

Programmes:

- Under Graduate : B.Tech Chemical Technology (Oil Technology)
- Post Graduate: M.Tech Chemical Technology (spl. in Oil Technology)
- Ph.D
 - Ø Chemical Tech. (Oil Tech)
 - Ø Applied Chemistry

Syllabus:**Harcourt Butler Technical University, Kanpur-208002**

B. Tech. Chemical Technology (Oil Technology)

Course Structure & Evaluation Scheme

(Effective from the session 2013-2014)

Year I Semester I Branch : Common to all branches

S.No	Course Code	Subject	Periods			Evaluation Scheme			Subject Total	Credit	
			L	T	P	Sessional Exam		ESE			
						CT	T A				Total
Theory											
1	IMA101	Mathematics I	3	1	0	30	20	50	100	150	4
2	IPH101/ICY101	Physics/Chemistry	3	1	0	30	20	50	100	150	4
3	IEE101/IET101	Electrical Engg./Electronics & Instrumentation Engg.	3	1	0	30	20	50	100	150	4
4	IME101/ICS101	Engg. Mechanics/ Concepts of Computer and C programming	3	1	0	30	20	50	100	150	4
5	IHU101/ICE101	Professional communication/ Engineering Graphics	3	1	0	30	20	50	100	150	4
6	IHU102/ICE102	Remedial English/Environment and	2	0	0				50	50	Audit

		Ecology										
Practical/Training/Project												
7	IPH151/ICY151	Physics Lab/Chemistry Lab	0	0	3	10	10	20	30	50	1	
8	IHU151/ICS151	Language Lab/Computer Lab	0	0	3	10	10	20	30	50	1	
9	IEE151/IWS151	Electrical Engg. Lab/Workshop Practice	0	1	3	30	20	50	50	100	2	
10	IGP101	General Proficiency						50		50		

Year I Semester II Branch : Common to all branches

S.No	Course Code	Subject	Periods			Evaluation Scheme			Subject Total	Credit	
			L	T	P	Sessional Exam		ESE			
						CT	TA				Total
Theory											
1	IMA201	Mathematics II	3	1	0	30	20	50	100	150	4
2	IPH201/ICY201	Physics/Chemistry	3	1	0	30	20	50	100	150	4
3	IEE201/IET201	Electrical Engg./Electronics & Instrumentation Engg.	3	1	0	30	20	50	100	150	4
4	IME201/ICS201	Engg. Mechanics/ Concepts of Computer and C Programming	3	1	0	30	20	50	100	150	4
5	IHU201/ICE201	Professional Communication/ Engineering Graphics	3	1	0	30	20	50	100	150	4

6	IHU202/ICE2 02	Remedial English/Environment and Ecology	2	0	0				50	50	Audit
Practical/Training/Project											
7	IPH251/ICY2 51	Physics Lab/Chemistry Lab	0	0	3	10	1 0	20	30	50	1
8	IHU251/ICS2 51	Language Lab/Computer Lab	0	0	3	10	1 0	20	30	50	1
9	IEE251/IWS2 51	Electrical Engg. Lab /Workshop Practice	0	1	3	30	2 0	50	50	100	2
10	IGP201	General Proficiency						50		50	

Harcourt Butler Technical University, Kanpur-208002

B. Tech. Chemical Technology (Oil Technology)

Course Structure & Evaluation Scheme

(Effective from the session 2014-2015)

Year-II

Semester-III

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
Theory											
1	ICY-301	Modern Analytical Techniques	3	1	0	30	20	50	100	150	4
2	IMA-301	Mathematics – III	3	1	0	30	20	50	100	150	4
3	ICH-301	Materials and Energy Balance	3	1	0	30	20	50	100	150	4
4	ICH-304	Fluid Flow and Solid Handling	3	1	0	30	20	50	100	150	4
5	IOT-301	Chemistry of Oils and Allied Products	3	1	0	30	20	50	100	150	4
6	ICS-301	Cyber Security	2	0	0	-	-	-	50	50	Audit
Practical/Design/Training/Project											
6	ICY-351	Applied Chemistry Lab	0	0	6	30	20	50	50	100	2
7	IOT-351	Oil Characterization Lab	0	0	6	30	20	50	50	100	2
8	IGP-301	General Proficiency						50		50	--

Year-II

Semester-IV

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
Theory											
1	IMA-401	Numerical methods & computer programming	3	1	0	30	20	50	100	150	4
2	ICH-401	Heat Transfer Operations	3	1	0	30	20	50	100	150	4
3	ICH-402	Chemical Engg. Thermodynamics	3	1	0	30	20	50	100	150	4
4	IOT-401	Sources, Composition, Characterization of Oils, Fats and Waxes	3	1	0	30	20	50	100	150	4
5	IOT-402	Expression and Extraction Techniques of Oil Bearing Materials	3	1	0	30	20	50	100	150	4
Practical/Design/Training/Project											
6	IMA-451	Numerical Methods & Computer Programming Lab	0	0	3	15	10	25	25	50	1
7	ICH-453	Chemical Engg. Unit Operation Lab	0	0	3	15	10	25	25	50	1
8	IOT-451	Oil and Oilseed analysis lab	0	0	6	30	20	50	50	100	2
9	IGP-401	General Proficiency						50		50	--

Harcourt Butler Technical University, Kanpur-208002

B. Tech. Chemical Technology (Oil Technology)

Course Structure & Evaluation Scheme

(Effective from the session 2015-2016)

Year-III Semester-V

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
Theory											
1	IME-506	Elements of Mechanical Engineering	3	1	0	30	20	50	100	150	4
2	ICH-501	Instrumentation and Process Control	3	1	0	30	20	50	100	150	4
3	ICH-506	Mass Transfer Operations	3	1	0	30	20	50	100	150	4
4	IOT-501	Technology of Soaps and Fat Splitting	3	1	0	30	20	50	100	150	4
5	IOT-502	Commerce and Process Economics; Food Safety and Environmental Aspects of Oil Industry	3	1	0	30	20	50	100	150	4
Practical/Training/Project											
6	IOT-551	Analysis of Soap Products	0	0	6	30	20	50	50	100	2
7	IOT-552	Oils and Allied Products Formulation Lab	0	0	6	30	20	50	50	100	2
8	IGP-501	General Proficiency						50		50	--

Year-III

Semester-VI

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam		ESE			
						CT	TA		Total		
Theory											
1	IME-604	Machine Design	3	1	0	30	20	50	100	150	4
2	ICH-606	Chemical Reaction Engineering	3	1	0	30	20	50	100	150	4
3	ICH-607	Transport Phenomenon	3	1	0	30	20	50	100	150	4
4	IOT-601	Refining of Oils	3	1	0	30	20	50	100	150	4
5	IOT-602	Quality Assurance of Oils and Allied Products	3	1	0	30	20	50	100	150	4
Practical/Design/Training/Project											
6	ICH-653	Instrumentation and Process Control Lab	0	0	3	15	10	25	25	50	1
7	IOT-651	Detergent Products Preparation and Analysis Lab	0	0	6	30	20	50	50	100	2
8	IOT-652	Seminar	0	0	3	15	10	25	25	50	1
9	IGP-601	General Profeciency						50		50	--

Harcourt Butler Technical University, Kanpur-208002

B. Tech. Chemical Technology (Oil Technology)

Course Structure & Evaluation Scheme

(Effective from the session 2016-2017)

Year-IV Semester-VII

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			ESE		
			L	T	P	CT	TA	Total			
Theory											
1	ICH-701	Process Modeling and Simulation	3	1	0	30	20	50	100	150	4
2	IOT-701	Hydrogenation and Modification of Oils	3	1	0	30	20	50	100	150	4
3	IOT-702	Technology of Surfactants and Synthetic Detergents	3	1	0	30	20	50	100	150	4
4	IOT-703	Advance Oil Chemistry and Oleochemicals	3	1	0	30	20	50	100	150	4
5	IOE-711(Open Elective)	Technology of Oils, Oleochemicals and Surfactants	3	1	0	30	20	50	100	150	4
Practical/Training/Project											
6	IOT-751	Oil Processing Lab -2	0	0	6	30	20	50	50	100	2
7	IOT-752	Industrial Training and Report Presentation	0	0	3	-	-	50	-	50	1
8	IOT-753	Project / Dissertation	0	0	3	-	-	50	-	50	1
9	IGP-701	General Proficiency						50		50	--

Year-IV

Semester-VIII

S.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credit
			L	T	P	Sessional Exam		ESE			
						CT	TA		Total		
Theory											
1	IHU-801	Engineering Economics and Management	3	1	0	30	20	50	100	150	4
2	ICT-801	Process Equipment Design	3	1	0	30	20	50	100	150	4
3	IOT-801	Essential Oils & Cosmetics	3	1	0	30	20	50	100	150	4
4	IOT-802	Biotechnology of Oilseeds and Oils	3	1	0	30	20	50	100	150	4
5	Branch Elective		3	1	0	30	20	50	100	150	4
	IOT-803	Petroleum Products and Petrochemicals									
	IOT-804	Packaging of Oils, Fats and Allied Products									
	IOT-805	Technological Advances in Perfumery and Cosmetics									
	IOT-806	Environmental Aspects of Oils and Allied Products									
	IOT-807	Fuels and Green Lubricants									
Practical/Design/Training/Project											
6	IOT-851	Design and Tehno-economic Feasibility Project	0	0	12	30	20	50	100	150	3
7	IOT-852	Project On Industrial Assignment	0	0	3	15	10	25	25	50	1
8	IOT-853	Educational Tour Evaluation	0	0	3	15	10	25	25	50	Audit

9	IGP-801	General Proficiency						50		50	--
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IOT-301 CHEMISTRY OF OILS & ALLIED PRODUCTS

L : T: P
3 1 0

Unit-I

History and general introduction

Oils, fats, waxes, mineral oils, essential oils, their sources, composition and structures. Constituents of natural fats Glycerides and fatty acids, their nomenclature, classification and principle sources; theories of glyceride structure. Statistics of area under cultivation and oil Production in the Country vis-à-vis world.

06

Unit –II

Non-glyceride components, important minor constituents and contaminants

Phosphatides, sterols, gossypol, carotenoids, hydrocarbons, coloring matter, natural pigments, vitamins, antioxidants, Fatty Alcohols, Sterols, Tocopherols, Tocotrinols, Oryzanols, Triterpine Alcohols Waxes etc. Gossypol, Sesamol and Sesamoline, Flavoring compounds. Some minor important constituents of oilseeds: ricin, sinigrin, linamarine, saponin, allyl iso thiocyanate , gossypol, sesamol and sesamoline; environmental contaminants.

08

Unit – III

Physico-chemical characteristics of natural oils, fats and fatty acids

Oiliness and viscosity, cloud point, titre, density and coefficient of expansion, melting point, plasticity of fats & plastic range, smoke, flash and fire points, Boiling point; solubility and miscibility, refractive index,. Acid value, saponification value, Iodine value, thiocyanogen value, diene value, acetyl and hydroxyl value Riechert Miessel and Polensky values, and Kirshner value, Peroxide Value, Anisidine Value, Oxirane Value, TBA value, Krishner Value, Totox value, unsaponifiable matter. BIS methods for testing of oils and fats

08

Unit –IV

Adulteration tests for vegetable and animal fats and oils and their chemistry

Boudiens Test, Holde Test, Halphens test, Hexa Bromide Test, Ammonium Molybdate test, Belliers Turbidity Test, Test for the presence of Argemone, Sal Neem Kusum, Karanja, Animal fat, Allylthiocyanate test, Detection of ricebran oil in other oils and other relevant test.

