

ANDHRA KESARI UNIVERSITY::ONGOLE
(A State University, Recognized by UGC)
M.Sc. OILS, FATS & PETRO PRODUCTS SYLLABUS
Course Structure as per National Educational Policy-2020 under CBCS
(For the students admitted from the academic year 2026-2027 onwards)

Semester	Components of Study	Course Code	Title of the Course	No. of Credits	Hr/Week	Internal Assessment	Semester End Exams	Total
SEMESTER–I	Mandatory Core	R26OF11	Chemistry and Composition of Oils and Fats	4	4	30	70	100
		R26OF12	Extraction Techniques of Oil bearing Materials	4	4	30	70	100
	Compulsory	R26OF13	Quality Control of Oil and Allied Products	4	4	30	70	100
	Elective Foundation	R26OF14A	Fluid Mechanics and Mechanical Operations	4	4	30	70	100
		R26OF14B	Elements in Mechanical Operations					
		R26 OF14C	Material and Energy Balance					
	Core Practical-I	R26OF15	Technical Analysis of Chemical Compounds	4	6	30	70	100
	Core Practical–II	R26OF16	Physical Analysis of Oils, Fats and Fatty Acids	4	6	30	70	100
	Audit Course	*R26OF17*	*Human Values and Professional Ethics*	*2*	*2*	*50*	--	--
	Sub-Total			**24**				**600**
SEMESTER–II	Mandatory Core	R26 OF21	Refining of Oils	4	4	30	70	100
		R26OF22	Oleochemicals and Surfactants	4	4	30	70	100
	Research methodology	R26 OF23	Research Methodology, Ethics & Scientific Writing	4	4	30	70	100
	Elective Foundation	R26OF24A	Principles of Heat and Mass Transfer	4	4	30	70	100
		R26 OF24B	Industrial Processes of Specialty Fats					
		R26OF24C	Chemical Thermodynamics					
	Core Practical-I	R26OF25	Unit Operations Lab	4	6	30	70	100
	Core Practical–II	R26 OF26	Chemical Analysis of Oils ,Fats and Fatty Acids Lab	4	6	30	70	100
	Skill Development	*R26OF27*	*MOOCS Online(https://swayam.gov.in/; https://swayam-plus.swayam2.ac.in/)*	*2*	*2*	*50*	--	--
	Sub-Total			**24**				**600**
SEMESTER–III	Mandatory Core	R26OF31	Production and Formulation of Soaps and Detergents	4	4	30	70	100
		R26 OF32	Extraction of Essential Oils	4	4	30	70	100
	Core Elective-I	R26OF33A	Environmental aspects of Oils and Allied Industries	4	4	30	70	100
		R26 OF33B	Material Engineering					
		R26 OF33C	Biochemistry of Fats and Other Lipids					
	Open Elective-II	R26OF34A	Energy Management for Edible Oil Refinery	4	4	30	70	100
		R26OF34B	Mass transfer Operations					
		R26 OF34C	Applied Mechanics					
	Core Practical-I	R26 OF35	Processing of Oils, Fats and Fat based Products Lab	4	6	30	70	100
	Core Practical–II	R26OF36	Internship (Report submission+ seminar)	4	6	30	70	100
	Skill Enhancement	*R26OF37*	*MOOCS Online(https://swayam.gov.in/; https://swayam-plus.swayam2.ac.in /)/AI in Chemistry*	*2*	*2*	*50*	--	--
	Sub-Total			**24**				**600**
SEMESTER–IV	Mandatory Core	R26OF41	Production and Formulation of Cosmetics	4	4	30	70	100
		R26OF42	Packaging of Oils, Fats and Allied Products	4	4	30	70	100
	Core Elective-I	R26OF43A	Processing of Petroleum Products	4	4	30	70	100
		R26OF43B	Strength of Materials					
		R26 OF43C	Organic Synthesis Process					
	Open Elective-II	R26OF44A	Chemical Process Economics and Industrial Management	4	4	30	70	100
		R26OF44B	Biotechnology of Oils and Fats					
		R26OF44C	Industrial Instrumentation					
	Core Practical-I	R26OF45	Soaps , Detergents and Cosmetic Formulations Lab	4	6	30	70	100
	Core Practical-II	R26OF46	Project work (dissertation+ seminar+vivovoce)	4	6	--	100 (50+ 30+ 20)	100
	Sub-Total			**24**				**600**
	Grand Total			**96**				**2400**



ANDHRA KESARI UNIVERSITY::ONGOLE -----
DEPARTMENT OF OILS, FATS & PETRO PRODUCTS
SYLLABUS FOR M.Sc.OILS, FATS & PETRO PRODUCTS
(*For the students admitted from the academic year 2026 -2027 onwards)*
SEMESTER–I

PAPER–I: CHEMISTRY AND COMPOSITION OF OILS AND FATS (R26OF11)
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning objectives: -

- To learn the basic chemistry and components of oils &fats
- To study about the non-triglycerides constituents
- To know about the composition and characteristics of individual of oils and fats
- To acquire knowledge about chemical reactions of oils, fats and fatty acids

Unit-1: **10 H**

General Introduction to Oils&Fats, their sources structure, Composition and classification of Oils & Fats, constituents of natural Oils & Fats, Glycerides, Fatty acids, their nomenclature, structure and occurrence in Oils & Fats.

