Syllabus of Final Year

B. Tech (Oils, Fats & Waxes Technology)

(w.e.f. 2017-18)

Faculty of Science and Technology

University Institute of Chemical Technology
North Maharashtra University, Jalgaon

(Academic Year 2017-2018)

B. Tech. (Oils, Fats & Waxes Technology) Final Year Course Structure w.e.f. 2017-18 (Overall Structure and Revised Syllabus w.e.f. 2017-18)							
Course Code	**Title of Course**	**Teaching Hours**	**Tutorial**	**Credits**	**Practical Hours**	**Credits**	**Total Credits**
Seventh Sem							
OTP-401	**Industrial Training/ Project**	**-**		**-**	**32**	**16**	**16**
OTP-402	**Technical Seminar & Colloquium**	**-**		**-**	**08**	**04**	**04**
Total		**-**	**-**	**-**	**40**	**20**	**20**
Eighth Sem.							
CHL-405	**Project Engineering & Economics**	**04**		**04**	**-**	**-**	**04**
CHC-406	**Process Equipment Design**	**02**		**02**	**03**	**1.5**	**3.5**
OTC-403	**Chemistry of Surfactants and Oleochemicals**	**04**		**04**	**03**	**1.5**	**5.5**
OTL-404	**Technology of Surfactants & Detergents**	**04**		**04**	**-**	**-**	**04**
OTP-405	**Synthesis & Analysis of Surfactants and Detergents**	**-**		**-**	**06**	**03**	**03**
Elective	**Elective-III**	**04**		**04**	**-**	**-**	**04**
Total		**18**	**-**	**18**	**12**	**6.0**	**24.0**

Nomenclature of the courses:

First two letters of the course code denote the branch/ division. Thus PT stands for Paints Technology Course and CH stands for Chemical Engineering Course. Similarly ES stands for Engineering Sciences and HM for Humanities and Management Sciences.

Third letter denotes the type of the course, viz lecture, practical or lecture + practical. If third letter is L, the said course is of lectures. Practical course is shown by P and C represents the course consisting of lecture + practical. First numeral of the course code denotes the level of course, and the other two are for number of course in particular branch/division.

For example course BSL-101 – mathematics-1. Here BS stands for basic science branch, L for lecture; For 101, first 1 for first year and 01 for first course of basic science.

Examination System:

For each theory paper of 04 and 03 credits, Major Examination with paper of 60 marks and duration of 03 Hours will be conducted.

For each theory paper of 02 credits, Major Examination with paper of 30 marks and duration of 02 Hours will be conducted.

For each practical Lab. of 1.5, 02 and 03 credits, the examination will be conducted for 03 hours duration for CH, ES and BS practical. For The practical examination is of 06 hours duration for all PT/PL/FT/OT labs, the Major examination carries 60 marks. For practical lab with 01 credit, the examination will be conducted as viva-voce (major- 30, minor - 20)

List of Electives (Elective III)

Paint Technology
PTL - 406 Special Purpose and Effect Coatings
PTL- 407 Nanotechnology in Paint Industry

Polymer Technology
PLL-405 Polymer Blends and Composites
PLL-406 Plastics for Packaging
PLL-407 Theory of Adhesion and Adhesives
PLL-408 Polymer Nanocomposites: Synthesis and Characterization

Oil Technology
OTL-406 Environmental Aspects of Oil and Allied Industries
OTL-407 Modern Instrumentation Techniques for Analysis of Oils and Oleochemicals
OTL-408 Non Traditional Oils and Non Triglyceride Constituents

Food Technology
FTL-406 Biochemical Engineering
FTL-407 Dairy Technology

Fourth Year Revised Syllabus of B. Tech (Oils, Fats & Waxes Technology) w.e.f 2017-18

VII SEMESTER

Department : Department of Oil Technology
Course Code : OTP-401
Course Title : Industrial Training/Project
Course Type : Project
Total Hrs : 32/week
Course Credit : 16

Pre-Requisites for Course:

All courses

Course Objective of Industrial Training:

Students undergoing Industrial Training will be able to enhance the academic material studied at Institute and, they will learn and develop key professional attributes. This is intended to produce engineering graduates that will able to apply technical skills, make sound decisions, demonstrate commitment and responsibility for future employment in their chosen career.