08

Unit –V

Brief introduction to chemical reactions of fats and fatty acids

Esterification, interesterification saponification, hydrolysis: reactions involving the carboxyl groups e.g., formation of metal soaps: nitrogen derivatives, acid chlorides, anhydrides etc.: alkoxylation, pyrolysis: reactions in the fatty acid chain; hydrogenation, dehydrogenation, halogenation, addition of sulphur, phenols, cresols , hydrogen sulphide and mercaptans: sulphation and sulphonation and miscellaneous addition to the double bonds, Rancidity and mechanism of chemical and auto oxidation, natural & synthetic antioxidants

10

Reference Books and suggested readings:

1. Bailey's Industrial Oil and Fat Products, Edition 6 Vol-1 (2005), Edited by Feireidoon Shahidi
2. A text book of oil and fat analysis By Cocks & Reid
3. An introduction to chemistry & Biochemistry of Fatty acids & their glyceride By F.D. Gunstone
4. Oils and Fats Manual Vol- I, 1996, Edited by A. Karleskind
5. Chemistry and Technology of Oils and Fats, 2003, Edited by M.M. Chakraborty
6. BIS specifications; IS- 548, part I,II & III
7. Food Lipids; Chemistry Nutrition and Biotechnology By Casimir C. Akoh & David B. Min
8. Lipid Analysis of Oils &Fats, P.J. Hamilton, Liver pool, John Moores Univ., Liver Pool (UK)
9. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)
10. Handbook of Oil Technology by AOCS

IOT- 351 Oil Characterization Lab

L : T: P
0 : 0 : 6

1. Determination of physical characteristics of oils and fats
 - i) Specific gravity
 - ii) Refractive Index
 - iii) Colour
 - iv) Viscosity by Ford cup and Ostwald Viscometer
 - v) Titre
 - vi) Flash Point, Smoke point and Fire point
 - vii) Slip point of fat
 - viii) Moisture and insoluble in crude oil
 - ix) Unsaponifiable Matter
2. Determination of chemical characteristics of oils and fats
 - i) Acid value
 - ii) Saponification value
 - iii) Iodine Value
 - iv) Hydroxyl and acetyl Value
 - v) Peroxide value

Reference Books and suggested readings:

1. BIS specifications; IS- 548, part I,II & III
2. A text book of oil and fat analysis By Cocks & Reid
3. Food Lipids; Chemistry Nutrition and Biotechnology By Casimir C. Akoh & David B. Min
4. Lipid Analysis of Oils &Fats, P.J. Hamilton, Liver pool, John Moores Univ., Liver Pool (UK)
5. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)
6. Analysis of Oil & Fats by Bookenhoogen

IOT-401 Sources, Composition, Characterization of Oils, Fats and Waxes

L : T: P

3 : 1: 0

Unit-I

Natural sources of oils and fats

Global and National production, demand and supply scenario of oilseed and oils, Import and export of oils, oilseeds and oil cake, Past trends and future projections in fluctuations of production and price and their reasons.

08

Unit-II

Handling and Storage of Oils and oilseeds

Handling of oilseeds, oil bearing materials and crude oils. Storage of oilseeds, Grading and evaluation of oilseed and oil bearing material as per BIS/ Codex, Drying of oilseed.

06

Unit –III

Commercial oils, oilseeds, cultivation, characteristics, composition and utilization from plant sources

Coconut, palm, palm kernel, olive, cocoa butter, sunflower, safflower, sesame, groundnut, mustard, rape-seed, canola, soybean, linseed, castor, rice-bran, cottonseed, corn, tung, oiticica, neem, mahua, kusum, karanja, sal, mango kernel, tobacco, shea fat, watermelon, maize germ, algae oils, chiaseed oil, jatropha etc. Genetically modified oilseeds 10

Unit -IV

Production, characteristics, composition and utilization of oils from animal sources

Milk fats and butter, Animal fats, lard, tallow, emu oil and greases etc. Fish and marine oils: halibut, herring, shark, menhaden, whale, sardine, fish liver oils, krill oil etc, Different methods of rendering.

08

Unit -V

Natural and synthetic waxes characteristics, composition and utilization

Natural waxes such as bees wax, shellac wax, carnauba wax, sugarcane wax, Montana wax, jojoba wax, sperm-oil, ricebran, sunflower and spermaceti, synthetic waxes, their occurrence, classification, general properties and uses.

08

Reference Book

1. Bailey's Industrial Oil and Fat, Edition 6 Vol-2 (2005), Edited by Feireidoon Shahidi
2. Oils & fats Technology Edited by E. Bernardini
3. Neem: A wonder tree Edited by R.K. Suri & Mehrotra
4. Non Traditional oilseeds and oils in India, (1987) Edited by N.V. Bringi

5. Rapeseed cultivation, composition, processing and utilization Edited by L.A. Appelquist & R.Ohlson
6. Deep Frying; Chemistry, Nutrition and Practical Application, Michel D.Erickson IInd Edition

IOT-402 EXPRESSION AND EXTRACTION TECHNIQUES OF OIL BEARING MATERIALS

L : T: P

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Unit-I

Pre-treatments of oil bearing materials:

Cleaning, dehulling, decortication, size reduction, pre-pressing, flaking, extrusion, pelletization, stabilization (for rice bran), etc. Plants, processes and the machinery used.

08

Unit-II

Production of Oil by mechanical expression:

Machinery employed for expression/ mechanical extraction of oils viz. Ghanis, hydraulic presses, screw presses, low pressure and high pressure expellers, expander- extruder system

08

Unit-III

Production of Oil by solvent extraction:

Principle of solvent extraction, solvents and their availability, selection of solvents, advantages and limitations, properties of different solvents. Solvent extraction techniques: Batch and continuous plants and processes employed for solvent extraction of low and high oil bearing materials.

08

Unit-IV

De-solventization of meals:

Equipments and plants employed for de- solventization from extracted meal and recovery of solvent from micella, current trends, storage & detoxification of oil cakes, production of Protein products, concentrates and isolates;

06

Unit-V

Alternative extraction processes:

Principle and comparison with conventional solvent extraction processes. Use of super critical fluid and liquefied gases for oilseed extraction and oleoresin preparations, HCF extraction, Aqueous extraction. Enzymatic extraction; Solvent losses and utility requirements, energy conservation. Safety & hazards, maintenance and environmental consideration of solvent extraction plants & solvent recovery systems.

10

Reference Book and suggested readings:

1. Bailey's Industrial Oil and Fat, Edition 6 Vol-5 (2005), Edited by Feireidoon Shahidi
2. Oil and Fat Technology Edited by E. Bernardini

3. Solvent extraction of vegetable oil by Parikh
4. Oilseed and Oil Milling in India
5. Proceedings of AOCS
6. Handbook of SEA
7. Oil Extraction & Analysis (critical issue and comparative studies) , D.L. Luthria, US
Department of Agriculture Behtsville, Maryland
8. Solvent extraction of Oils, Monogram by Dr. R.K. Trivedi
9. Chemical Process safety by Crowl

IOT-451 OIL AND OILSEEDS ANALYSIS LAB

L : T: P
0 : 0 : 6

1. Analysis of individual oils as per FSSIR/ BIS /CODEX methods
2. Identification tests and detection of adulteration in oils and fats.
Boudiens Test, Holde Test, Halphens test, Hexa Bromide Test, Ammonium Molybdate test, Belliers Turbidity Test, Test for the presence of Argemone, Adulteration of rice bran in mustard oil, Adulteration of palm oils in other oils, Adulteration of other oils in olive oil, Adulteration of Animal fats in vegetable oils.
3. Analysis of oilseeds and cakes as per FSSIR/ BIS methods:
 - (a) Moisture Content
 - (b) Oil Content
 - (c) Nitrogen/ Protein Content
 - (d) Crude fiber Content
 - (e) Ash Content
 - (f) Trace metals, pesticides and naturally occurring toxins
4. Analysis of toxic constituents in oilseed and oilcakes
5. Determination of Allyl Iso-thio cynate in mustard oil as per Agmark
6. Complete analysis of oilcakes from oilseeds
7. Complete analysis of rice bran and its meal
8. Shelf life tests(OSI) , anisidine value

Reference Books and suggested readings:

1. BIS specifications; IS- 548, part I,II & III
2. A text book of oil and fat analysis By Cocks & Reid
3. Food Lipids; Chemistry Nutrition and Biotechnology By Casimir C. Akoh & David B. Min

4. Lipid Analysis of Oils & Fats, P.J. Hamilton, Liver pool, John Moores Univ., Liver Pool (UK)
5. Modern Technology in Oils and Fats Industry, Vol-II, OTAI (NZ)
6. Analysis of Oil & Fats by Bookenhoogen
7. Analysis of Oil & Fats by Malhenbacher
8. Official methods of AOCS
9. Handbook of FSSR

IOT-501: TECHNOLOGY OF SOAPS & FAT-SPLITTING

L : T: P

3 : 1: 0

Unit-I

Fundamentals of soaps:

History and background of soaps, General principles of soap-making, chemistry of cleaning action in soaps. Study of saponification reaction, velocity and temperature. Raw material for soaps and their selection: role of INS factor, solubility ratio and hardness number, quality specifications and soap making properties of oils and fats. Selection and functions of builders, fillers and other auxiliary raw materials, Upgradation of raw materials including fractionation .

10

Unit-II

Manufacture of household soaps:

Machinery employed and quality specifications with emphasis on effect on quality of milling and plodding, Production of soap base by traditional methods in single vessel, saponification in presence of catalysts and/or at high temperature and high pressure and Production of washing and toilet soaps from soap base by cold, semi-boiled and full boiled processes, phase behavior , Manufacture of soaps from fatty acids & methyl esters.

08

Unit-III

Continuous processes of soap manufacture:

Principles related to the production of extruded soaps-solidification and high shear reaction system, drying, extrusion, solid-solid co-extrusion, homogenization and plastic working. Modern process and plant for the production of household and toilet soaps viz. cascade, mazzoni . Specifications of soaps and fatty acids as per BIS standards.

08

Unit-IV

Manufacture of specialty soaps:

Soft soaps, liquid soaps, transparent and translucent soaps, super fatted soaps, medicated soaps, floating soaps, multicoloured soaps etc. Soap powders like spray-chilled and spray-dried powders.

06

Unit-V

Fat splitting and fatty acid distillation:

Hydrolysis of oils and fats; composition of partially split fats. Effect of temperature, pressure, catalyst and ratio of reactants in hydrolysis of fats; degree of splitting; Plants and processes employed for fat splitting: Twitchell process, enzymatic fat splitting, low, medium and high-pressure autoclave processes; semi-continuous and continuous processes of fat splitting, single cut and two cut column for DFA production. Fatty acids, distillation, crystallization, fractionation, high purity fatty acid products blends distillation. Specifications of fatty acids and glycerine as per BIS. Recovery of glycerine from spent soap lye & sweet water.

08

Reference Books and suggested readings

1. Soaps: Their chemistry & Technology by J.G. Kane
2. Soaps & detergent by K.S. Parasuram
3. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi
4. Glycerin Edited Vol -11 (1991) by Eric Jungermann & Norman O.V. Sonntag
5. Surfactants Series vol I- VII
6. Soap Technology By Davidson
7. Soap Technology By Elliot
8. Fatty Acid Series By Markley

IOT-502: Commerce and Process Economics; Food safety and Environmental aspects of Oil Industry

L : T: P
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Unit- I

Procurement process for oilseeds and oils:

Different mechanisms, Agencies involved in procurement at national and international level. Tax and import duty structure for oilseeds, oils – crude and refined, edible as well as non edible. Component of transport, labour, insurance and storage involved in cycle of procurement. Present day practices of sale through bulk/ packaged imports, with supply chain management.

08

Unit II

Components of Costing and Human resource development:

Cost and cost analysis of establishing plants e.g. Fixed and variable cost, Break Even Point, Rate of Return, Pay Back Period, Depreciation etc. Human resource Planning: Importance and processes, Job analysis and Engagements, Training need analysis.

08

Unit- III

Utilities & Production planning

Utilities; power, steam, air, water in expression, solvent extraction refining plant, hydrogenation plant, oleochemical unit. Energy conservation in oil processing

industry. A working layout and calculation of cost of production for above plants and feasibility studies.