Unit-II: **12 H**

Non triglyceride constituents like Phospholipids, Free fatty acids, sterols, vitamins, waxes and constituents imparting colour, odour and stability of Oils & Fats. Toxic constituents, Antioxidants and Synergists.

Unit-III: **12H**

Composition and characteristics of Individual Oils & Fats-Milk fat group: Ghee, butter, Vegetable fat group: Cocoa butter, Shea butter, Animal fat group: Lard, Tallow, Lauric acid oils: Coconut oils, Palm kernel oils, Marine animals' group: Fish oils, Fish liver oils, shark oils, whale oils.

Unit-IV: **14H**

Composition and characteristics of Individual Oils & Fats-Oleic-Linoleic acid oils: Sunflower oil, Palm oil, Rice bran oil, Cotton seed oil, Ground nut oil, Corn oil, Olive oil, Sesame oil, Neem oil, Karanja oil etc., Linolenic acid group: Soy bean oil, Linseed oil, Hydroxy acid group: Castor oil, Erucic acid group: Mustard oil, Rapeseed oil, Conjugated acid group: Tung oil, Oiticica oil.

Unit-V: **12H**

Chemical reaction of Oils, fats & Fatty acids, Chemistry of hydrogenation, Dehydrogenation, hydrogenolysis, hydrolysis, Saponification, neutralization, esterification,

transesterification, interesterification, isomeriation, Polymerization, dehydration, pyrolysis, Rancidity in oils, prevention of rancidity.

Reference Books:

1. Bailey's Industrial oil and fat products Volume-1(4^{th} Edition)
2. Chemistry and Technology of oils & fats by M.M.Chakrabarthy.
3. Treatise on fats, fatty acids and oleo chemicals by O P Narulla

Learning outcomes:-

- Student can have knowledge regarding the basic chemistry of oils & fats
- Student shall able to understand the non-triglyceride constituents and their structures.
- Student can gain the knowledge about composition and characteristics of individual oils and fats
- Student can have knowledge about chemical reactions of oils, fats and fatty acids



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SEMESTER–I

PAPER–II: EXTRACTION TECHNIQUES OF OIL BEARING MATERIALS (R26OF12)
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning objectives:-

- To understand the harvesting and storage of oils seeds
- To know the machinery employed for oil extraction from different seeds
- To grab the knowledge on solvent extraction
- To learn about desolventization of miscella and meals
- To know the extraction of fat from fatty materials.

Unit-I: **14H**

Harvesting conditions of various Oils seeds and their effect on Oil recovery, Drying of Oil seeds, and methods of drying. Shortage of Oilseeds, conditions of shortage Cooking of Oil seed, their effects on Oil Yield and quality. Grading and evaluation of OBM, Crude Oil as per BIS method. Handling and pretreatment of Oilseeds, machinery employed for handling and pretreatment Oilseeds viz. conveyors, elevators, seed cleaning machines, decorticators, disintegrators, reduction rolls and high rolls etc.,

Unit-II: **12H**

Machinery employed for production of Oils viz. Ghani, Hydraulic presses, Screw presses, low pressure and high-pressure expellers etc. Filter presses and centrifuges, Preparation of Soya flakes, Rice Bran pellets and cotton seed prior to solvent extraction.

Unit-III: **10H**

Solvent extraction theory, selection of solvents, their availability, advantages and limitations. Batch and continuous plants employed for solvent extraction of Low and high oil-bearing materials.

Unit-IV: **12H**

Desolventization of miscella and meals: Equipment and plants employed, Effects of operating parameters on the quality of Oil meal after desolventization of miscella and meals. Solvent losses and utilities requirements, Energy conservation, Safety and Environmental consideration of Solvent Extraction plants, Solvent recovery system.

Unit-V: **12H**

Rendering of animal fats: Different methods of rendering, production of tallow, lard, fish oils and Fish liver oils. Spoilage during storage of oils and fats, storage systems for Oils and Fats.

Reference Books:

1. Bailey's Oil and Fat products Volume II(4th Edition)

2. Bailey's Oil and Fat products volume IV(5th Edition)

3. Treatise Volume .I byK.P.Narula.

Learning outcomes:-

- Student can able to learn the harvesting and storage of oils seeds
- Student can know the machinery of oil extraction of different seeds
- Student can grab the knowledge on solvents extraction of different seeds
- Student can able to learn desolventization of miscella and meals
- Student can know the extraction of fat



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SEMESTER–I

PAPER–III: QUALITY CONTROL OF OILS AND ALLIED PRODUCTS (R26OF13)
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning Objectives:

* To know the elementary methods of analysis of oilseeds, Oils, Fats& Fatty acids

* To know the physico-chemical properties and their evaluation methods

* To get knowledge about the Chromatographic methods.

* To know the principles and uses of modern analytical techniques.

* To learn about the Dilatometric measurement and its significance.

Unit-I: **12H**

Elementary methods of analysis of oil seeds, Oils, Fats & Fatty acids, Physical characterization of Oils, fats and fatty acids-oiliness and viscosity, surface and interfacial tension. Density and expansibility, melting point, thermal properties, smoke, fire and flash points, solubility and miscibility, optical properties, refraction, absorption spectra, electrical properties resistance, dielectric constant.