Course Objective of Project:

At the end of this course student will understand to create a research project plan that include problem identification, sequential nature of research design, conducting several experimental runs, effectively interpret and utilize the research results for a better decision making.

Course Content:

The student(s) will be required to undertake training in the industry for a period of six month and submit its report after completion for evaluation and oral examination. Alternatively, Student(s) will be encouraged to undertake the Research Project work at the Research Institute / Department and shall submit the monthly report to the Department. The student shall submit the synopsis of project to the Department after achieving project objectives, followed by submission of neatly bound and typed thesis within 3 weeks from the date of submission of synopsis for assessment.

Course Outcome of Industrial Training:

1. An undergraduate student, upon completion of the industrial training shall be able to:
2. Demonstrate the ability to successfully relate the theoretical concepts to industrial problems.
3. Apply the acquired knowledge, gain practical skills and be aware of current technologies in oil and allied industries.
4. Develop a structural thinking ability to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
5. Acquire interpersonal skills and ability for team work.
6. Learn about ethics in professional industrial practices.
7. Learn about the working culture, discipline and safety practices in the industry.

8. Mold themselves into prospective employees from academia transition to career opportunities

Course Outcome of Project:

1. An undergraduate student, after undertaking the laboratory based research project on Oil Technology and allied subjects, shall be able to:
2. Extend the boundaries of knowledge through research project and integrate the classroom theory with workplace practice.
3. Create a research project plan that include problem identification, sequential nature of research design, conducting several experimental runs, effectively interpret and utilize the research results for a better decision making.
4. Provide the possible solution to the tangible research questions in most efficient way while taking due care of environmental issues.
5. Identify the limitation of the research project, outline thoughtful recommendation for the future research opportunities and generate well structured user-friendly research report.
6. Understand ethical principles and codes of conduct that must be observed when any research project is conducted.
7. Exhibit the ability to independently research scientific and non-scientific information
8. Mange the time and develop interpersonal skills.

Department : Department of Oil Technology

Course Code : OTP-402

Course Title : Technical Seminar & Colloquium

Course Type : Seminar

Total Hrs : 8/week

Course Credit : 04

Course Objective:

This course enables students to gather scientific information on a particular topic, analyze the information from scientific principles, and present a written and oral summary on that topic. This enables the students to function in a professional environment later on in their career.

Course Content:

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

Course Outcome:

1. As a result of the preparation and presentation of the seminar, the students will grow in their ability to:
2. Undertake the critical review of technical topics in Oil Technology and allied subjects.
3. Access the information in a variety of ways appropriate to a discipline, including locating and using library collections, other search tools and databases.
4. Undeveloped the process of writing to enhance intellectual level and resolve the complexities of thought.

5. Understand the role of effective presentations in public/professional contexts and gain experience in formal/ informal presentation.
6. Deliver well-rehearsed and polished presentations meeting time, content, and interactive requirements.
7. Engage in reflective listening and storming conversations.

VIII SEMESTER

Department: Department of Oil Technology

Course Code: CHL 405

Course Title: Project Engineering and Economics

Course Type: Theory

Total Hrs/Week: 04 Hrs (3 Hrs Lectures+1 Hr Tutorial)/week

Course Credit: 04

Course Objective:

The objective of the course is to provide students with a firm grasp of the essential principles of Management, Project identification project feasibility and Project Scheduling Technique with Suitable Examples. This course will help student to understand the concepts and terminology that are used in Management economics and costing. Students know about pipeline design on the basis of fluid dynamics and mechanical properties. students also understand the balance sheet, store ledger account by various methods and solve various engineering problems in process optimization.