Factory lay out: Principles, general considerations, typical flow diagrams, single & multi storied buildings, different sections of a paint factory and their locations, Instrumentation and automation. 08

Unit-IV

By- products of oil and oilseed processing industry and their utilization;

Phospholipids, production of industrial and edible grade Lecithin, gums. Manufacture of cattle and poultry feed; production of protein concentrates and isolates. Re-esterification of fatty acid with glycerin and its trans-esterification for production of biodiesel. Utilization of deteriorated deep fried oil for industrial utilization. 08

Unit- V

Safety measures, Effluents and their treatment:

Segregation of deodorizer distillate and isolation of value added products by conventional and molecular distillation and other plants and machinery involved. Classification of effluents of oil and allied industries, Safety considerations in storage of hazardous, and inflammable raw materials. Fire Protection and safety: Sources, types, Fire & explosion index, safety measures for protection. Health and Hazards: Resources, competence & regulations, systems & tools, HAZOP guidelines, Environment: Eco-friendly, waste minimization & waste disposal, Effluent Treatment Plants, system efficiency, respiratory protective equipments. GOI specifications of effluents, eco-friendly processes and green technologies

8

Reference Books and suggested readings:

1. Plant Design & Economics by Peter Timmer House
2. Air & Water by Giringer
3. Efficient use of Steam by Goodall

IOT-551 : ANALYSIS OF SOAP PRODUCTS

L : T: P
0 : 0 : 6

1. Analysis of household washing and toilet soaps as per BIS:
 - (a) Moisture and volatile matter content
 - (b) Free alkali
 - (c) Total alkali
 - (d) Total fatty matter
 - (e) Sodium chloride content
 - (f) Glycerol content
 - (g) Titre of fatty acids of soaps

- (h) Alcohol soluble & Insolubles
- (i) Identification of fat base
- 2. Analysis of P₂O₅ content in STPP
- 3. Determination of Surface Tension, Interfacial Tension, CMC and Contact angle
- 4. Determination of Fatty Acid profile of Toilet soaps
- 5. Analysis of Glycerin as per BIS/AOCS Method
- 6. Karl-Fischer method for determination of moisture

Reference Books and suggested readings

1. Soaps: Their chemistry & Technology by J.G. Kane
2. Soaps & detergent by K.S. Parasuram
3. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi
4. Glycerin Edited Vol -11 (1991) by Eric Jungermann & Norman O.V. Sonntag
5. Surfactants Series vol I- VII
6. Soap Technology By Davidson
7. Soap Technology By Elliot
8. Fatty Acid Series By Markley
9. BIS- 286

IOT-552: OILS AND ALLIED PRODUCTS FORMULATION LAB

L : T: P
0 : 0 : 6

1. Laboratory preparation for the following:
 - (i) Metallic soaps
 - (ii) Turkey Red Oil
 - (iii) Pilot scale manufacture of Toilet soaps
2. Laboratory preparation for the following:
 1. Cold Creams
 2. Vanishing Creams
 3. Tooth Pastes
 4. Tooth Powders
 5. Face Powders
 6. Talcum Powders
 7. Hair Oils

3. Preparation of Shampoos

Reference Books and suggested readings

1. Soaps: Their chemistry & Technology by J.G. Kane
2. Soaps & detergent by K.S. Parasuram
3. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi

IOT-601: REFINING OF OILS

L : T: P

3 : 1: 0

Unit-I

Pretreatment of oils:

Impurities of crude oils & micronutrients: Effect of refining and other processing on specific impurities. Washing of crude cotton seed oil, degumming of oils and fats: Mechanism of degumming, various methods employed for degumming, De-waxing of oils: Principle and methods of de-waxing of individual oils,

08

Unit-II

De-acidification of oils and fats:

De-acidification by alkalis e.g. caustic soda and sodium carbonate; batch and continuous methods; separators, refining losses, effect of operating variables, liquid-liquid extraction, miscella refining; Zenith refining, cold refining, physical refining of oils: Batch, semi-continuous and continuous methods, principle of major types of continuous process, their merits and demerits, esterification, nano-neutralisation etc. and their limitations. Treatment and disposal of gums and soap stock: Batch and continuous methods.

10

Unit-III

Bleaching of oils and fats:

Theory of adsorption bleaching; components responsible for oil color; chemical and physical characteristics of various bleaching agents; activated bleaching earth and activated carbon and their methods of manufacture, extraction of oils from spent earth, determination of bleachability and bleaching efficiency of adsorbents, batch and continuous methods of bleaching by adsorption; DOBI value, filtration techniques for removal of spent bleaching agents from bleached oils viz. Plate & frame filter, polish filter, pressure leaf filter, use of hydro gel & silica gel, chemical bleaching; color fixation in oils and fats.

08

Unit-IV

Deodorization of oils:

Components responsible for odor, flavour reversion, principle of deodorization, batch and continuous methods of deodorization; effect of operating variables; deodorization losses, commercial deodorizer design, thin film deodorization, vacuum systems and their applications, cooling tower, blending of oils, micronutrients present in vegetable oil and effect of processing on micronutrients Nutritional significance, specifications of blended and refined oils. Specifications of oils as per FSSAI, permissible limits of additives.

08

Unit-V

Membrane technology, Biotechnology and other separation processes of crude vegetable oils:

Degumming, de-acidification and bleaching. . Fractionation of Palm Oil and other vegetable and animal oils & fats. Biotechnology: Principle and its application in oil and fat processing,

06

Reference Books and suggested readings:

1. Technology and refining of oil and fats by T.L. Mahatta
2. Bailey's Industrial Oil and Fat, Edition 6 Vol-5 (2005), Edited by Feireidoon Shahidi
3. Bleaching & purifying fats and oils; Theory & Practice Edited by H.B.W. Patterson
4. Practical guide in vegetable oil processing by Manoj K. Gupta
5. Chemistry & Technology of Oils & Fats by M.M. Chakarobarty
6. Fats & Oils Handbook by Michael Bockich
7. Fats & Oils handbook vol. 1 AOCS press
8. Fats & Oils by Richard O' brien

IOT-602: Quality Assurance of Oils and Allied Products

L : T: P

3 : 1: 0

Unit -I

Quality control and Quality Assurance:

Concept of quality assurance and quality control in relation to oil industry; quality management systems - ISO 9000; total quality management (TQM); hazard analysis of critical control points (HACCP); good manufacturing practices (GMP); role of international organisations such as ISO; IDF; CAC; AOAC; WTO and national organisations like BIS; and Agmark; FSSAI and APEDA (Agricultural and Processed Foods Export Development Authority) in oil industry; guidelines for setting up quality control laboratory. Legislation on oils and allied products

10

Unit –II

Chromatographic Techniques:

Theoretical developments of various techniques viz. thin layer chromatography, column chromatography, gas-liquid chromatography, HPLC and Super critical Chromatography; their principles, practices and their applications in the quality control and quality assurance of oils, fats and allied products.

8

Unit –III

Spectroscopic Techniques;

Ultra-Violet, Visible, FTIR, NIR and NMR, Mass spectroscopic techniques: principles, practices and their application in the analysis of oils and allied products; Interpretation of spectra and

quantitative applications.

8

Unit –IV

Special quality control methods:

Nickel content of catalyst and hydrogenated oils; iron, sulphur and phosphatide content of crude and refined vegetable oils; wax content of vegetable oils; Vitamin A,D & E(natural & fortified); residual pesticide and solvent analysis, chlorophyll content, amino acid analysis by chemical and instrumental method etc.

8

Unit –V

Hyphenated techniques:

TLC-FID/FPD, GC-MS, SFC-GC, LC-MS, ICP-MS, AAS in analysis of oils and fats.

6

Reference Books and suggested books:

1. Fatty acids; Their chemistry, properties, production and uses Part – III Edited by K.S. Markley
2. Principles of Instrumentation analysis, Edition- III (1985) Edited by Douglas A. Skog
3. CODEX/ BIS
4. PFA
5. Agmark

IOT-651: DETERGENT PRODUCTS PREPARATION AND ANALYSIS LAB

L : T: P

0 : 0 : 6

1. Preparation of Detergent powder
2. Preparation of Liquid detergents
3. Analysis of synthetic detergent powders as per BIS
 1. Active matter content and its type
 2. Moisture and volatile matter content
 3. Matter insoluble in water
 4. Matter insoluble in alcohol
 5. Active alkalinity
 6. Sodium poly phosphate content & Total phosphate content
 7. Other builders

8. Chloride content
 9. Polymers
 10. Enzymes
-
4. Analysis of alkyl benzene sulphonic acid as per methods of BIS
 - (a) Active matter
 - (b) Free LAB
 - (c) Sulphuric acid content

 5. Determination of performance characteristics of surfactants and detergent products:
 - (a) Foaming power
 - (b) Dispersing power
 - (c) Relative detergency
 - (d) Surface tension and Interfacial tension
 - (e) Critical miscelle concentration
 - (f) Detergency test

Reference Books and suggested readings

1. Soaps: Their chemistry & Technology by J.G. Kane
2. Soaps & detergent by K.S. Parasuram
3. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi
4. BIS-286

IOT-652: Seminar

L : T: P

0 : 0 : 3

The student will be required to prepare and deliver a seminar as well as submit a written

IOT-653 SEMINAR

L : T: P
0 : 0 : 3

The student will be required to prepare and deliver a seminar as well as submit a written report on the topic assigned to him/her

IOT-701 HYDROGENATION AND MODIFICATION OF OILS

L : T: P
3 : 1: 0

Unit-I

Hydrogenation of oils:

Principle and importance of hydrogenation, kinetics of reaction, operating variables and their effect on rate of hydrogenation, selectivity and isomer formation, trans fat replacement solutions and technology, worldwide trends & regulations.

06

Unit-II

Hydrogenation catalysts and hydrogen production:

Catalyst structure, catalyst poisons and promoters, theory of catalysis, properties of catalysts e.g. porosity, selectivity, activity and other properties, different types of catalysts employed for hydrogenation of oils and fats, methods of catalyst manufacture, regeneration of nickel catalyst, Manufacture of hydrogen: methods of production and purification, storage of hydrogen, distribution through manifold & direct gasification in hydrogenation vessel. Estimation of purity of hydrogen and oxygen gas. Hydrogen gas requirements for hydrogenation of different oils.

10

Unit-III

Commercial plants and processes for hydrogenation of oils:

Different commercial plants for hydrogenation, design of hydrogenation vessels, chilling equipments for shortening, nitrogen gas based hydrogenation plants, batch and continuous methods, loop reactors, impellers Manufacture of salad oils and salad dressing, shortening, margarine, butter, bakery and confectionery fats, cocoa butter substitute, hard oils for industrial applications e.g. soaps, lubricating greases etc

10

Unit-IV

High-pressure hydrogenation:

Production of fatty alcohols, Hydrogenation of fatty acids: importance of operating variable and feed stock purity, commercial fatty alcohols and their industrial applications.

06

Unit-V

Modification of oils and their applications:

Analysis of modified fats, dilatometry- theory and practice, Trans unsaturated fatty acids and polyunsaturated fatty acids in nutrition and health, energy conservation in hydrogenation process, frying & stability characteristics, nutrition & health aspects, Interesterification, fractionation, winterization, diacylglycerols as low calorie fats.

08

Reference Book

1. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi
2. Hydrogenation of Oil & Fat Edited by H.B.W. Patterson
3. Markley Fatty Acid Vol. II
4. Oils & Fats Analysis by Cocks & Reid
5. Fats and oils formulation and for application by Richard D.O. Brien

IOT-702 TECHNOLOGY OF SURFACTANTS & SYNTHETIC DETERGENTS

L : T: P
3 : 1: 0

Unit-I Surface active agents:

Theory of surface action; effect and behaviour of surface active agents on the interfaces; solid- liquid, gas-liquid, liquid-liquid and interfaces formed by three phases e.g. solid, liquid and gas and two immiscible liquids. Bulk properties of surfactant solutions and methods of their measurements: micelle properties; foaming; wetting, emulsification, dispersion; and detergency; measurement of critical micelle concentration; foaming power and foam stability, wetting power, emulsifying power, stability of dispersion and detergency.