Unit-II: **12H**

Chemical characterization of oils, fats and fatty acids- Acid Value, Saponification Value, Iodine Value, Peroxide Value, Ester Value, Reichert Missile Value, Polenske Value, Acetyl Value, BIS methods, Identification of Oils&Fats: Methods for detection of adulteration in Oils & Fats. BIS, FSSAI specifications for Oils and Fats.

Unit-III: **12H**

Chromatographic methods: Introduction, Theoretical developments and various techniques- Thin layer chromatography, Column chromatography, Gas –Liquid chromatography, High performance liquid chromatography, super critical chromatography etc.,

Unit-IV: **12H**

Principles and applications of modern spectral analysis techniques such as Ultra Violet, Visible, Infrared, Nuclear Magnetic Resonance spectroscopy, Mass Spectroscopy, high resolution spectra of fats and fatty acids.

Unit-V: **12H**

Special quality control methods -Dilatometric measurement and its significance, Wet bulb temperature& Measurement of humidity, Detection of Nickel in hydrogenated oils, Iron, Sulphur and phosphatide contents of crude and refined vegetable oils.

Reference Books:

1. Analytical methods in Oils&Fats byL.V Cocks

2. Laboratory Handbook for chromatographic methods byO.Milkes.

3. Treatise on Fats, Fatty Acids, Oleochemicals byO.P.Narula.

4. Instrumentation byD.PEck men.

5. Principles of Instrumentation analysis, Edition-III(1985)Edited by Douglas A.Skog

6. BIS/FSSAI manual of methods of analysis of foods.

Learning outcomes:

* Student can able to understand elementary methods of analysis of oil seeds, Oils

* Student can able to understand the chromatographic techniques.

* Student can able to understand the spectral method analysis of oils.

* Student can know the special analytical techniques.

* Student can able to understand the Dilatometric measurement and its significance.



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SEMESTER–I

PAPER–IV: FLUID MECHANICS AND MECHANICAL OPERATIONS (R26OF14[A])

Max. Marks: 100 **(Internal-30M&External-70M)**

Learning Objectives:

* To learn the principles of manometers and types of flows
* To get knowledge about the types of fluids and Boundary layer of flows.
* Toget Knowledge about the pump working with Bernoulli's equation.
* To learn about NPSH and centrifugal pumps.
* To get knowledge about the Mechanical separation equipment.

Unit-1: **12H**

U-tube and inclined manometers-Hydrodynamics; potential flow, Laminar flow, turbulent, Velocity gradient and rate of shear, Newtonian and non-Newtonian fluids, Reynolds experiment, Reynolds number, Boundary layer flow, development of turbulent boundary layer on a flat plate

Unit-II: **12H**

Fluid head, Potential head & friction factor definitions, Continuity equations, Bernoulli equations, pump work in Bernoulli equation, Velocity distribution in pipe. Hagen-Poiseuille equation. Flow at sudden enlargement and sudden contraction of cross section.

Unit-III: **12H**

Transportation and metering of fluids: Pipe, fittings and valves, pumps, developed head, power requirement, NPSH, positive displacement pumps and Rotary pumps, Characteristics of a centrifugal pump, steam jet ejector, orificemeter, venturimeter, Pitot tube, rotameter, notches and weirs.

Unit-IV:

12H

Agitation and mixing of liquids: purpose of agitation, flow pattern in vessels, description of equipment for agitation and mixing, size reduction, Particle shape and size, principles of Crushing, Crushing efficiency, Rittenger's law, Bond's law and kicks law. Blake Jaw crusher, Ball Mill, and ultrafine grinders, closed circuit grinding.

12H

Unit-V:

Description of Mechanical separation equipment: Gyratory screens, vibrating screen s, centrifugal-sifter, cartridge filter, plate and frame filters, shell and leaf filters continuous rotary vacuum filter, suspended batch centrifugal gravity thickener, cyclones, Tubular centrifuge, Disk centrifuge and nozzle discharge centrifuge.

Reference Books:

1. Unit operation in chemical Engineering by McCabe and Smith McGraw Hill.

2. Introduction to Chemical Engineering by Badger and Bancherc McGraw Hill Internationa l Students Edition.

Learning outcomes:-

* Students can able to understand the principles of manometers and types of flows
* Student can get knowledge about the types of fluids and Boundary layer of flows.
* Students are able to get Knowledge about the pump working with Bernoulli's equation.
* Students are able to Understand about NPSH and centrifugal pumps.
*Students can get knowledge about the Mechanical separation equipment.



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SEMESTER–I

PAPER–IV: ELEMENTS IN MECHANICAL OPERATIONS (R26OF14[B])
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning objectives:-

- To learn about classification of simple vertical boiler
- To understand about Dryness fraction of steam
- To gain knowledge about Reciprocating steam engines
- To acquire knowledge about classification of IC engines
- To learn about working principle of motor

Unit-1: **12H**

Steam Boilers: Classification of simple vertical Boiler, Lancashire boiler, Cochran boiler and water tube boiler, structures and operations.

Unit-II: **12H**

Dryness fraction of steam, Measurement of dryness fraction of steam by throttling and separating Colorimeter, Latent heat, Total heat, Sensible heat and energy.