Course Content:

Unit -I

1. Project identification, project feasibility
2. Project testing based on vibality risk & Cost estimation.
3. Evaluation of project by different methods on the basis of Vibality
   i) Net Present Value method. ii) Method of Rate of Return on Initial Investment
   iii) Pay out Period iv) Method of Discount Cash Flow v) Capitalized cost method
   vi) Internal rate of return method vii) Break Even Chart
4. Evaluation of project by different methods on the basis of Risk
   i) Profitability Index ii) Demand fore casting iii) Standard Deviation Approach
5. Evaluation of project by different methods on the basis of Cost
   i) Preparation of Cost sheet and statements ii) Preparation of Profit Loss Statement

(10 Hrs)

Unit -II

1. New developments in management, CPM & PERT
   Principle and Objectve of CPM and PERT
   Net work Diagram for calculation Time Duration
2. Linear Programming Problem (Numerical based on each method)
   i) General simplex method ii) Primary & Dual technique method
   iii)Direct simplex method Iv) Graphical Method

(10 Hrs)

Unit -III

1. Cost analysis, fixed capital, working capital, Preparation of store ledger account by Pricing issue methods. LIFO, FIFO, Simple average, weighted average
2. Depreciation, significance of inadequacy and obsolescence, and depreciation methods (Numerical Based on It)

(10 Hrs)

Unit -IV

1. Layout and location, objective, principle
2. Layout and Location factors.
3. Equipment layout diagram (ELD)
4. Tank firm cum utility block diagram for different processes. (TFCUBD)

(10 Hrs)

Unit -V

1. Design of process flow sheet from process information. Plant utility line diagram for including valve, IPC symbol, unit operations symbols (mass & heat transfer)
2. Utility Block diagram for Boiler House, Refrigeration Plant,Compressor House and Electricity
3. Piping design: Fluid dynamic parameter (Q, Delta, D), piping insulation, Pipe Welding, pipe Fittings, types of valves, selection of valve, P.C. and instrumentation Symbols. Numerical Based On it
4. Design of pipeline on the basis of fitting, valve, Insulation, IPC & utility panel board.

(10 Hrs)

Course Outcome:

1. To enhance knowledge of students about pipeline design on the basis of fluid dynamics and mechanical.
2. To understand the various methods of profitability evaluation and their application.
3. To enhance knowledge of students to understand the balance sheet and store ledger account by various methods.
4. To enhance knowledge of students about various scale up methods and to understand the new development in management and optimization techniques.
5. To enhance the ability of students to identify and solve various engineering problems in process optimization.

Reference Books:

1. Dawande, S. D. "Process Design of Equipments." Central Techno Publication, Nagpur (2000).
2. Pathak B.V. & Mahajan M.S. “Industrial Organization & Management”, Nirali Prakashan 1986
3. Peters, Max Stone , Timmerhaus K.D.. “Plant Design and Economics for Chemical Engineers”. Vol. 4. New York: McGraw-Hill, 1968.
4. Austin, George T. "Shreve's Chemical Process Industries." (1984): 136-138.
5. G.V.Kumbhojkar , “Applied Mathematics Optimization –IV” , 2002
6. Dhone D.B., “ Plant Utilities” Nirali Prakashan, 2008.
7. T,S,Grewal and S.C.Gupta, “Introduction to Accountancy” S.Chand Publication 2008
8. Christopher J,S. and L.M.Weather, “Managerial and Cost Accounting” Ventus Publisher APS, 2011

Department	**: Department of Oil Technology**
Course code	**: CHC 406**
Course Title	**: Process Equipment Design (Th)**
Course Type	**: Theory**
Total Hrs/ Week	**: 02**
Course credit	**: 02**

Course Objective:
To study the design procedure for chemical equipments. To study the behavior of material under stress. The student should be able to understand the designing of pressure vessels, high pressure vessels, supports, calendria evaporator, shell and tube heat exchanger, sieve tray and bubble cap tray for distillation column, agitators.

