/ Japanese/ Indian Patents and Research Papers published in PEER Reviewed Journals.

## Electives

<b>Code &amp; Title of the Course</b>	<b>Elective II BST 2106: Intellectual Property Rights</b>
<b>Marks</b>	50
<b>Number of Hours per Week</b>	2+1
<b>Credits</b>	3
<b>Class</b>	M Tech
<b>Semester</b>	II

<b>Sr. No.</b>	<b>Topic</b>	<b>Hrs.</b>
1	Introduction & History - Intellectual Property Rights	4
2	Trademarks & Trade-names	3
3	Patents / Patent filing	5
4	Designs, Copyright & Brand-name	3
5	Geographical Indication	3
6	Intellectual Property Right – Rules, Acts & Treaties	4
7	Case-studies in Intellectual Property Right	8

### Course Outcomes

1. Able to have a basic knowledge of IPR and patent, analysis, filling procedure for their research topic (K4)
2. Able to compare and judge the implications of patent and other IPR infringement (K5)
3. Able to categorize, compare and examine patents available in prior art for their research work (K4)
4. Able to prepare patent draft for their invention (K6)
5. Able to compare and interpret different inventions and other IPR from available prior art ( K6)

### Reference books:

1. WIPO Handbook
2. [www.ipindia.nic.in](http://www.ipindia.nic.in)
3. [www.indianpatents.org.in](http://www.indianpatents.org.in)
4. [www.wipo.in](http://www.wipo.in)

M. Tech.	<b>Course Code:</b>	<b>Course Title:</b> Technology of Fine and Speciality Chemicals	<b>Credits = 3</b>		
			<b>L</b>	<b>T</b>	<b>P</b>
	<b>Semester: II</b>	<b>Total contact hours: 45</b>	<b>2</b>	<b>1</b>	<b>0</b>
<b>Description of relevance of this course in the M. Pharm / M. Tech. Program</b>					
<b>Sr. No.</b>	<b>Course Contents (Topics and subtopics)</b>				<b>Reqd. hours</b>
1	Introduction. Characteristic features of fine and speciality chemicals manufacture. Types of Catalysts in Fine Chemicals Synthesis. Role of Heterogeneous Catalyst in Improving Selectivity. Aspects of Process Development of Fine Chemicals. Relevant Separation Methods. Different Types of Manufacturing Facilities of Fine Chemicals				7
2	Chemistry of Fine and Speciality Chemicals Synthesis. What are fine and speciality chemicals? Historical development of organic synthesis. Fine and speciality chemicals vs. bulk chemicals manufacture. Process selection: process profile analysis. Factors influencing process choice: cleaner and safer technologies. E factors and atom utilization. The role of catalysis in waste minimization. Fine chemicals and speciality chemicals and catalysis: examples.				8
3	Types of Catalysts in Fine Chemicals and speciality Synthesis. Introduction. Mechanism of catalysis. Heterogeneous catalysts - types and preparation. Catalyst performance: activity, selectivity, and stability. Catalyst selection. Catalyst characterization. Homogeneous catalysis. Phase-transfer catalysis. Biocatalysis.				8
4	Role of Heterogeneous Catalyst in Improving Selectivity. Heterogenization of homogeneous catalysis. Additional liquid phase. Rate and selectivity improvement via manipulation of 'microenvironment'. Rate and selectivity improvement via manipulation of 'macroenvironment'. Unconventional techniques. Continuous processes.				7
5	<b>Aspects of Process Development of Fine and speciality Chemicals.</b> Introduction. Steps in process development. Scale-up procedures. Chemical reactor scale-up, design, and operation. Acronyms and symbols. <b>Brief overview of Relevant Separation Methods.</b> Distillation. Extraction. Crystallization. Adsorption. Membrane separations. <b>Brief overview of Different Types of Manufacturing Facilities of Fine and speciality Chemicals.</b> Types of production plants. Typical equipment in a multi-product plant. Production costs. Design and scheduling of batch plants. Principles of good manufacturing practice.				15
<b>List of Text Books/ Reference Books</b>					
1	Fine Chemicals Manufacture: Technology and Engineering, A. Cybulski M.M. Sharma R.A. Sheldon J.A. Moulijn				
2	Sustainable Value Creation in the Fine and Speciality Chemicals Industry – R Rajagopal				
3	Speciality Chemicals Innovations in industrial synthesis and applications - BPerason				
<b>Course Outcomes (students will be able to.....)</b>					
1	Able to understand the manufacturing of various Fine chemicals and speciality chemicals				
2	Able to understand the process flow diagram and various process parameters				
3	Able to identify and solve engineering problems during production				