12H

Unit-III:

Reciprocating steam Engines: Classification of Reciprocating stream engines, cycle of operations and slide valves. Mechanical and Thermal efficiencies.

Unit-IV: **12H**

Internal combustion engines: Classification of IC engines. Indicator diagram for otto and Diesel engines. Mechanical and Thermal efficiencies.

Unit-V: **12H**

General working Principles of motors, generators and transformers, types of motors, working

principles, types of generators, types of transformers, working principles of generators

Reference Books:

Elements of Mechanical Engineering by Roy and Chowdary.

Learning outcomes:-

- Student can learn about classification of simple vertical boiler
- Student can understand about Dryness fraction of steam
- Student can gain knowledge about Reciprocating steam engines
- Student can acquire knowledge about classification of IC engines
- Student can learn about working principle of motor

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SEMESTER–I



PAPER–IV: MATERIAL AND ENERGY BALANCE (R26OF14[C])
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning objectives:-

✓ To get the stoichiometric and composition relations

✓ To know the ideal gas, partial pressures and it's applications

✓ To learn about humidity and saturation

✓ To learn about the material balance and bypass calculations

✓ To know about the energy and heat capacity of gases.

Unit-1: **12H**

Stoichiometric and composition relations, Gram mole, pound mole, gram atom concepts, Volume, weight percentage and mole percentages. Excess reactants, conversion and yield. Selectivity, degree of completion.

Unit-II: **12H**

Ideal gases, partial pressures, application of ideal gas laws on calculating pressure, volume and temp. Vapor pressure, Vapor pressure of immiscible liquids, Roult's Law for solutions.

Unit-III: **10H**

Humidity and Saturation: Relative and percent Saturation, dew point, wet and dry bulb temperatures, Use of humidity charts for Engineering calculations.

Unit-IV: **12H**

Material balance without chemical reaction, Recycle, purge and bypass calculations, material balance with chemical reaction.

Unit-V: **14H**

Energy, heat capacity of gases, liquids and mixture solutions, latent heats, Energy balance with and without chemical reactions. Classification of coal, Liquid and Gaseous fuels, Proximate and ultimate analysis of coal and the significance of constituents. Calorific valuoefs fuels.

Reference Books:

Chemical process principles, Part-I,Second Edition. By Hougen, Dr.Weston, Ragatz,

Learning outcomes:-

* Students are able to understand the stoichiometric and composition relations

* Students are able to understand the ideal gas, partial pressures and it's applications

* Student can able to understand the about humidity and saturation.

* Student can able to understand the material balance and bypass calculations

* Students are able to understand the about the energy, heat capacity of gases, liquids and mixture solutions.



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SEMESTER–I

PRACTICAL–I: TECHNICAL ANALYSIS OF CHEMICAL COMPOUNDS (R26OF15)
Max. Marks: 100 **(Internal-30M&External-70M)**

(Minimum Five Experiments must be carry out)

1. Percentage purity of sodium hydroxide(NaOH).
2. Percentage purity of Potassium hydroxide (KOH).
3. Percentage purity of sulfuric acid (H_2SO_4).
4. Percentage purity of hydrochloric acid(HCl)
5. Percentage purity of sodium thio sulphate($Na_2S_2O_3$).
6. Percentage purity of Sodium carbonates(Na_2CO_3).
7. Total Hardness ofWater.
8. Total Dissolved Solids of Water.
9. Determination of Acidity of Water.
10. Determination of Alkanity of Water.



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SEMESTER–I

PRACTICAL–II: PHYSICAL ANALYSIS OF OILS, FATS AND FATTY ACIDS (R26OF16)

Max. Marks: 100 **(Internal-30M&External-70M)**

(Minimum Five Experiments must be carry out)

1. Determination of Specific gravity of given oil sample
2. Determination of viscosity of given oil sample
3. Determination of refractive index of given sample
4. Determination of color forgiven oil sample
5. Determination of Titre value
6. Determination of Smoke, Flash and Fire points of given Oil Sample.
7. Determination of Melting Point
8. Determination of Moisture and Volatile matter.
9. Determination of oil content
10. Determination of ash content



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SEMESTER–I

PAPER-VII: HUMAN VALUES AND PROFESSIONAL ETHICS (R26OF17)

Max. Marks: 50(Internal)

Learning Objectives:

- ✓ To know the nature of ethics and goals.
- ✓ To know the basic moral concepts.
- ✓ To know the non-vio lance of non possession.
- ✓ To know the crime and theories of punishment.
- ✓ To know the Bhag avd Gita, Buddhism, Jainism.

Unit-I: **6H**

Definition and Nature of Ethics–Is relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics–Goals–Ethical Values in Various Professions.

Unit-II: **6H**

Nature of Values-Good and Bad, Ends and Means, Actual and Potential Values, Objective and Subjective Values, Analysis of Basic Moral Concepts-Right, Ought, Duty, Obligation, Justice, Responsibility and Freedom, Good Behavior and Respect for Elders, Character and Conduct.

Unit-III: **6H**

Individual and Society: Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non Possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues) - Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

Unit-IV: **6H**

Crime and Theories of Punishment –(a)Reformative, Retributive and Deterrent,(b)Views on Manu and Yajnavalkya.