Course Content:

Unit –I
General design procedure for designing chemical equipment, protective coating, corrosion causes and prevention. Theory of failure, factor of safety. The material behavior under stresses.Unfired pressure vessel subjected to internal and external pressure. Design of shell, nozzle, different types of head. **(10hrs)**

Unit –II
Vessels for high pressure operation, constructional features, multi shell construction, determination of thickness of shell applying various theories of failures.Agitators, selection, types application, power required for agitation. **(10hrs)**

Unit-III
Types of support for vertical and horizontal vessels, Process design for short tube calendria type of evaporator, Types of heat exchangers, shell and tube heat exchanger construction and design in details. Design for sieve tray and bubble cap tray for distillation column, Heating and cooling arrangements for reaction vessel. **(10hrs)**

Reference Book:

1. Bhattacharya, B. C. "Introduction of Chemical Equipment Design." Mechanical Aspects (2003): 201-203.
2. Sinnott, R. K. Coulson & Richardson's "Chemical Enginering: Volume 6/Chemical Engineering Design", Elsevier Butterworth Heinemann, 1999.
3. Joshi, Mansukhlal Vrajlal, and V. V. Mahajani. Process Equipment Design. Macmillan India, 1996.
4. Dawande, S. D. "Process design of equipments." Central Tecno Publication, Nagpur (2000).

Course Outcome:

1. At the end of the course the student exhibits how to design and draw in a competitive manner various process equipment with proper scale and each components with detail dimensions.
2. Learn how to design Pressure vessels, Reaction vessels, Shell and Tube Heat Exchanger, Short Tube Calendria Evaporator.
3. Understands the constructional features of high Pressure vessels, Detail arrangement of Sieve tray and bubble cap trays.
4. Understand how to read drawings to know details about process equipment, which can be utilized for fabrication, maintenance, assembling and dismantling.

Department	**: Department of Oil Technology**
Course Code	**: CHC 406**
Course Title	**: Process Equipment Design (Pr)**
Course Type	**: Practical**
Total Hrs/ Week	**: 03**
Course Credit	**: 1.5**

Course Objective:

To study the design procedure for designing chemical equipment and selection of proper material of construction by considering different mechanical and physical properties. To study the behavior of material under stresses. The student should be able to understand the designing of pressure vessels, high pressure vessels, supports, calendria evaporator, shell and tube heat exchanger, sieve tray and bubble cap tray for distillation column, agitators.

Course Content:

Students will be required to do process design and submit drawings of at least six equipments such as pressure vessels, heat exchangers, agitators, short tube calendria type evaporator etc. Types of agitators, supports. Design of bubble cap tray, sieve tray, different types of packing

Course Outcome:

1. At the end of the course the student exhibits how to design and draw in a competitive manner various process equipments with proper scale and each component with detail dimension.
2. Learn how to draw from the design problem solved in theory the exact Drawings of Pressure vessel, Reaction vessel, Shell and Tube Heat Exchanger, Short Tube Calendria Evaporator.
3. Understands the constructional features with the help of drawings of high Pressure vessels, Detail arrangement of Sieve tray and bubble cap trays.
4. Understand how to read drawings to know details about process equipment, which can be utilized for fabrication, maintenance, assembling and dismantling.

Department : Department of Oil Technology

Course Code : OTC-403

Course Title : Chemistry of Surfactants and Oleochemicals

Course Type : Theory

Total Hrs : 4/week

Course Credit : 04

Pre-Requisites For Course:
Quality Control Techniques in Oils and Fats. (OTC-302)
Technology of Fat Splitting and Soaps (OTL-303)

Course Objective:
This course will focus on enriching the subject knowledge of student in terms of surfactants classification, their synthesis mechanism, surface properties and industrial applications of the prepared oleo-derivatives.

Unit I:
General chemistry and classification of surfactants Synthesis of anionic surfactants & their application: Sulfated and sulfonated surfactants (AOS, LABS, Alkyl Sulphates, Sulphated castor oil, Sulphated Monoglycerides, Sulphosuccinates, Ester and Amide sulphonates, Sulphated Alkanolamides, Alkyl ether Sulphates, etc.), phosphorous based surfactant, and miscellaneous anionic surfactant. **(10hrs)**

Unit II:
Synthesis and applications of Cationic Surfactants:
Synthesis of Non-Quaternary Nitrogen bases (Amines, Amides and Nitriles); tertiary Amines and Quaternary Nitrogen Bases (Imidazoline, Morpholines, Cyclic Quaternary compounds etc.) Synthesis and applications of Amphoteric Surfactants (Betaines, Amine oxides, amphoteric imidazoline etc.) **(10hrs)**