08

Unit-II Classification, synthesis and applications of surfactants:

Anionic surfactants: sulfated and sulfonated surfactants e.g. sulfated oils, alkyl sulfates, alkyl ether sulfates, sulfated mono-glycerides, alkyl glyceryl ether sulfonates, sulfated derivatives alkanolamides, ester and amide sulfonates, sulfonated poly-carboxylic acid surfactants, alkyl aryl sulfonates, olefin sulfonates, methyl ester sulfonates, mahogany and petroleum sulfonates and other miscellaneous anionic surfactants. Cationic surfactants: Non-quaternary nitrogen bases e.g. amines, nitriles and their: quaternary nitrogen bases and miscellaneous cationic surfactants. Nonionic surfactants: Poly-ethoxy ethers and esters and poly-hydroxy nonionic surfactants. Amphoteric surfactants, Biosurfactants, Novel surfactants.

10

Unit-III Plants and manufacturing processes of surfactants:

of anionic surfactants viz. alcohol sulfates, alkyl aryl sulfonates, olefin sulfonates, sulfated and sulfonated oils, alpha methyl esters etc., nonionic surfactants viz. Poly-ethoxy ethers and esters, poly-hydroxy surfactants etc. and cationic surfactant e.g. quaternary ammonium compounds.

10

Unit-IV Builders, fillers and auxillary materials, production of detergent products:

Inorganic and organic builders and fillers, polymers, optical brighteners, enzymes and other performance additives used in the manufacture of synthetic detergents and their functions. Various physical forms of synthetic detergents: Solid, liquid, and non/liquid forms. Manufacture of household synthetic detergents: Plants and processes employed for manufacture of powder, liquid, cake and other forms.

08

Unit-V Evaluation of detergent products:

Analytical techniques employed for analysis of synthetic detergents and surfactants as per BIS Methods. Environmental impact and toxicity of surfactants. Methods for determination of efficacy of surfactants

04

Reference Book

1. The manufacture of soaps other detergents and glycerin Edited by Edgar Woollatt
2. Synthetic detergent Edited by Milwidsky
3. Bailey's Industrial Oil and Fat Products Vol-1 Fourth Edition, Edited by Daniel Swern
4. Soaps & detergent Edited by K.S. Parasuram

5. Synthetic Detergents Edited by Davidson
6. BIS – IS: 4955-1978; Specification for Synthetic Detergent Powders for household use
7. Gemini Surfactants : Synthesis interfacial and Application
8. Handbook of Detergent; Part A,B,C,D

IOT-703 ADVANCE OIL CHEMISTRY AND OLEOCHEMICALS

L : T: P
3 : 1: 0

UNIT-1

Glyceride structure :

Advanced theories of glyceride structure of natural fats, Determination of glyceride structure; Synthesis of glycerides; estimation of mono – di and triglycerides. stereo specific analysis, lipase hydrolysis, polymorphism of fats and fatty acid. chemical synthesis of fatty acid and their derivatives. 08

UNIT-2

Mechanism of important chemical and biochemical reaction of fats and fatty acids:

Esterification,inter-esterification,isomerisation,polymorphism,dehydration,pyrolysis and oxidation of fatty acid esters and other oleo chemicals derived from fats and fatty acids, products and byproducts from castor oil, ,soybean oil, rapeseed oil, neem oil, mahua oil, cotton seed oil etc. 08

UNIT-3

Oil derivatives and their applications:

Production and utilizations of fatty nitriles, amines, sulphited and sulphurised oils; properties, specification, plant and processes employed. Textile chemicals, leather chemicals, polymer additives, paint additives, lubricants additives, 08

UNIT-4

Chemistry and applications of drying oils:

Modification of oils for surface coating industries, thermal and chemical modification methods; properties of modified oils ,changes in drying oils during heat bodying and oxidative polymerization. process and plants employed for their commercial production. Processes for production of malenised oils, epoxidised oils, boiled oils, stand oils blown oils, urethanes oils and alkyds, evaluation of surface coating materials. 10

UNIT-5

Production and applications of methyl ester:

Various methods for production of methyl esters, production of biodiesel, specifications as per ASTM and BIS, sulphated and sulphonated methyl esters and their applications.

REFERENCE BOOK

- 1.Fatty acid Vol.-1-5 by K.S.Markley
- 2.Bailey's industrial oil and fat,Part -1-5 by bailey

IOE- 711 : TECHNOLOGY OF OILS, OLEOCHEMICALS AND SURFACTANTS

L : T: P
3 : 1: 0

Unit-I

Introduction to oils & fats, types of glycerides, theories of glyceride structure, determination of glyceride structure, non-glyceride components of oils, component fatty acids of oils & fats.

08

Unit-II

Chemical reactions of oils & fats and their industrial importance, physico-chemical characteristics of oils & fats, classification of oils, adulteration of oils.

08

Unit-III

Post harvest technology of oilseeds, handling and storage of oilseeds , different methods for extraction of oils from oil-bearing materials.

08

Unit-IV

Degumming, deacidification, bleaching hydrogenation, deodorization and physical refining. Nutraceuticals derived from oils

08

Unit-V

Saponification of oils, different methods of soap manufacture, selection of raw materials, analysis of soaps. Types of surfactants and fat based surfactants.

08

Reference Book

1. Bailey's Industrial Oil and Fat, Edition 6 Vol-6 (2005), Edited by Feireidoon Shahidi

2. Oil & Fats Technology Edited by E. Bernardini
3. Soaps & detergent Edited by K.S. Parasuram
4. Soaps: Their chemistry & Technology by J.G. Kane
5. Chemistry and Technology of Oils and Fats, 2003, Edited by M.M. Chakraborty

IOT-751: OIL PROCESSING LAB

L : T: P
0 : 0 : 6

1. Laboratory degumming of vegetable oils
2. Laboratory refining(alkali neutralization) of vegetable oils
3. Laboratory bleaching of vegetable oils
4. Analysis of following intermediate and by products:
 - A. Acid oil : Moisture & FFA
 - B. Neutral oil : Acidity, soap ppm
 - C. Soap stock :
 - i) FFA
 - ii) Neutral oil
 - iii) Total fatty matter
5. Analysis of vegetable oils for Phosphatide content, Iron content and Wax content
6. Determination of DOBI value for palm oil
7. Analysis of bleaching earth, activated carbon and nickel catalyst
8. Preparation of methyl esters from crude oils
9. Determination of fatty acid composition and detection of adulteration by Chromatographic techniques.
10. Determination of mono, di and tri glyceride
11. Determination of diene and triene content by UV-Visible

Reference Books and suggested readings:

1. Technology and refining of oil and fats by T.L. Mahatta
2. Bailey's Industrial Oil and Fat, Edition 6 Vol-5 (2005), Edited by Feireidoon Shahidi
3. Bleaching & purifying fats and oils; Theory & Practice Edited by H.B.W. Patterson
4. Practical guide in vegetable oil processing by Manoj K. Gupta
5. Chemistry & Technology of Oils & Fats by M.M. Chakarobarty
6. Fats & Oils Handbook by Michael Bockich

IOT-752 : INDUSTRIAL TRAINING AND REPORT PRESENTATION

L : T: P

0 : 0 : 3

The student(s) will be required to undertake training in the Oil and Allied industries after III B. Tech. VI semester for a specified period and submit its report after completion for evaluation and oral examination in the VII semester of his studies in Final B.Tech.

IOT-753: PROJECT / DISSERTATION

L : T: P
0 : 0 : 3

The student (s) will be required to search literature pertaining to design of an equipment / processing of a Oil and allied product, comprehend it and prepare a report for assessment.

IOT-801: ESSENTIAL OILS & COSMETICS

L : T: P
3 : 1: 0

Unit -I

Sources, classification and chemistry of essential oil bearing materials

Different methods of manufacturing essential oils, Grading and standardization of essential oils 06

Unit -II

Physico-chemical characteristics of essential oils

Specific gravity, refractive index, optical rotation, solubility, acid value, ester value, Analysis of essential oils e.g. free alcohol, total alcohol, aldehyde and ketone content, , phenol content, common adulterants and their detection

08

Unit -III

Production, properties and composition of important Indian essential oils

Rose, jasmine, khus, sandal wood, keora , palmarosa, lemon-grass, peppermint, lemon, spices oils, clove oil, orange oil, eucalyptus oil , natural fats and bi additives compounds etc. 08

Unit -IV

Important isolates, synthetic perfumery materials and fixatives

Menthol, camphor, thymol, geraniol, citral, eugenol, terpeniol, vanillin, coumarins, musk: Natural, Synthetic & Artificial, benzyl acetate, benzyl benzoate etc, Synthesis ;Esters of geraniol, citraniel & terpenols, ionones, Hydroxy citronellol etc. Castor oil based perfumery chemicals, blending of perfumes.

08

Unit -V

Production of cosmetic products

Face creams(cold and vanishing creams), Face powders, Talcum powders, Hair oil, Hair cream & dyes, Shampoos, Tooth pastes & powders, Shaving creams, body gels Lipsticks, Nail polishes, Depilatories, aroma therapeutic products and herbal products etc; related plant and machinery.

10

Reference Book

1. Essential oils –Vol. I –V by Guenther
2. Perfume Cosmetics & Soaps Vol.-I –III by W.A. Poucher
3. Manufacture of perfumes and essence by Kalicharan
4. The essential oils book Edited by Colleen K. Dodt
5. Conditioning agent for hair and skin Edited by Randyschuller and Perry Romanowski
6. Glycerin Edited Vol -11 (1991)by Eric Jungermann & Norman O.V. Sonntag

IOT-802: BIO-TECHNOLOGY OF OILSEED AND OILS

L : T: P

3 : 1: 0

Unit -I Introduction to GM crops

Genetically modified crops for oil bearing materials, composition, characteristics, composition of GM and non-GM crops, certification of GM crops, global scenario in GM crops.

06

Unit-II Enzymes and their Technology

Types of enzymes, sources and their isolation and their applications, immobilized enzymes, assay of enzymes for oil application

06

Unit –III Bio processing of Oils & Fats

Bio Processing of Oils: Bio degumming , Bio deacidification ,Bio bleaching, Chemistry and technology of bio-interesterification, interesterified fats vis-a-vis bio-interesterified fats/ hydrogenated fats .

10

Unit –IV Speciality fats & Oils

Structured Lipids , Margarine and Shortening ,Production of plastic fats , Cocoa butter substitute ,Food emulsions ,Medicinal applications ,Preparation of diacyl glycerols, polyol and other oleo chemicals. 10

Unit –V GM Oilseeds

Canola (rapeseed) , Linola (flax) ,High Oleic sunflower ,Low-linloenic soyabean etc.

08

Reference Book

1. Biotechnology for the Oils & fats industry (1983) Edited by Colin Ratledge, Peter Dawson and James Rattray
2. Bioactive Lipids
3. Modifying Lipids for use in Foods
4. Biocatalysts and Biotechnology for Functional Foods

IOT-803: PETROLEUM PRODUCTS AND PETROCHEMICALS

L : T: P

3 : 1: 0

Unit I

Introduction to mineral oils:

Origin and mode of occurrence. Oil resources and refineries in India. Composition of petroleum, Refinery products and their test methods. Evaluation of oil stocks

08

Unit II**Processing of petroleum;**

Processing of crude oil distillation, refinery products and their applications, natural gas, gasoline, naphtha kerosene, fuel oils and gas oils, petroleum waxes, lubricating oils, tar and asphalt.

08

Unit III**Petroleum refining processes and operations:**

Thermal cracking, catalytic cracking, hydro-forming, catalytic reforming, alkylation, polymerization, isomerisation.

08

Unit IV**Auxiliary processes:**

Vis-breaking, de-waxing and de-asphalting operations. Manufacture of paraffin wax and microcrystalline waxes.

08

Unit V**Petrochemicals;**

Manufacture of alkyl aryl compounds, ethylene oxide condensation products benzene, toluene, xylene, buta-di-enes, vinyl chloride and styrene etc.