Unit-V: **6H**

Bhagavd Gita – (a) Niskama Karma, (b) Buddhism – The Four Nobel Truths – Arya astangamarga, (c) Jainism - Mahavratas and Anuvratas. Values Embedded in Various Religions, Religious Tolerence, Gandhian Ethics.

Reference Books:

1) Johns S Mackenjie:A Manual of ethics
2) "The Ethics of Management" by Larue Tone Hosmer, Richard D.Irwin Inc.
3) Management Ethics–Integrity at work by JosephA.Petrick and John F.Quinn, Response Books, New Delhi.
4) "Ethics in Management"byS.A. Shelekar, Himalaya Publishing House.
5) Harold H.Titus: Ethics for Today
6) Maitra, S.K:Hindu Ethics
7) William Lilly: Introduction to Ethics
8) Sinha:A Manual of Ethics
9) Manu: Manav aDharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed) G.C. Haughton.
10) Sasruta Samhita: Tr.Kaviraj Kunjanlal, Kunjanlal Brishagratha, Chowkamba Sanskrit Series, Vol I,II and III, Varanasi, Vol I PP, 16-20, 21-32 and 74-77 only.
11) Charaka Samhita: Tr.Dr.RamKaran Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series Office. Varanasi I, II, III Vol I PP 183-191.
12) Ethics, Theory and Contemporary Issues. Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13) Analyzing Moral Issues, Judith A.Boss, Mayfield Publishing Company,1999.
14) An Introduction to Applied Ethics(Ed.,)John H.Piet and Ayodya Prasad, Cosmo Publications.
15) TextBook for Intermediate First Year Ethics and Human Values, Board of Intermediate Eduction – Telugu Academy, Hyderabad.
16) I.C.Sharma Ethical Philosophy of India. Nagin&Co Jul und har.

Learning Outcomes:

- ✓ Students are able to understand relation to religion&ethical values.
- ✓ Students are able to understand to character&conduct.
- ✓ Students are able to understand to crime&theories of punishment.
- ✓ Students are able to understand toG and
- ✓ hian ethics&values embedded in various religions.
- ✓ Stud etns are able to understand various individuals of society.



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SEMESTER–II

PAPER–I: REFINING OF OILS (R26OF21)

Max. Marks: 100 **(Internal-30M&External-70M)**

Learning Objectives:

To know the impurities of crude oils

To know the removal of gums from the oils.

To get knowledge about Deacidification of oils.

To get knowledge about miscella refining

To get knowledge about Bleaching of oils.

To get knowledge about the Deodorization of oils.

To know about the byproducts of oil refining industries.

UNIT-I **10H**

Impurities of Crude oils, Effect of refining due to impurities, Degumming of Oils: Mechanism of degumming, methods of degumming, super degumming, degumming processes for specific oils, recovery of Lecithin from gums. Principle and methods of dewaxing of oils, separation of waxes from oils

Unit-II: **12H**

Deacidification of oils&Fats: Deacidification by Caustic soda and So daash, Batch and continuous methods, refining losses. Effect of operating variable on chemical refining, deacidification by steam, Liquid-Liquid extraction, esterification etc., and their limitations. Miscella refining, deacidification by Zenith process. Treatment and disposal of soap stock, batch and continuous methods.

Unit-III: **14H**

Bleaching of Oils and Fats. Theory of adsorption bleaching, components responsible for oil color. Chemical and Physical characteristics of various bleaching agents. Activated carbon, bleaching earth and their manufacturing methods. Batch and continuous methods of bleaching. Effects of operating variable on quality of bleached oil, recovery of Oil from spent bleaching agents. Filtration techniques for removal of spent bleaching agents from bleached Oils.

Unit-IV: **12H**

Deodorization of Oils: Principal components responsible for odor and flavor, their properties, Principle of deodorization, Deodorization types, vertical deodorizer, Horizontal deodorizer, batch and continuous processes, effect of operating variables, deodorization losses, design of commercial deodorizer, thin film deodorization,

Unit-V: **12H**

Physical refining of oils, steps involved in the physical refining, advantages and disadvantages, Miscella refining, merits and demerits, operating variable of different refining processes, energy conservation in oil refining, By-products and their utilization-Gums, Waxes, spent soap stock, spent earth, deodorization distillates, fortification of micro nutrients, vitamins and stabilizing agents.

Reference Books:

1. Bailey's Oil and Fat Products. Volume II(4th Edition)
2. Bailey's Oil and Fat Products. Volume IV (5th Edition)
3. Treatise Volume-I byO.P.Narulla
4. Chemistry and Technology of oils and fats byM.M.Chakrabarthy.

Learning Outcomes:

Student can understand the impurities of crude oils

Student can understand the recovery of lecithin.

Student can understand the Deacidification of oils&fats

Student can understand the liquid extraction method.

Student can know the Bleaching process

Student can have knowledge about all the refining processes.

Student can have knowledge about the byproduct's utilization



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SEMESTER–II

PAPER–II: OLEOCHEMICALS AND SURFACTANTS (R26OF22)
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning objectives:

- To understand the theory of fat splitting and application of fatty acids
- To learn about pretreatment of sweet water and spent soap lye
- Toget knowledge about the manufacture of oil derivatives
- To acquire knowledge about surfactants and applications
- To learn about synthesis of different surfactants

Unit-I: **12H**

Theory of fat splitting. Fat Splitting curves-Methods of Fat Splitting, Enzymatic fat splitting, Twitchell's fat splitting, Pressure fat splitting-Single tower, Multi tower fat splitting, Distillation and Fractionation of Fatty Acids-Application of fatty acids in Pharmaceuticals, textile, plastic, food, leather, soaps, surfactants and cosmetics industries.