Unit III:
Synthesis and applications of Non-ionic surfactant (Polyoxyethylene and polyoxy proplylene condensate, Polyhydroxy non-ionic surfactant etc.); Bulk properties of surfactants solutions and Methods of their measurements: Miscellar properties, Foaming, wetting, emulsification, dispersion, and detergency. **(10hrs)**

Unit IV:
Castor oil derivatives: DCO, Sebacic acid, Undecenoic acid, Heptaldehyde, 2-Octanol, Ethoxylated castor oil, Hydrogenated castor oil etc.
Oleochemicals from non-traditional oils: Neem oil, Karanja oil, Mahua oil, Sal fat etc.
Erucic acid and Brassylic acid from rapeseed oil, Sterols from Soybean oil deodorizer distillates, Oryzanol from rice bran oil etc. **(10hrs)**

Unit V:

Chemical synthesis of fatty acid and their derivatives, mechanism of oxidative and thermal polymerization, Ozonolysis, Epoxidation; Halogen derivatives and their uses in identification of fatty acids; Application of Oleochemicals: Food, textile, pharmaceuticals, plastic, leather industries etc. **(10hrs)**

Course Outcome:

1. Understand the basic chemistry and classification of surfactant.
2. Describe synthesis methodologies and surface properties of anionic, cationic, non-ionic and amphoteric surfactants.
3. Describe the methods for the development of various oleo-derivatives from castor oil and other non-traditional oils.
4. Discuss the different chemical synthesis methods and applications of fatty derivatives

Reference Books:

1) Farn, Richard J., ed. "Chemistry and technology of surfactants". John Wiley & Sons, 2008.
2) Myers, Drew. " Surfactant science and technology". John Wiley & Sons, 2005
3) Kronberg, Bengt, and B. Lindman. "Surfactants and Polymers in aqueous Solution", John Wiley & Sons Ltd., Chichester, 2003.
4) Porter, Maurice R. "Handbook of surfactants". Springer, 2013

Department : Department of Oil Technology

Course Code : OTC-403

Course Title : Chemistry of Surfactants and Oleochemicals

Course Type : Practical

Total Hrs : 3/week

Course Credit : 1.5

Pre-Requisites For Course:

Quality Control Techniques in Oils and Fats. (OTC-302)
Processing and Analysis of Soaps and High Fat allied Products (OTP -305)

Course Objective:

This course will enable the students to prepare oleochemicals from fatty acids, fatty alcohol and non-traditional oils, and will evaluate the surface properties of surfactants.

Course Content:

1. Preparation of oleochemicals such as FAME, fatty Alcohols, fatty amides, ethanolamides etc. Nitrogen and sulphur derivatives of fatty acids etc.
2. Preparation of oleochemicals from castor oil (DCO, Sebacic acid, Undecenoic acid, Ethoxylated castor oil etc.) and non-traditional oils such as neem oil etc.
3. Determination of performance characteristics of surfactants:
   (a) Foaming power
   (b) Dispersing power
   (c) Relative detergency
   (d) Surface tension and Interfacial tension

Course Outcome:

1. Design and conduct the experiment for preparation of oleochemicals from oils, fatty acids, fatty alcohols, fatty amines.
2. Perform the experiment for preparation of oleochemicals from castor oil and neem oil.
3. Evaluate the foaming power of surfactant.
4. Analyze the surface tension and interfacial tension of surfactant at different concentration.
5. Develop the laboratory scale synthesis of oleochemicals and surfactant.
6. Perform the experimental computing and summarize the results

Department : Department of Oil Technology

Course Code : OTL-404

Course Title : Technology of Surfactants & Detergents

Course Type : Theory

Total Hrs : 4/week

Course Credit : 04

Pre-Requisites For Course:
Technology of Fat Splitting & Soap (OTL-303)
Instrumentation and Process Control (CHC-310)
Refining of Oils and Fats (OTC-301)

Course Objective:
This course will update a thorough technically knowledge of the students about different synthesis methodologies, their characterization techniques and design of pilot plant reactors for oleo-based surfactants and detergents.