08

Reference Book

1. Petroleum Products Hand Book By V. B. Guthrie
2. Petroleum processing hand book (1967) Edited by Bland & Davidson
3. Petroleum refinery Engineering edited by Nelson
4. Petroleum refining technology Edited By Dr. Ramprasad

**IOT-804 PACKAGING OF OILS ,FATS
AND ALLIED PRODUCTS**

L : T: P

3 : 1: 0

Unit I Introduction to Packaging

Elements of packaging, scopes and functions of a package. Materials used for packaging: paper and paperboards; films and foils; glassware; metals plastics; wood; miscellaneous other materials; 08

Unit II Criteria and selection of packing material

Requirements of packaging surfaces for oils and allied products viz. Compatibility with the material to be packed, properties of various packaging materials and their specifications, Different packaging and sealing machine for liquid /semisolid packaging

08

Unit III Forms of packaging:

Folded cartons/boxes; corrugated board boxes, metal containers bags and envelopes, aerosols. Tubes, cans and different forms of plastics etc. 08

Unit IV Printing of packaging surfaces

Requirements of Printing and evaluation of printed surfaces. Coatings and laminations of the packaging surfaces, types and properties of coatings and limitations, different types of laminating machines. 08

Unit V Packaging of various products

Oils and fats, soaps and detergents; cosmetics; petrochemicals, wax and wax products; essential oils and perfumes; lubricating oils and greases; by products of oils, soaps and allied industries. Effect of environmental conditions on packaging materials.

08

**IOT-805: TECHNOLOGICAL ADVANCES
IN PERFUMERY AND COSMETICS**

L : T: P

3 : 1: 0

Unit I Fragrance –raw materials.

Plant Oils : Essential Oil , Flower Oil, Resin and gum exudation. Animal secretions. Chemical substance – isolates (Plant , derivatives of plant materials ,synthetic organic substances.

08

Unit II Newer extraction technologies

Raw materials for essential oils , newer extraction technologies of essential oils, Supercritical extraction ,HFC extraction ,Bio extraction etc. Instrumental analytical techniques of analysis of essential oils. 08

Unit III Skin Preparations

Facial makeup : Creams, Cleansing ,emollient , hand and hormones Cream/lotions , foundation makeup , lipstick , sunscreen preparations. 08

Unit IV Hair Preparations

Skin anatomy, raw materials and their selection ,additives etc.for hair dyes ,Bleaches , Hair coloring, hair fixatives ,Hair grooming preparations. Hair Care : Shampoos ,Shaving soaps and creams, pre-shave and aftershave preparation. 08

Unit V Herbal Products

Herbal Cosmetic preparations; Chemical components of herbs & its extraction, Application of herbs & its extracts, Application of herbs in cosmetics application, preservation; Advantages in perfumery: Notes of perfume, compatibility of perfume , fixation and stability of perfume ; analysis of perfumes, Medicinal applications of herbal and other essential oils & perfumes. 08

Reference Books:

- a. Perfume Cosmetics & Soaps Vol.-I –III by W.A. Poucher
- b. Cosmetics Science & Technology Edition 2 Vol-II (1972 Edited By M.S. Balsam & Edward Sagarin

**IOT-806: ENVIRONMENTAL ASPECTS OF OILS
AND ALLIED INDUSTRIES**

L : T: P

3 : 1: 0

Unit I Industrial pollution and its impact

Magnitude of industrial waste , Legislative regulations. Recycle and reuse of waste water , recovery of by/c0-product from industrial effluents.

08

Unit II Environmental Management Policy and Regulations

Environmental policy global and Indian scenario, scope of air and water pollution problems, economic considerations of waste disposal, separation and segregation of wastes, gaseous, liquid and solid waste disposal with special reference to oils and allied product processing CPCB/ state pollution control board guidelines and regulations.

08

Unit III Waste Management

Pollution prevention and environment Management system ISO 14000. Waste audit, Quality management systems, Different regulation means & acts for air , water& solid pollution control.

06

Unit IV Liquid Effluent Treatment Technology

Pretreatment methods, centrifugation filtration, evaporator and concentrator , extraction and distillation, treatment of dilute waste water. Treatment requirements, Neutralisation liquid-solid separation, biological oxidation, plant control programme, absorption, liquid phase system, reclamation of waste water effluent and by-product recovery, ion exchange system, acid and alkali purification, continuous ion-exchange,. Case studies on vegetable oil processing, soaps and detergents.

10

Unit V Solid & Gas Effluent treatment

waste gas treatment: spent earth, catalyst, fly ash boiler ash, Air pollution control by mechanical method: mechanical collectors, electrostatic precipitator, filters,wet scrubbers, vapour phase system, activated carbon. Typical air purification system.

08

IOT -807 FUELS AND GREEN LUBRICANTS

L : T: P

3 : 1: 0

Unit I Handling and storage of fuels

Fuels used in industry such as LDO, furnace Oil ,HSD, Gas, thermic fluid, coal, husk, briquets.

06

Unit II Introduction to lubricants

Liquid, Solid and gas lubricants and their applications, Lubricating oils Synthetic lubricants. Physical properties, manufacture of lubricating oils. Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, , classification of lubricating oils such as thermic fluids , gear oils , hydraulic oils etc, viscosity index improver.

10

Unit III Properties of Fuels

Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc.

08

Unit IV Lubricants

General aspects of lubrication, lubricant characteristics and types, selection principle, Lubrication in metal cutting, conditions of use for cutting fluids, coolants, gear oils.

06

Unit V Lubricating Greases

Properties, types, ingredients, additives, analysis of lubricating oils and greases as per BIS test methods. Manufacture of lubricating Greases-Processes and equipments.

10

Reference Books:

1. Internal Combustion Engineering Edited by V. Ganesan. 2003
2. Lubrication and Lubricants, Edited by Eric R. Braithwaite (1967)
3. Lubricating Greases by C.J.Boner
4. Lubricating Oils by C.J.Boner

IOT-851 DESIGN & TECHNO-ECONOMIC FEASIBILITY PROJECT

L : T: P
0 : 0: 12

Continuation of Term work of IOT-753 with product and/or plant designing with a Techno-economic Feasibility Report of suitable size.

IOT-852 PROJECT ON INDUSTRIAL ASSIGNMENT

L : T: P

0 : 0: 3

Students have to undertake an experimental project on industrial problem assigned to them

IOT-853: EDUCATIONAL TOUR

Students will be taken for the visit of Industrial / Research organization, in their field of specialization, during the vacation period.

H.B.Technological Institute, Kanpur-208002

M. Tech. Chemical Technology (With Specialization in Oil Technology)

Course Structure & Evaluation Scheme

(Recommended by B.O.S. w.e.f. 2013-14)

STREAM - A - I Semester

(For candidates with B. Tech. Degree in Oil Technology)

S. No.	Course Code	Subject	Periods L T P			Evaluation Scheme				Subject Total	
						Sessionals			Examination		
						CT	Attendance	TA	Total		
1	QCH-109	Advance Modeling and Simulation of chemical engineering system	3	1	0	30	10	10	50	100	150
2	QCH-103	Advance Chemical Reaction Engineering and Catalysis	3	1	0	30	10	10	50	100	150
3	QOT-101	Advances in Oleochemicals	3	1	0	30	10	10	50	100	150
4	QOT-102	Advances in Emulsion Technology	3	1	0	30	10	10	50	100	150
		Total	12	4	0				200	400	600

H.B. Technological Institute, Kanpur-208002

M. Tech. Chemical Technology (With Specialization in Oil Technology)

Course Structure & Evaluation Scheme

(Recommended by B.O.S. w.e.f. 2013-14)

STREAM - B - I Semester

(For candidates with B.Tech. Degree in Engineering other than Oil Technology)

S. No.	Course Code	Subject	Periods L T P	Evaluation Scheme					Subject Total
				Sessionals				Examination	
				CT	Attendance	TA	Total		
1	QCH-103BC	Process Calculation	3 1 0	30	10	10	50	100	150
2	QOT-103	Chemistry & Technology of Oil & Allied Products	3 0 2	30	10	10	50	100	150
3	QOT-104	Quality Control Techniques in Oil and Allied Industries	3 0 2	30	10	10	50	100	150
4	QOT-105	Interfacial Science and Engineering	3 1 0	30	10	10	50	100	150
		Total	12 2 4				200	400	600

H.B.Technological Institute, Kanpur-208002

M. Tech. Chemical Technology (With Specialization in Oil Technology)

Course Structure & Evaluation Scheme

(Recommended by B.O.S. w.e.f. 2013-14)

M. Tech. Chemical Technology (With Specialization in Oil Technology)

STREAM -C - I Semester

(For candidates with M. Sc. Degree in Chemistry)

S. No.	Course Code	Subject	Periods L T P	Evaluation Scheme					Subject Total
				Sessionals				Examination	
				CT	Attendance	TA	Total		
1	PCH-103BC	Process Calculation	3 1 0	30	10	10	50	100	100
2	QOT-103	Chemistry & Technology of Oil & Allied Products	3 0 2	30	10	10	50	100	150
3	QOT-104	Quality Control Techniques in Oil and Allied Industries	3 0 2	30	10	10	50	100	150
4.	QOT-106 QMA-101C	Elective i) Lipid Biotechnology ii) Engineering Mathematics	3 1 0	30	10	10	50	100	150
		Total	12 2 4				200	400	600

M. Tech. Chemical Technology (With Specialization in Oil Technology)

II Semester (Common to All Streams)

S. No.	Course Code	Subject	Periods L T P	Evaluation Scheme					Subject Total
				Sessionals				Examination	
				CT	Attendance	TA	Total		
1	QOT-201	Modern Processing Technology of Oil-bearing Materials	3 1 0	30	10	10	50	100	150
2	QOT-202	Technology of Modified and Specialty fats & Oils	3 1 0	30	10	10	50	100	150
3	QOT-203	Modern Processing Technology of Oils	3 1 0	30	10	10	50	100	150
4	QOT-204 *QOT-205	Elective i) Processing Plants and Their Designs ii) Soaps and Synthetic Detergents	3 0 2	30	10	10	50	100	150
5.	QOT-206	Audit Course Critical review of research publications on one relevant topic	0 2 0						
6.	QOT-207	Audit Course Research Methodology and IPR	2 1 0						
		Total	14 6 2				200	400	600

* For B and C streams only

M. Tech. Chemical Technology (With Specialization in Oil Technology)

III Semester (Common to All Streams)

S. No.	Course Code	Subject	Periods L T P	Evaluation Scheme					Subject Total
				Sessionals			Examination		
				CT	Attendance	TA	Total		
1	QOT-301	Novel Surfactants- Production and Industrial Applications	3 1 0	30	10	10	50	100	150
2	QOT-302 QOT-303	Elective Nutraceuticals and Functional Foods Perfumery and Cosmetics	3 0 2	30	10	10	50	100	150
3	QOT-304	Dissertation/ Project*	0 8 0	-	-	-	100	-	100
4	QOT-305	Seminar	0 2 0		-	-	-	-	-
		Total	6 11 2				200	200	400

* 100 marks for Dissertation work will be evaluated during IV Semester

M. Tech. Chemical Technology (With Specialization in Oil Technology)

SEMESTER –IV (Common to all Streams)

S. No.	Course Code	Subject	Periods L T P	Evaluation Scheme					Subject Total
				Sessionals				Examination	
				CT	Attendance	TA	Total		
1.	QOT-401	Dissertation (Research Project)	- - 18	-	-	-	200*	200	400
		Total	- - 18	-	-	-	200	200	400

* 100 marks for Project-Dissertation work of III Semester are included in these marks.

QCH 301/ CH-11 PROCESS CALCULATION

L:T:P
3:1:0

UNIT 1

Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions, Ideal and real gas laws - Gas constant - calculations of pressure, volume and temperature using ideal gas law, Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.

UNIT2

Stoichiometric principles, application of material balance to unit operations like distillation, evaporation, crystallization, drying etc., Material balance with chemical reaction, Limiting and excess reactants, recycle, bypass and purging

UNIT 3

Unsteady state material balances, calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, use of humidity in condensation and drying, Humidity chart, dew point.

UNIT 4

Determination of Composition by Orsat analysis of products of combustion of solid, liquid and gas fuels, calculation of excess air from orsat technique and problems, heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

UNIT5

Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction, effect of pressure and temperature on heat of reaction, Energy balance for systems with and without chemical reaction, unsteady state energy balances. Introduction to Computer aided calculations-steady state material and energy balances.