Unit-II: **12H**

Glycerin: Pretreatment of sweetwater and spent soap lye-continuous glycerin liquor pretreatment plant-continuous glycerin evaporation plant- continuous glycerin refining plant-Synthetic Glycerin-Grades of glycerin-properties and utilization of glycerin.

Unit-III: **12H**

Manufacture of Methyl esters, Fatty Alcohols, Fatty amines, Fatty Nitriles, Castor oil derivatives, Sebasic acid-Trihydroxy Stearic acid-Turkey red oil, perfumery-chemicals, Hydrogenated Castor oil, Polyurethane foams.

Unit-IV: **12H**

Fat based surface-active Agents: Introduction, Chemical structure of surfactants, theory of surface action, solubility, properties of surfactants, Hydrophilic Lipophilic Balance (HLB), Types of surfactants and applications of surfactants.

Unit-V: **12H**

Synthesis of Surfactants: Raw materials: Oleochemical and petrochemical raw materials-contrast or supplement, Chemistry and Technology involved in the synthesis of anionic, cationic, nonionic and amphoteric surfactants, Analysis of surfactants, Bio degradation of surfactants.

Reference Books:

1. Bailey's Industrial Oil and fat products Volume III and V(5th edition)

2. Bailey's Industrial Oil and fat product Volume I(4th edition)

3. Surfactants in consumer products Theory, Technology and application by J.Falbe.

4. Treatise Volume-I and III byO.P.Narulla

Learning outcomes:-

- Student can understand the theory of fat splitting.
- Student can learn about glycerin recovery.
- Student can have a knowledge about manufacture of oleochemical derivatives
- Student can have a knowledge about surfactants and applications
- Student can have a knowledge about synthesis of surfactants.



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SEMESTER–II

PAPER–III: RESEARCH METHODOLOGY, ETHICS & SCIENTIFIC WRITING

(R26OF23)

Max. Marks: 100 **(Internal-30M&External-70M)**

Course Objectives
After completing this course, the student will be able to:

- Understand the principles and methodologies of scientific research.
- Develop skills in literature search using scientific databases.
- Learn scientific writing for research papers, dissertations, and technical reports.
- Understand research ethics, plagiarism, intellectual property rights, and publication ethics.
- Apply statistical and digital tools for research planning, data analysis, and reference management.

UNIT–I: Research Methodology **(12 Hours)**

Introduction to Scientific Research: Meaning, objectives, significance, and characteristics of scientific research; Basic, applied, and interdisciplinary research; Qualitative and quantitative research; Fundamental, exploratory, descriptive, analytical, and experimental research.

Scientific Method: Observation, hypothesis, experimentation, data collection, analysis, and conclusion; Identification and formulation of research problems; Selection of research topics in chemistry.

Research Design: Components of research design; Independent, dependent, and controlled variables; Sampling methods and experimental planning; Laboratory notebooks and proper maintenance of research records.

UNIT–II: Literature Survey and Information Retrieval **(12 Hours)**

Scientific Information Sources: Primary, secondary, and tertiary literature; Research journals, review articles, books, patents, conference proceedings, and technical reports.

Literature Search Tools: Google Scholar, Scopus, Web of Science, SciFinder, Reaxys, PubChem, ChemSpider.

Literature Review Techniques: Keyword selection and Boolean operators; Citation searching; Evaluating journal quality; Impact Factor, CiteScore, h-index, and i10-index, Identifying research gaps and preparing a literature review.

UNIT–III: Scientific Writing and Communication **(12 Hours)**

Research Paper Writing

Structure of a research article: Title, Abstract, Keywords, Introduction, Experimental Section, Results and Discussion, Conclusion, References

Technical Writing: Thesis and dissertation writing, Laboratory reports, Project reports, Standard chemical nomenclature, Units, symbols, and abbreviations.

Scientific Communication: Poster preparation, Oral presentation techniques, PowerPoint presentation design, Writing cover letters for journal submission, Responding to reviewers' comments.

UNIT–IV: Research Ethics, Publication Ethics and Intellectual Property Rights **(12 Hours)**

Research Ethics: UGC guidelines on research ethics, Responsible conduct of research, Data integrity and reproducibility.

Publication Ethics: Authorship criteria, Acknowledgements, Conflict of interest, Duplicate publication, Predatory journals, Peer-review process.

Plagiarism: Types of plagiarism, Similarity index, Plagiarism detection software (Turnitin, Ouriginal), Avoiding

plagiarism through proper citation.

Intellectual Property Rights: Copyright, Patent fundamentals, Patentability criteria, Indian Patent Act (overview), Technology transfer and commercialization.

UNIT–V: Data Analysis, Statistics and Digital Research Tools (12 Hours)

Statistical Methods: Accuracy and precision, Significant figures, Mean, median, and mode, Standard deviation, Relative standard deviation, Error analysis (absolute and relative error).