Course Content:

Unit-I:
Sulphonation and Sulphation: Characteristics, storage and handling of sulphonation reagents (Oleum, H_2SO_4, SO_3, Sulphamic acid, Chlorosulphonic acis); Mathematical modeling of reactors for sulphonation, various design option for reactors, mass & heat transfer aspect; Raw material, plant and process for manufacturing of AOS, LABS, Alkyl Sulphates, Fatty Acid Methyl Ester Sulphonates; Manufacture of polyethylene condensates with due emphasis on safety aspects. **(10hrs)**

Unit-II:
Inorganic, organic builders and fillers for synthetic Detergents and their properties and functions: Phosphate, Silicates CMC, Carbonates Borates, Enzymes, Optical brighteners, Sodium sulphates, Sodium chloride, Colloidal silica, Zeolite, Solvents,Pine Oil etc. **(10hrs)**

Unit-III:

Principle of Detergent formulation, requirement and identification of different cleaning jobs (heavy duty/ light duty, dish washing, fabric washing etc.); Formulations for Foam, heavy duty and light duty laundering, low foaming formulations, commercial laundering, liquid detergents, dish washing detergents, solvent detergents, waterless detergents, industrial cleaning, sanitary cleaning, detergent bar etc. **(10hrs)**

Unit-IV:
Different method of manufacture of detergent powder: combined adsorption and neutralization, dry mixing, drum drying, spray drying etc; Design of equipments and plant layout for manufacturing of detergent cake and bar; Manufacture of liquid detergent. **(10hrs)**

Unit-V:
Analytical techniques for synthetic detergents, surfactants and builders: Active matter, SO_3 content, molecular weight, amine value, moisture content, P_2O_5 content, silicate analysis, Na_2CO_3/ NaOH content, DOS in CMC etc.
Biological effects and toxicity of surfactants, mechanism of biodegradability and eutrophication, estimation of biodegradability. **(10hrs)**

Course Outcome:
1. Understand the characteristics of sulphonating reagents for storage and handling.
2. Use the engineering knowledge in designing of reactors and mathematical modeling of reactor.
3. Selection of raw materials for manufacture of oleochemical and surfactants.
4. Propose and evaluate the ingredients for detergent formulation.
5. Use analytical skills/ methods in characterizing surfactants and builders.
6. Recognize the biological toxicity of surfactants on aquatic ecosystem.

Reference Books:

1. Zoller, Uri, ed. "Handbook of detergents, part E: applications". Vol. 141. CRC Press, 2008.
2. Showell, Michael, ed. "Handbook of detergents, part D: formulation". Vol. 128. CRC Press, 2016
3. "The complete Technology Book on Detergents", Niir Board (2nd Edition), 2013
4. P.K. Chattopadhyay, "Modern Technology of Soaps & Detergents", 2003

Department : Department of Oil Technology

Course Code : OTP-405

Course Title : Synthesis & Analysis of Surfactants and Detergents

Course Type : Practical

Total Hrs : 6/week

Course Credit : 03

Pre-Requisites For Course:
Instrumentation and Process Control (CHC-310)
Quality Control Techniques in Oils and Fats (OTC-302)
Processing and Analysis of Soaps and High Fat allied Products (OTP -305)

Course Objective:
After completion of this course the students will be to perform the experiments of surfactant and detergent synthesis. Also they will analyze the various BIS characteristics of the detergents samples.

Course Content:

1. Preparation of acid slurry
2. Preparation of Detergent powder
3. Preparation of Liquid detergents
4. Analysis of synthetic detergent powders as per BIS
5. Active matter content and its type
6. Moisture and volatile matter content
7. Matter insoluble in water
8. Matter insoluble in alcohol
9. Active alkalinity
10. Total phosphate content
11. Sodium poly phosphate content
12. Chloride content
13. Analysis of alkyl benzene sulphonic acid as per BIS
14. Active matter
15. Free LAB
16. Sulphuric acid content

Course Outcome:

1. Prepare the surfactant products like acid slurry, detergent powder and analyze them for active matter, moisture, phosphorus content.
2. Analyze the synthetic detergent powders for quality specifications as per BIS standards.
3. Gain the in-depth knowledge of Organic Chemistry and Oil Technology principles for better outcome as a product developer.
4. Lead a team of Research and Development personnel for developing quality products.
5. Understand the International Environment standards to produce a product globally acceptable.