BOOKS:

1. Bhatt, B.L., VORA, S.M., "Stoichiometry ", Tata McGraw-Hill, 1976.
2. Hougen, O.A., Watson, K.M and Ragatz, R.A., " Chemical Process Principles Part-I ",John Wiley and Asia Publishing, 1970.
3. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering ",Fourth Edition, Prentice Hall Inc., 1982.
4. Whitwell, J.C., Tone, R.K. "Conservation of Mass and Energy ", McGraw-Hill, 1973.
5. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical Engineering Education Development Centre, I.I.T., Madras, 1981.

OCH-103 : Advanced Chemical reaction engineering

**L:T:P
3:1:0**

Catalysis and catalytic process , catalyst formation, adsorption on solid surfaces, physical - chemical adsorption model, multiplayer adsorption theory; catalytic reaction kinetic model, real and ideal surface models; various models for data analysis, adsorption enhancement, multi step rate control, significances of dual rate – determining step and non equilibrium kinetic model, catalyst deactivation, catalyst classification.

Fixed bed catalytic reactor; reactor and reaction parameter, chemical and physical dimensionless parameters, radial pecelet, aspect and biot numbers, velocity variance, adiabatic and non adiabatic fixed bed reactor, design and modeling of fixed bed reactors

Fluidized bed catalytic reactor; character and quality of fluidization, fluid bed reactor modeling; Davidson Harrison model, Kunii - Levenspiel model, anatomy of overall rate coefficient, Olsons’s fluid bed reactor analysis. Introduction and performance of catalytic gaze reactor, trickle bed reactor, catalyst deactivation in fixed bed, batch fluid bed, moving bed and continuous fluid bed reactors, comparison of fixed moving and fluid beds; reactor poisoning in terms of spm, thermal waves in fixed bed regeneration, optimization of regeneration cycles.

Books & References:

1. James J. Carberry: Chemical and catalytic reaction engineering McGraw Hill.
2. J.M.Smith, “ Chemical Engineering Kinetics”, McHill.
3. O.Levenspiel, “Chemical Reaction Engineering”, Wiley Eastern, 2nd ed, 1972
4. Froment G.F., Bischoff K.B.; Chemical Reactor Analyser and design, John Wiley & Sons.

OCH-109 :Modeling and Simulation of Chemical Engineering Systems

L:T:P
3:1:0

Fundamentals of mathematical modeling-Principles of formulations, Fundamental laws: Continuity equations, energy equation, equation of motion, transport equations, equation of state, equilibrium, chemical kinetics; Advantages and limitations of models and applications of process models of stand-alone unit operations and unit processes; Classification of models-Simple vs. rigorous, lumped parameter vs. distributed parameter, Steady state vs. dynamic, Transport phenomena based vs. Statistical; Concept of degree of freedom for steady state and unsteady state systems.

Mathematical models of heat-transfer equipments: Shell & tube heat exchangers, Evaporators, Fired heaters, Partial condensers

Mathematical models of mass-transfer equipments: Batch and continuous distillation columns, Reactive distillation columns, Packed absorption columns, Dehumidifiers

Mathematical models of reactors: Batch reactors, Continuous-stirred tank reactors, Plug-flow reactors, Industrial reactors-Ammonia converter, Sulphuric acid converter, Methanol reactor, FCC reactor, Claus reactor, etc.

Numerical methods: Linear and non-linear simultaneous algebraic equations, Ordinary-differential equations-Initial-value problems & boundary-value problems, Partial-differential equations

Different approaches to flow sheet simulation- Sequential modular approach, Simultaneous modular approach, Equation oriented approach; Review of thermodynamic procedures and physical property data banks.

Books:

1. W.L.Luyben, Process Modeling, Simulation and Control for Chemical Engineers, McGraw-Hill, New York (1990).
2. M.M.Denn, Process Modeling,
3. C.D.Holland, Fundamentals and Modeling of Separation Processes,

QOT 101 : Advances in Oleochemicals

L T P
3 1 0

Unit-1

Advanced knowledge on glyceride structure of natural fats & oils. Non glyceride components of important Indian oils. Oleochemicals from palm, palm kernel, coconut, neem, mahua, mustard, sunflower, soybean, safflower, cotton seed and castor oil. Production and utilization of rice wax and sunflower wax.

Unit-2

Advances and industrial application of important chemical reactions of fats and fatty acids; esterification, interesterification, isomerisation, polymerization, pyrolysis, dehydrogenation, sulphation, sulphonation, sulphitation, alkoxylation, epoxidation etc.

Unit-3

Advances in recovery and refining of glycerine from oils and fats, plants and processes, Industrial utilization and oleochemicals from glycerine. Production of synthetic glycerol.

Unit-4

Newer production technologies of fatty acids and their purification. Chemical synthesis of fatty acids and glycerides. Oil based additives for food, printing ink and packaging industry.

Unit-5

Advances in chemistry and technology of major oleochemicals; fatty alcohols, fatty amines, fatty amides , methyl esters, Biodiesel, alfa olefins using triglyceride route, polyols, plasticizers and other derivatives, reactive extractions, green diesel (deoxy hydrogenation)

Reference book:

1. ----- by Doherties & Malieur

QOT-102 Advances in Emulsion Technology

L T P
3 1 0

UNIT-1

Characterization of water/oil interfaces: Introduction. Adsorption isotherms. Dynamic interfacial tension. Extremely low interfacial tension, surfactant transfer across the interface. Interfacial Dilational Rheology, Interfacial shear rheology. HLB concept. [6]

UNIT-2

Properties and behavior of emulsions: Introduction phase diagrams and emulsion stability. Evaporation from emulsions. Structure and stability of emulsion: coalescence and flocculation in dilute o/w emulsions. [8]

UNIT-3

Microemulsions. Macroemulsions and nanoemulsions: Introduction of dielectric polarization, dielectric spectroscopy, dielectric properties of microemulsion, nonequilibrium colloidal systems, dielectric study of human blood cell. [8]

UNIT-4

Electroacoustic characterization of emulsions, acoustic spectroscopy of emulsion, surface forces and emulsion stability, double emulsion for controlled release application, environmental . emulsion.heavy hydrocarbon emulsion. [8]

UNIT-5

Application of emulsion technology in various fields viz. food, cosmetics, petroleum, lubricants etc. Chemical demulsification of stable crude oil and bitumen emulsion in petroleum recovery. [10]

Reference books:

1. Encyclopedic Handbook of Emulsion Technology edited by Johan Sioblom published by Marcel Dekker. Inc. (2001)
2. Surfactants and Interfacial Phenomena edited by Milton .1. Rosen published by Wiley Interscience (2004)

Unit-1

Sources, Structure and composition of oils and fats:

Importance of oils, fats and their derivatives, theories of glyceride structure, classification of oils and fats, Status of production of oilseeds, oil-bearing materials, oils and fats. non-glyceride components of natural oils and fats. Chemical reactions of fats and fatty acids; Esterification, interesterification saponification, hydrolysis: reactions involving the carboxyl groups e.g., formation of metal soaps: nitrogen derivatives, acid chlorides, anhydrides etc.: alkoxylation, pyrolysis: reactions in the fatty acid chain; hydrogenation, dehydrogenation, halogenation, hydrogen sulphide and mercaptans: sulphation and sulphonation and miscellaneous addition to the double bonds, Rancidity and mechanism of chemical and auto oxidation (primary and secondary), natural & synthetic antioxidants

Unit-2

Commercial oilseeds, oils, cultivation, characteristics, composition and utilization from plant sources:

Major commercial oilseeds, oil – bearing materials and their oils: Production, characteristics, composition and utilization; Coconut, palm, palm kernel, olive, cocoa butter, sunflower, safflower, sesame, groundnut, mustard, rapeseed, canola, soybean, linseed, castor, rice-bran, cottonseed, corn, tung, oiticica, neem, mahua, kusum, karanja, sal, mango kernel, tobacco, shea fat, watermelon, maize germ, jatropha etc. genetically modified oilseeds and oils.

Unit-3

Minor oilseeds and adulteration of oils:

Production, characteristics, composition and utilization of minor oilseeds and oils. Analysis of oilseeds, oils & cakes. Detection of adulteration and identification of oils by chemical methods including chemistry involved, specification of cake, export parameter of oil meal and quality checks for meal.

Unit-4

Milk and animal fats:

Production, characteristics, composition and utilization of milk fats and butter, animal fats such as lard and tallow, fish and marine oils.

Unit-5

Waxes:

Natural waxes, their occurrence classification and general properties and uses of synthetic and vegetable waxes. Specification for different vegetable oils and oilseeds as per BIS

Reference Books

1. Fatty acids Vol-1 by K.S. Markley
2. Bailey's Industrial Oil and Fat, Part-1-V
3. Chemistry and Technology of Oils & Fats by M. M. Chakarobarty
4. A text book of oil and fat analysis by Cocks & Reid
5. An introduction to Chemistry & Biochemistry of Fatty acids & their glyceride by F. D. Gunstone
6. Fats and Oils Hand book by Michael Bockish: AOCS Press, Champaign, Illinois

Unit-1

Quality control and Quality Assurance:

Concept of quality assurance and quality control in relation to oil industry; quality management systems - ISO 9000; total quality management (TQM); hazard analysis of critical control points (HACCP); good manufacturing practices (GMP); role of international organisations such as ISO; IDF; CAC; AOAC; WTO and national organizations like BIS; Agmark; significance of oil and allied products order, FSSAI and APEDA (Agricultural and Processed Foods Export Development Authority) in oil industry; guidelines for setting up quality control laboratory. Legislation on oils and allied products

Unit-2

Chromatographic techniques and their applications in oils and fats:

Thin layer chromatography, paper chromatography, column chromatography, gas-liquid chromatography and H.P.L.C. and super critical chromatography; their principles, practices and applications to the analysis of oils and allied products Detection of adulteration by chromatographic techniques.

Unit-3

Spectral methods of analysis and their applications in oils and fats:

Ultra-violet, visible, infrared and near infrared spectroscopy techniques: principles, practices and application to the analysis of oils and allied products. Nuclear and magnetic resonance spectroscopy: principle, high resolution spectra of fats and fatty acids, adsorption of special groups, analysis of spectra and quantitative applications, Dilatometry of fats Solid fat index, congealing point of fats; calorimetry of fats.

Unit-4

Special quality control methods:

Iron and phosphatide content of crude and refined oils, nickel content of hydrogenated oils, wax content of vegetable oils. Analysis of intermediate products and by-products of oil processing.

Unit-5

Hyphenated techniques:

Application of TLC-FID analyzer AAS, GC-MS, SFC-GCLC-MS, ICP (Induction Coupled Plasma)-MS for trace meta analysis in analysis of oils and fats. Legislation on fats and oils, packaging laws and testing of packaged materials.

Reference Books:

1. Fatty acids; Their chemistry, properties, production and uses Part-III Edited by K.S. Markley
2. Principles of Instrumentation analysis, Edition- III (1985) Edited by Douglas A. skog
3. CODEX/ BIS
4. PFA
5. Agmark
6. Prevention of Food Adulteration Act (PFA) 1954 and PFA Rules. 1955 Official methods of A.O.A.C. (11th and 15th editions)
7. ISI Handbook of Food Analysis S.P. 18(Part II) 1981 ISI Specifications (concerned)(ISI)
8. Ralph Early, Guide to Quality Management System for Food Industry; Heinz Bullworth, Establishment and Implementation of HACCP Personal Hygiene Practices
9. Spectrometric Identification of Organic Compounds, by Robert M. Silver, Francis *Websiter & David Kiemle, John Wiley & Sons 7th Edition, (2005)
10. Vogel Organic Analysis
11. Application of Absorption Spectroscopy of Organic Compounds by J.R.Dyer, PHI (2005)
12. FASSR
13. Official methods of A.O.A.C. (11th and 15th editions)
14. ISI Handbook of Food Analysis S.P. 18 (Part II) 1981 ISI Specifications (concerned) (ISI)

Unit-1

Surfactants: Definition, classification, characteristic features and uses of commercial surfactants: Anionic, Cationic, Nonionic, Zwitterionic and newer surfactants based on renewable raw materials. Environmental effects of surfactants, surfactants biodegradability and toxicity.