Graphical Representation: Tables and charts, Scatter plots, Calibration curves, Trendline interpretation.

Reference Management: Mendeley, Zotero, Citation styles (ACS, APA, Vancouver).

Digital and AI Tools for Research: AI-assisted literature search, AI-assisted scientific writing (ethical use), ChemDraw basics, Chemical structure databases, Best practices for responsible AI use in research.

Course Outcomes

Upon successful completion of the course, the student will be able to:

- Explain research methodologies and scientific approaches used in chemical research.
- Apply literature search techniques using scientific databases to identify research gaps.
- Prepare research papers, technical reports, dissertations, and scientific presentations.
- Analyze issues related to research ethics, plagiarism, publication ethics, and intellectual property rights.
- Apply statistical methods, reference management software, and digital tools for research planning and data analysis.

Recommended Books

1. C.R. Kothari – Research Methodology
2. UGC Research Ethics Manual
3. Day & Gastel – Scientific Writing



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SEMESTER–II

PAPER–IV: PRINCIPLES OF HEAT AND MASS TRANSFER (R26OF24[A])
Max. Marks: 100 **(Internal-30M&External-70M)**

Learning Objectives:

* To learn the principles of Fourier's I Law and thermal conductivity.
* To get knowledge about the industrial heat exchangers.
* To acquire knowledge about Diffusion and Vapour liquid Equilibrium.
* To learn about Principals of heat flowin fluids.
* To get knowledge about Equipment for gas liquid operations.

Unit-1: **10H**

Heat transfer by conduction in solids. Fourier's Law, Thermal conductivity, steady and unsteady state conduction, charts, Heat transfer in pipes, heat transfer in tanks, heat transfer in solid surfaces.

Unit-II: **12H**

Principles of Heat Flow in Fluids: Heat transfer by convection, Heat transfer by radiation, Examples for convection and radiation, Energy balances, individual and overall heat transfer coefficients, Logarithmic mean temperature difference.

Unit-III: **14H**

Industrial heat Exchange equipment: Double pipe heat exchangers hell and tube, Heat exchanger, Plate type heat exchanger, extended surface Heat exchanger, scraped surface heat exchanger, spiral plate heat exchanger, steam heated tubular evaporators, jacketed vessels.

Unit-IV: **12H**

Diffusion, Ficks first law of diffusion, Vapor liquid Equilibrium, relative volatility, the boiling point Diagram, Distillation, Flash, differential and steam distillation. Continuous distillation with rectifications, overall material balances for two components system.

Unit-V: **12H**

Equipment for Gas liquid operations: Gas dispersed, sparged vessels, mechanically agitated vessels. Tray tower, their general characteristics, Tray efficiency. Liquid dispersed Venturi scrubbers, Wetted Wall towers, Spray towers, packed towers, types of packings.

Reference Books:

1. Unit operations in Chemical Engineering by McCabe and Smith McGraw Hill.
2. Introduction to Chemical Engineering by Badger and Banchero.

LEARNING OUTCOMES

* Students can get knowledge about the industrial heat exchangers.
* Students able to acquire knowledge about Diffusion and Vapour liquid Equilibrium.
* Students able to learn about Principles of heat flowin fluids.
* Students able to get knowledge about equipment for gas liquid operations.
* Students able to learn the principle of Fourier 'Law and thermal conductivity.



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SEMESTER–II

PAPER–IV: INDUSTRIAL PROCESSES OF SPECIALITY FATS (R26OF24(B))
Max. Marks: 100 (Internal-30M&External-70M)

Learning Objectives:

* To learn about the Hydrogenation of Oils and its importance.

* To know the Fractionation process.

* To get knowledge about the esterification and transesterification processes.

* To get knowledge about the Interesterification process.

* To acquire knowledge about the Blending process.

UNIT-Il: 14H

Hydrogenation of Oils and Fats, theory and importance of hydrogenation of Oils, reaction kinetics, operating variables and their effect on rate of hydrogenation. Selectivity and isomerization. Catalysts used in hydrogenation of Oils, theory of catalyst structure, Preparation of Nickel catalyst, reclamation and regeneration of Catalyst from spent catalyst. Manufacture of Hydrogen, Commercial plants and processes employed for hydrogenation of oils, design of reactors.

UNIT-II: 10H

Fractionation, introduction, fractionation techniques Bernardini(CMB),DeSmet, Fast dry process, solvent fractionation of fats, winterization, deoiling and fractionation of phospholipids by solvent, supercritical extraction, liquid liquid extraction.

Unit III: 12H

Esterification: Introduction, Mechanism, esterification techniques, application of esterified products, Transesterification- Mechanism, transesterification processes, transesterified products, application of transesterified products, characteristics of the esterified and transesterified products, catalysts used in transesterification process, choice of catalyst, recovery of catalyst.

Unit IV: **14H**

Interesterification: Introduction, ester -ester interchange, mechanisms, triglyceride-mono ester interchange, analytical methodologies, application of interesterified products, stability and frying, characteristics of interesterified fats, interesterification process, acidolysis, alcoholysis of polyesters with monohydric alcohols, alcoholysis of polyesters with polyhydric alcohols.

Unit-V: **10H**

Blending: Blending of fats and fat fractions, margarine manufacture, shortenings cake and pastry shortenings, general purpose shortenings, puff pastry shortenings, creaming shortenings, pour able shortenings, dry shortenings, spreads, confectionary fats, specialty fats.