Elective –III

Department : Department of Oil Technology

Course Code : OTL-406

Course Title : Environmental Aspects of Oil and Allied Industries

Course Type : Theory

Total Hrs : 4/week

Course Credit : 04

Course Objectives:

On completion of the course students will have an understanding of air and water pollution caused by industries, their environmental impact and various methods of industrial pollution prevention and control.

Course Content:

Unit- I:

Industrial pollution and its impact, Magnitude of industrial waste, Legislative regulations. Recycle and reuse of waste water, recovery of by/co-product from industrial effluents.**(10hrs)**

Unit –II:

Philosophy of waste treatment, 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. **(10hrs)**

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. **(10hrs)**

Unit- IV:

Waste liquid treatment: 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. **(10hrs)**

Unit –V:

Solid waste treatment: Spent earth, catalyst, fly ash, boiler ash treatment and disposal.

Waste gas treatment: Air pollution control by mechanical method: mechanical collectors, electrostatic precipitator, filters, wet scrubbers, vapour phase system, activated carbon, typical air purification system. **(10hrs)**

Course Outcome:

1. Understand the different types of wastes generated in the industry, their impact on living and non-living things.
2. Know about the environmental regulatory legislations and standards.
3. Identify the air and water pollution problems and suggest suitable measures.
4. Understand the different methodologies and unit operations involved in industrial waste treatment.
5. Propose use of pollution control equipment and their design.

Reference Books:

1) Rao, C. S. “Environmental pollution control engineering”. New Age International, 2007.

2) Prof.N.H. Gopal Dutt, “Environmental Pollution & Control”.

3) Sell, Nancy J. “Industrial pollution control: issues and techniques”. John Wiley & Sons, 1992.

Department : Department of Oil Technology

Course Code : OTL-407

Course Title : Modern Instrumentation Techniques for Analysis of Oils and Oleochemicals

Course Type : Theory

Total Hrs : 4/week

Course Credit : 04

Course Objective:
This course will enable students to understand, identify and propose the suitable instrumental methods for analysis of oils and allied products.

Course Content:
Unit -I:
Chromatography- History, theoretical developments and various techniques e.g., thin layer chromatography, column chromatography, gas-liquid chromatography, HPLC and Super critical Chromatography; their principles, practices and applications to the analysis of oils and allied products. **(10hrs)**

Unit -II:
Ultra-violet, visible, infrared and near infrared spectroscopy techniques: principles, practices and application to the analysis of oils and allied products. **(10hrs)**

Unit –III:
Nuclear magnetic resonance spectroscopy: principle, high resolution spectra of fats and fatty acids, adsorption of special groups, analysis of spectra and quantitative applications. **(10hrs)**

Unit –IV:
Construction, operation principle and applications of Color Matching and Lovibond Tintometer, Differential Scanning Calorimeter, Thermo gravimetric Analyzer, tesniometer, viscometer in the analysis of oils and allied products. **(10hrs)**

Unit –V:
Applications of TLC-FID analyzer,GC-MS, SFC-GCLC-MS, Induced Coupled Plasma-MS in analysis of oils and fats. **(10hrs)**

Course Outcome:
1. Understand the fundamentals, principles, working mechanism and applications of various chromatographic techniques including GC, TLC etc.
2. Understand the principles, practices and applications of spectroscopy techniques such as UV, IR, and NMR to the analysis of oils and allied products.
3. Understand the construction, operation principle and applications of various instrumental analysis including tintometer, DSC, TGA, tensiometer.

Reference Books:
1) "Analytical Chromatography": Dr. G.R. Chatwal
2) Bruno, Thomas J., and Paris DN Svoronos. " CRC handbook of basic tables for chemical analysis". CRC press, 2003.