Unit-2

Adsorption of surface active agent at interfaces: The electrical double layer, adsorption at the solid – liquid (S/L) interface and adsorption at liquid – gas (L/G) and liquid – liquid (L/L) interfaces.

Unit-3

Micellar formation by surfactants: Critical micelle concentration and type, micellar aggregation number and factors effecting CMC in aqueous media. Thermodynamic parameter of micellization and mixed micelle formation in mixture of two surfactants and solubilization by solution of surfactants.

Unit-4

Reduction of surface and interfacial tension by surfactants: Wetting, foaming and emulsification by surfactants with special reference to microemulsion and nanoemulsion.

Unit-5

Dispersion and aggregation of solids in liquid media by surfactants: Detergency and its modification by surfactants and molecule interaction and synergism in mixture of two surfactants.

Reference books

1. Novel surfactants- Kristen Holmberg of Surfactant Science Series
2. Soaps and detergents- Parashuram
3. Soaps - J.G. Kane

OOT 106 Lipid Biotechnology

L T P
3 1 0

Unit-1 **Sources**

Plant lipid sources. Animal lipid sources. Lipids in human nutrition. The lipid soluble vitamins.

Unit-2

Biochemical Organization, Single cell lipids their production and applications, genetically modified oils their properties and applications, ethical values.

Unit-3

Enzymes their classification, Isolation of stains from different sources, Production of enzymes Mechanism of enzyme action, determination of enzyme assay, immobilization of enzymes, Reaction kinetics, application of enzymes.

Unit-4

Protein synthesis, structure, isolation of proteins, Isoelectric PH and function, gene protein relationship, protein metabolism.

Unit-5

Synthesis and inter-conversion of fatty acids. Synthesis of triglycerides. Regulation of lipid metabolism, Phosphoglycerides, Sphingolipids and sterol metabolism, Disturbance of lipid metabolism. Determination of glyceride structure of fats by enzymatic methods.

Reference Books:

1. Biotechnology by Lehninger
2. Biotechnology by Stryer
3. Biotechnology by J.L.Jain
4. Encyclopedia of Biotechnology

QOT-201 : Modern Processing Technology of Oil bearing Materials

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3 1 0

Unit-1

Introduction to oilseeds of tree origin and other minor oil bearing materials. Storage of oilseeds : various methods, conditions of storage and their effect on oil yield and its characteristics. Grading and evaluation of oilseeds, oil bearing materials and crude oils as per BIS methods.

Unit-2

Handling and pre treatment of oilseeds: machinery employed for handling and pre treatment of oil seeds viz. conveyers, elevators, seed cleaning machines, decorticator, disintegrators, reduction rolls and high roll etc. Machinery employed for production of oils viz. ghanies, hydraulic pressures, screw presses, low and high pressure expellers etc. Filter presses, and centrifuges.

Unit-3

Techniques of production of various oils from oilseeds viz. Mustard, rapeseed, groundnut, cottonseed, sunflower, sesame, linseed, castor, neem and sal. Production of oils from coconut, olive, palm and palm kernel.

Unit-4

Extrusion pretreatment of oilseeds and oil bearing materials expander-extruder system, Recent trends in preparation of oilseeds and oil bearing materials for solvent extraction.

Unit-5

Latest extraction processes and plants. Desolventisation processes for meal and miscella: Equipments and plants employed; current trends with comparison of each. Alternative solvents for oil extraction; their principle and comparison with conventional solvents. Use of super critical fluid and liquefied gases for oilseed extraction and oleoresin preparations, HCF extraction, Aqueous extraction. Enzymatic extraction.

Reference Book

4. Bailey's Industrial Oil and Fat, Edition 6 Vol-5 (2005), Edited by Feireidoon Shahidi
5. Oil and Fat Technology Edited by E. Bernardini
6. Solvent extraction of vegetable oil by Parikh
4. Oilseed and Oil Milling in India
5. Proceedings of AOCS
6. Handbook of SEA
7. Oil Extraction & Analysis (critical issue and comparative studies) , D.L. Luthria, US Department of Agriculture Behtsville, Maryland

QOT-202: Technology of Modified and Specialty Fats & Oils

L T P
3 1 0

Unit-1

Commercial production and recent technological advancements in modification of oils for application in surface coating industry; polymerized oil such as boiled oils, stand oils etc. Epoxidised oils, urethane oils, plasticizers and driers for paints

Unit-2

Modification of oils for manufacture of fatty acids, metallic soaps, lubricants, greases and hydraulic fluids. Blown oils, mould releasing agents, wire-drying lubricants etc.

Unit-3

Modifications of oils for leather and textile industries viz. fat liquors. Leather chemicals, textile chemicals etc. Sulfated, sulfonated and sulphited oils; chemistry, manufacture and applications in leather industry

Unit-4

Modification of oils and fats for the use in pharmaceuticals and cosmetic industry. Technology for the manufacture of edible films and coatings from protein sources. Technology for the production of biodiesel and green diesel by modification of oils and fats; specifications, commercial plants and processes

Unit-5

Metal sulfonates; Their manufacture and uses in various lubricant formulations, additives and other fat based lubricant for petroleum industry

Reference Books:

1. Organic Coatings Technology by H.F. Payne
2. Bailey's Industrial Oils & Fats Products Vol. I to IV
3. Lubricating Oil & Greases By C.J. Bonner

QOT-203: Modern Processing Technology of Oils

L T P
3 1 0

Unit-1

Processing of Oils: Modern techniques of oil pretreatment, newer technologies of dewaxing, degumming deacidification, bleaching of oils, coloring pigments, their coloring effects, steam generation & utilities (air, water & electrical energy), refrigeration system for dewaxing and winterization, Processing conditions during refining of different oils.

Unit-2

Deodorization, soft column, physical refining, effect of various operating variables, design consideration of deodorizer, inter-esterification, hydrogenation of oils, fractionation(dry & wet), trans free fats and fat products, margarine, and bakery fat, crystal behavior and polymorphism.

Unit-3

Bio-processing of oils : Bio degumming, bio neutralization, bio bleaching, bio inter-esterification membrane technology for processing of oils and fats, blended oils, specification of blended oils, refined oils & hydrogenated fats as per FSSAI rules.

Unit-4

Utilization of wastes and by products produced in oil processing industry, environmental considerations like effluent treatment, ETP plants of oilseed and oil processing industries, energy audit and energy conservation practices in oil processing industry.

Unit-5

Processing of oils for production of biodiesel by trans esterification of oils using heterogeneous and homogeneous processes.

Reference Books:

1. Technology and Refining of Oils by T. L. Mahatta
2. Bailey's Industrial Oils and Fats, 6th edition, vol-5 (@)) Edited by Feireidoon Shahidi
3. Bleaching & purifying fats and oils : Theory & Practice by H. B. W. Patterson
4. Practical guide in vegetable oil processing by Manoj K. Gupta
5. Chemistry & Technology of Oils & Fats by M. M. Chakaraborty
6. Fats & Oils Handbook by Michael Bockich
7. Fats & Oils handbook vol. 1 AOCS press
8. Fats & Oils by Richard O' brien

QOT-204 : Processing Plants and their Designs

L T P
3 1 0

Unit-1

Design aspects of major oil processing equipments of vegetable oil refinery , Effect of oil processing parameters on the designs of these equipments. Batch vessels, viz. neutralizer, bleacher, deodorizer, autoclave etc.

Unit-2

Continuous processing equipments, centrifuges for separation of gums and soap-stock from oil, continuous bleacher, different types of continuous deodorizers, physical deacidification vessels etc

Unit-3

Designing of fat splitting autoclaves, fatty acids distillation plants, miscella distillation column, desolventisation vessel for deoiled meal etc.

Unit-4

Designing of soap kettle, continuous saponification equipments. Sulphonation reactors-batch and continuous. Design of spray- drying tower.

Unit-5

Design of various auxiliary equipments e.g. storage tank, heat exchangers, filter presses etc., Safety aspect of all above equipment, plant layouts, safety processing

Reference Book :

1. Plant Design & Economics for Chemical Engineers by H.S.Peler & K.D. Timmerhans, Mc Graw Hill:11,2004
2. Handbook of Heat Transfer Media by P.L. Geiringer, 1977 Remhold Publication
3. P.M. Goodall, The Efficient Use of Steam,1980, Westbury House
4. Parry's Handbook of Chemical Engineering
5. Process Safety Fundamentals with Application by D.A. Crowl & J.F. Lauver, Prentice Hall, U.S.A., 1996
6. Principles of Processing Engineering by S.M. Handerson & R.L.Perry & J.H. Young, 4th Edition, 1993

QOT-205 Soaps and Synthetic Detergents

L T P
3 0 2

Unit-1

Soaps:

Principle and chemistry of soap boiling, raw materials and their selection, manufacture of soap base for household and toilet soap by cold, semi boiled and full boiled processes. Continuous processes of soap manufacture. Processes and plants employed for production of household and toilet soaps. Quality specifications as per BIS and specialty soaps.

Unit-2

Fat splitting:

Effect of temperature, pressure, catalyst and ratio of reactants on hydrolysis of fat, degree of splitting, plants and processes employed viz. Twitchell process, enzymatic fat splitting, low , medium and high pressure autoclave processes. Batch, semi continuous and continuous processes of fat splitting, recovery of glycerin from spent soap lye and sweet water.

Unit-3

Raw materials for synthetic detergents:

Active surfactants, organic and inorganic builders, fillers and other auxiliary materials .

Unit-4

Production of active detergents:

Plants and processes for production of linear alkyl benzene sulfonate, alcohol sulfates, alkyl acyl sulfonates, α -olefin sulfonates, sulfated and sulfonated oils, polyethenoxy ethers and esters, poly hydroxy surfactants and quaternary ammonium compounds.

Unit-5

Manufacture of household synthetic detergents:

Plants and processes employed for powders, liquids and cakes etc. Analysis of synthetic detergents as per BIS methods.

Reference Book :

1. Manufacture of soaps other detergents: Edgar Woollatt.
2. Synthetic detergents: Milwidsky.
3. Bailey Industrial oils & fat products VOL. 1: Daniel Swern.
4. Soaps and detergents: K.S. Parasuram.
5. Synthetic detergent: Davidson.
6. BIS-IS: 4955-1978 Specification for synthetic detergent powders for households use.
7. Gemini surfactants: Synthesis, interfacial and applications.
8. Handbook of detergents, Part A, B, C, D
9. CRC surfactants series

QOT-206 Audit Course

L T P
0 2 0

Student has to do critical review of research publications on one relevant topic

QOT301 NOVEL SURFACATANTS; PRODUCTION AND INDUSTRIAL APPLICATIONS

L T P

3 1 0

Unit-1

Introduction:

Definition, amphiphilic nature of surfactants, classification of novel surfactants, raw material for novel surfactants based on petrochemical and oleochemical origin

Unit-2

Properties of novel surfactants:

Surface and interfacial tension, hydrophilic lipophilic balance, critical micelle concentration, cloud point, kraft point, HLB Temp/ phase inversion temperature, foaming, wetting, dispersing and emulsification properties and their measurements, properties of novel surfactants mixtures, polymer- novel surfactants interactions

Unit-3

Chemistry and Technology for production of various novel surfactants and their industrial applications:

N- alkanoyl-N-alkyl-1-glycamines, Alkyl polyglycosides, sugar fatty acid esters, sucrose ester based surfactants, saccharide based surfactants, methyl ester ethoxylates

Unit-4

Technology for the manufacture and their applications:

Amino acid based surfactants, esterquats, imidazoline surfactants, cleavable surfactants, Gemini surfactants, polymerizable and polymeric surfactants, silicone surfactants

Unit-5

Biosurfactants: Classification of bio surfactants, production of biosurfactants from various natural sources, properties and applications of biosurfactants, Surfactants produced by micro organisms

Reference Books:

1. Novel Surfactants: Preparation, Applications and Biodegradability, II Edition, edited by Krister Holmberg

QOT - 302 Nutritional and functional foods

L T P
3 1 0

Unit-1

Principles of Human Nutrition: Dietary sources, intake levels, physiological role, and requirement of major nutrients. The biological determinants of nutrient requirements and the assessment of nutrient status in individuals and populations, lipid oxidation in different matrix.