Reference Books:

2. Chemistry&Technology of Oils &Fats byM.M.Chakrabarty

3. Treatise Volume I byO.P.Narulla

4. Baileys Industrial oil and fat products Volume-1,6th Edition

Learning outcomes:

* Student can able to understand Hydrogenation of Oils and its importance.

* Student can able to understand the Fractionation process.

* Student can able to understand the esterification and transesterification routes.

* Student can have a knowledge about the Interesterification process and their products

* Student can able to understand the Blending process.



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SEMESTER–II

PAPER–IV: CHEMICAL THERMODYNAMICS (R26OF24[C])
Max. Marks: 100 (Internal-30M&External-70M)

Learning Objectives:

* To learn the basic concepts of about work, energy, equilibrium, head and phase rule.

* To get knowledge about the laws of Thermodynamics.

* To get knowledge on ideal Gas laws.

*To learn about the Carnot cycle.

* To get knowledge on effect of temperature on equilibrium constant and evaluation of equilibrium constant.

Unit-I: 10H

Basic concepts of about work, energy, Equilibrium, Head, Phase rule. Thermodynamic state and state functions. Thermodynamic properties, thermodynamic equilibrium and Equilibrium state. Zeroth Law of Thermodynamics processes. Maxwell equations.

Unit-II: 12H

First law of Thermodynamics for closed systems, First law of Thermodynamics for cyclic processes, First law of Thermodynamics for an open system, conservation of mass for an open system, steady state flow process.

Unit-III: 12H

The ideal Gas law, constant volume process, constant pressure process, constant temperature process, adiabatic process, polytrophic processes, PVT relation of fluids, PVT behavior of pure substances, equation of state for gases, principle of corresponding states.

Unit-IV: 12H

Statement of Second law of Thermodynamics, Second Law of Thermodynamics for closed and open systems, Heat engine and heat pump. Efficiency of Heat engines. Carnot cycle and deviations

from it.Carnot refrigerator, liquefaction processes. Entropy and quality of energy, entropy change of a work and heat reservoir, Mathematical statement of Second law.

Unit-V: **14H**

Heat capacities of Gases, specific heats of liquids and solids. Internal energy, enthalpy, Joule Thomson coefficient, Clausius, Cla peyron equation. Chemical potential, ideals solutions, fugacity and fugacity coefficient. Excess Gibbs free energy, activity and activity coefficient, VLE, Chemical equilibria, standard Gibbs energy change, equilibrium constant. Effect of temperature on equilibrium constant. Evaluation of equilibrium constant.

Reference Books:

Introduction to Chemical Engineering thermodynamics by J.M.Smith and H.G.vanNess. Chemical

Engineering Thermodynamics by Y.V.C. Rao.

Learning Outcomes:

* Student can able to understand the basic concepts of about work and energy.
* Students can able to understand about the laws of Thermodynamics.
* Student can able to understand Gas laws.
* Student can able to understand the Carnot cycle and deviations.
* Students can able to understand the effect of temperature on equilibrium.



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SEMESTER–II

PRACTICAL–I: UNIT OPERATIONS LAB (R26OF25)
Max. Marks: 100 **(Internal-30M&External-70M)**

(Minimum Five Experiments must be carry out)

1. To verify the law of steam distillation.
2. To verify the Rayleigh's equation for differential distillation.
3. Size reduction by using Jaw crusher.
4. [redacted]
5. Determine the co-efficient of Discharge of Rotameter
6. Determine the co-efficient of Discharge of Venturimeter.
7. Determine the co-efficient of Discharge of Orifice meter.
8. To determine the equilibrium distribution
9. To find the overall recovery of solute in a single as well as two stage cross current extraction
10. [redacted]
11. To determine the minimum thickener area required for continuous thickening



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SEMESTER–II

PRACTICAL–II: CHEMICAL ANALYSIS OF OILS, FATS& FATTY ACIDS (R26OF26)
Max. Marks: 100 **(Internal-30M&External-70M)**

(Minimum Five Experiments must be carry out)

1. Determination of acid value of given oil samples.
2. Determination of saponification value of given oil samples.
3. Determination of iodine value of given oil samples.
4. Determination of peroxide value of given oil samples.
5. Determination of ester value of given oil samples.
6. Determination of unsaponifiable matter of given oil samples.
7. Determination of Hydroxyl value of given oil sample.
8. Detection of adulteration in Oils and Fats

(a) Test for presence of Sesame Oil(Baudouin's Test)

(b) Test for presence of Groundnut Oil(Belier's Turbidity Test)

(c) Test for presence of Linseed Oil(Hexabromide Test)

(d) Test for presence of Mineral Oil (Hold's Test)

(e) Test for presence of Cottonseed Oil(Halpern's Test)

(f) Test for presence of Rancidity(Kries Test)



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SEMESTER–II

Paper-VII: MOOCS (R26OF27)

Max. Marks: 50M

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1) The students can choose a course from Swayam or Swayam plus platform using the below links with not less than 4 weeks course

https://swayam.gov.in/

(or)

https://swayam-plus.swayam2.ac.in/

Note: Finally, the student has to submit the certificate to the University through respective College Principal.