3) Settle, Frank A. “Handbook of instrumental techniques for analytical chemistry”. Prentice Hall PTR, 1997.
4) Rouessac, Francis, and Annick Rouessac. “Chemical analysis: modern instrumentation methods and techniques”. John Wiley & Sons, 2013.

Department : Department of Oil Technology

Course Code : OTL-408

Course Title : Non Traditional Oils and Non Triglyceride Constituents

Course Type : Theory

Total Hrs : 4/week

Course Credit : 04

Course Objective:
This course will add to the technical knowledge of students about different non-traditional oil and some of the important non-triglyceride constituents such as carotenoids, sterols, tocopherols, flavonoids, oryzanol, sesame lignans, phospholipids etc. This includes sources, classification, biological roles and the eco-industrial utilization of the fatty and non-fatty components.

Course Content:
Unit –I:
Plant based oil bearing materials: Sources & composition of oil bearing materials; Extraction methodology; fatty acid composition and triglyceride distribution; characteristics; their minor lipid associates & industrial applications- Karanja, Neem, Mahwah, Sal, Rubber seed, Palash, Jojoba. **(10hrs)**

Unit –II:
Plant based oil bearing materials: Sources & composition of oil bearing materials; Extraction methodology; fatty acid composition and triglyceride distribution; characteristics; their minor lipid associates & industrial applications- Jatropha, Kokum, Mangokernel, Dhupa, Khakan, Kusum, Niger. **(10hrs)**

Unit –III:
Carotenoids: Types, sources and distribution; Properties and Utilization
Chlorophyll: Classification and structures; Biosynthesis and culinary uses; Mechanism of chlorophyll removal from oils
Sterols, Tocopherols and Tocotrienols: Forms and structures; distribution and properties
Flavanoids: Classification, distribution and structures; their biological roles and potential health benefits
Squalene: Source and distribution; Biosynthesis and its applications. **(10hrs)**

Unit –IV:
Phenolic Compounds Such as Sesamol, Sesamin, Seasmolin: Sources, structures and classification; Antioxidant Effects; Therapeutic utilization like Lipid Metabolism, Fatty Acid Oxidation, Reduction of Cholesterol, Enhancement of Vitamin-E Level, Neuroprotective Effect etc.

Oryzanol: Rice Bran and Oryzanol; Biological Aspect of γ-Oryzanol; Influence of Rice Bran and Rice Bran Oil Processing on γ-Oryzanol; Toxicology and Carcinogenicity Studies of γ-Oryzanol; Clinical applications of γ-Oryzanol to Human Health. **(10hrs)**

Unit –V:

Phosphatides: Sources of Phospholipids/Phosphatides; Classification, Structure and Composition; Chemical and Physical Properties; Manufacture, Fractionation of Crude Lecithin using Batch and Continuous Degumming Methods; Manufacture of Refined-Grade and De-Oiled Lecithin; Modified forms of Lecithin such Acetylated Lecithin, Hydroxylated Lecithin, Hydrolyzed Lecithin etc.; Food-Grade Lecithin Products and their Uses; Nonfood and Industrial application of lecithin. **(10hrs)**

Course Outcomes:

1. Describe the sources, composition, extraction methodology, fatty acid composition, triglyceride distribution, characteristics and industrial application of plant based oil bearing materials.
2. Distinguish between the different types of pigments and antioxidants associated with oil bearing materials.
3. Describe the key distinguishing therapeutic and clinical features of antioxidants from sesame and rice bran oil.
4. Understand the classification, structures and composition of phosphatides of oil origin.
5. Outline the major chemical and physical properties of phospholipids and describe the continuous degumming methods for manufacturing of lecithin.
6. Identify the different chemical reactions to modify the lecithin for non-food and industrial applications.

Reference Books:

1) Bailey, Alton Edward. "Industrial oil and fat products." Industrial oil and fat products.Vol II, Edition 5

2) Bringi, Naganathan Vishwanath. "Non-traditional oilseeds and oils in India". Oxford and IBH Pub. Co., 1987.

3) "Foods and Nutrition": Kalpna Bharatwaj, Ista international publishing house ,Delhi.

4) "A Text Book Of Nutrition": Digumarti Bhaskara Rao. Discovery Publishing house, New Delhi.