Unit-2

The role of nutrition in growth and health through the life cycle. The rationale for the development of dietary guidelines and of nutrition policies in different countries. The role of diet in the development of chronic diseases, such as cardiovascular disease, cancer, diabetes, etc.

Unit-3

Nutritional importance of oils and fats function of oil and fats in food: -Tenderness

- Texture - Flavor - Emulsion :Introduction – definition, status and scope of health and functional foods in India. Definition of nutraceuticals and their importance. Types of health and functional foods and their properties

Unit-4

Various food constituents responsible for functional effects:

- Anti-carcinogenic, hypocholesterolemic and hypoglycemic foods - Dietetic foods,- Fortified foods,- Biofedic and probiotic foods , Low and non-calorie sweetening agents, -Fat replacers

Unit-5

Processing of health and functional foods, criteria for selection of raw materials, and their processing,Storage, packaging and labeling of health and functional food. Marketing and legal aspects of health and functional foods. Organic foods and Genetically Modified (GM) foods in relation to health

Reference Books:

1. Essentials of human nutrition by J.Mann and S. Truswell (2nd Edition, 2002), Oxford University
2. Encyclopedia of human nutrition (1998) , London: Academic press
3. Modern nutrition in health and disease, 9th edition edited by Shils, Olson, Shike and Ross
4. Nutritional Biochemistry and \metabolism, 2nd edition edited by Linder (1991)

QOT-303 PERFUMERY AND COSMETICS

L : T: P

3 : 1: 0

Unit –I

Sources, classification and chemistry of essential oil bearing materials

Different methods of manufacturing essential oils, Grading and standardization of essential oils 06

Unit -II

Physico-chemical characteristics of essential oils

Specific gravity, refractive index, optical rotation, solubility, acid value, ester value, Analysis of essential oils e.g. free alcohol, total alcohol, aldehyde and ketone content, , phenol content, common adulterants and their detection 08

Unit -III

Production, properties and composition of important Indian essential oils

Rose, jasmine, khus, sandal wood, keora , palmarosa, lemon-grass, peppermint, lemon, spices oils, clove oil, orange oil, eucalyptus oil , natural fats and bi additives compounds etc. 08

Unit -IV

Important isolates, synthetic perfumery materials and fixatives

Menthol, camphor, thymol, geraniol, citral, eugenol, terpeniol, vanillin, coumarins, musk: Natural, Synthetic & Artificial, benzyl acetate, benzyl benzoate etc, Synthesis ;Esters of geraniol, citraniel & terpenols, ionones, Hydroxy citronellol etc. Castor oil based perfumery chemicals, blending of perfumes. 08

Unit -V

Production of cosmetic products

Face creams(cold and vanishing creams), Face powders, Talcum powders, Hair oil, Hair cream & dyes, Shampoos, Tooth pastes & powders, Shaving creams, body gels Lipsticks, Nail polishes, Depilatories, aroma therapeutic products and herbal products etc; related plant and machinery. 10

Reference Book

7. Essential oils –Vol. I –V by Guenther
8. Perfume Cosmetics & Soaps Vol.-I –III by W.A. Poucher
9. Manufacture of perfumes and essence by Kalicharan
10. The essential oils book Edited by Colleen K. Dodt
11. Conditioning agent for hair and skin Edited by Randyschuller and Perry Romanowski
12. Glycerin Edited Vol -11 (1991)by Eric Jungermann & Norman O.V. Sonntag

QOT-304 Dissertation

L : T: P

0 : 8: 0

Students have do literature survey on assigned topic and prepare a report on the same

QOT-305 Seminar

L : T: P

0 : 2: 0

Students have to prepare a report on a topic and make power point presentation of the same

QOT-306 Research Methodology and IPR (Audit Course)

L : T: P

2 : 1: 0

Research: Meaning, Objective of research, types of research Selecting a problem and preparing research proposal for different types of research Literature survey: Use of library, books and journals, use of internet (different useful sites) patent search Methods and tools in research: Qualitative and quantitative studies enquiry forms, questionnaire,

opionnarie Data analysis: Parametric and non parametric data, Hypothesis testing Descriptive and inferential analysis, Statistical analysis of data including standard deviation, student test, f test,

ANOVA, Multiple regression and correlation coefficient Documentation: Research paper/ Thesis writing: Different parts of the research paper Presentation: Oral, poster Sources of procurement of research grants Industrial Institution Interaction Introduction to intellectual property and its relation with regulations Introduction to patent, patent system in India and worldwide (Paris convention and TRIPS agreement)

People

- (a) Dr. R.K. Trivedi Professor
- (b) Dr. V.K. Tyagi Professor
- (c) Dr. P.K.S. Yadav Assistant Professor
- (d) Mr. P.C. Gupta Guest Faculty
- (e) Mr. H.S. Sharma Guest Faculty

Staff

- (a) S.M. Tiwari

Student:

Under Graduate 30

Post Graduate 11

Ph.D Scholar

- Mr. Vinay Kr. Tiwari
- Mr. Ashutosh Mishra
- Mr. A.K. Mishra
- Ms. Gunjan

Facilities:

(A) Knowledge Resource Center

Design Expert Software (10 User)
STATISTICA (5 User, 5 years)

MATLAB & Simulink (Users)
Origin Lab Professional (10 Users)

(B) Books

S. No.	Title of the book	Author/ Editor
1.	Bailey's Industrial Oil and Fat Products, Volumes 1-6	Fereidoon Shahidi
2.	Processing and Nutrition of Fats and Oils	Ernesto M. Hernandez and Afaf Kamal-Eldin
5.	Biobased Surfactants and Detergents: Synthesis, Properties, and Applications	Douglas G. Hayes, Dai K.Y. Kitamoto, Daniel Solaimon, and Richard D. Ashby
6.	Biocatalysis and Biotechnology for Functional Food	Ching Hou and Jei-Fu Shaw
9.	Healthful Lipids	Casimir C. Akoh and Oi-Ming Lai
10.	Soap manufacturing Technology	Luispitz
12.	Biocatalysis and Bioenergy,	C. T. Hou and Jei-Fu Shaw
13.	Hydrogenation of Fats and Oils: Theory and Practice	Gary R. List and Jerry W. King
14.	Structure and Functional Properties of Colloidal Systems	Roque Hidalgo- Alvarez
15.	Colloids in Drug Delivery	Monzer Fanun
17.	The Science and Technology of Industrial Water Treatment	Zahid Amjad
18.	Logistic Regression Models	Joseph M. Hibe
19.	Regression Modeling	Michael Panik
20.	Analysis of Messy Data George A, Volume 1	Milliken and Dallas E. Johnson
21.	Design and Analysis of Experiments Classical and Regression Approaches with SAS	Leonard C. Onyiah
22.	An Introduction to Statistical Inference and Its Applications with R	Michael W. Trosset
23.	Linear Model Methodology	Andre I. Khuri
24.	Teaching Innovations in Lipid Science	Randall J. Weselake
25.	Fatty Acids in Health Promotion and	Ranald R. Watson

	Disease Causation	
26.	Lipid Oxidation Pathways, Volume2	Afaf Kamal-Eldin and David Min
27.	Surfactant – Based Separation Processes, Volume- 33	J.F. Scamehorn
29.	Biosurfactants :Production Properties, applications, Volume-48	N. Kosaric
30.	Surfactants in Agrochemicals, Volume-54	T.F. Tadros
31.	Structure- Performance Relationships In Surfactants, Volume- 70	K. Esumi
32.	Protein – Based Surfactants: Synthesis: Physicochemical Properties, and Applications, Volume- 101	I.A. Nnanna
33.	Impact of Zeolites and other Porous Materials on the New Technologies at the Beginning of the New Millennium (142 Part-A + Part- B)	Aiello R.
34.	Surface Activity in Drug Action, Volume- 21	R.C. Srivastava
35.	Design Aspects of Used Lubricating Oil Re-Refining	Firas Awaja
36.	Fuels of Opportunity: Characteristics and Uses In Combustion Systems	David A. Tillman
37.	Waste Engine Oils: Rerefining and Energy Recovery	Francois Audibert
38.	Transportation Biofuels : Novel Pathways for the Production of Ethanol, Biogas and Biodiesel	A. Hoogendoorn
39.	Nonionic Surfactants, Volume-1	Schick M.J.
40.	Emulsions and Emulsion Technology Part 1, valume-6	K.J. Lissant
41.	Cationic Surfactants : Organic Chemistry, Volume – 34	J.M. Richmond
43.	Anionic Surfactants: Biochemistry, Toxicology, Dermatology, Second Edition, Revised and Expanded, Volume- 43	C. Gloxhuber
44.	Defoaming: Theory and Industrial Applications, Volume- 45	P.R. Garrett
45.	Coagulation and Flocculation: Theory and Applications, Volume-47	B. Dobias
46.	Fluorinated Surfactants : Synthesis, Properties, Process, Volume-33	E. Kissa

47.	Technological Applications of Dispersions, Volume-52	R.B. Mckay
48.	Cationic Surfactants : Analytical and Biological Evaluation, Volume-53	John Cross
49.	Solubilization in Surfactant Aggregates, Volume-55	S.D. Christian
50.	Emulsions and Emulsion Stability, Volume-61	J. Sjoblom
51.	Vesicles, Volume-62	M. Rosoff
52.	Surfactants in solution, Volume-64	A.K. Chattopadhyay
53.	Detergents and the Environment, Volume-65	M.J. Schwuger
54.	Industrial Applications of Microemulsions, Volume- 66	C. Solans
55.	Nonionic Surfactants: Organic Chemistry, Volume-72	N.M. Van Os
56.	Novel Surfactants: Preparation, Application and Biodegradability, Volume- 74	K. Holmberg
57.	Computational Methods in Surface and Colloid Science, volume- 89	M. Borowko
58.	Adsorption on Silica Surfaces, volume – 90	Eugene Papirer
59.	Nonionic Surfactants: Alkyl Polyglucosides, Volume-91	D. Balzer
60.	Gemini Surfactants: Synthesis, Interfacial and Solution – Phase Behavior, and Applications, Volume- 117	R. Zana

(D) Advanced Surfactant Laboratory

- (a) UV-Vis spectrophotometer
- (b) Rotary Evaporator with Vacuum Controller & Diaphragm Vacuum pump
- (c) UPS- 10 Kva 'Uniline'
- (d) Automatic Microprocessor Controlled
- (e) Multifuel Anlyzer
- (f) FT-IR
- (g) Analytical Balance
- (h) Gloss-O-meter
- (i) Differential Scanning Calorimeter
- (j) Thermo gravimetric Analyzer System
- (k) SAFETEST -II Analyzer
- (l) Lovibond Tintometer

- (m) Gas Chromatograph
- (n) Rheometer
- (o) Hybrid SFC-HPLC

(E) Processing Lab.

- (a) Pilot Plant for refining of vegetable oil
- (b) Pilot Plant for soap manufacture
- (c) Pilot Plant for biodiesel production

(F) Instrumentation Lab

- (a) UV-Visible Spectrophotometer
- (b) Rancimat
- (c) Tensiometer
- (d) Gas-Chromatograph
- (e) FT-IR

(G) UG Lab.

- (a) Tergometer
- (b) Laundrometer
- (c) Lovibond Tintometer
- (d) Refractometer
- (e) Laboratory setups for under graduate experiments

Research

The faculty members are involved in research activities in following areas:

- (a) Oil Processing
- (b) Oleo-Chemicals
- (c) Novel Surfactants
- (d) Bio-Fuels
- (e) Bio - Lubricants
- (f) Nutraceuticals and functional foods

Achievements

- (a) The alumni of Oil Technology are serving the corporate, academic and research organizations at senior positions in India and abroad.
- (b) The faculty has completed a number of the research projects sponsored by UNDO, CSIR, ICAR, MHRD, AICTE, DST, UPCST etc.
- (c) The faculty members represent various National level committees like BIS.

Consultancy:

The faculty members are providing testing and consultancy services to various Oils and allied industries.

Publications:

The faculty members are actively involved in research activities and publishing the research work in reputed journals. The details of the publications are provided in the bio-data of individual faculty members.

Contact Person

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