ANDHRAKESARI 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 2023-2024 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	R23OF11	Chemistry and Composition of Oils and Fats	4	4	30	70	100
		R23 OF 12	Extraction Techniques of Oil bearing Materials	4	4	30	70	100
	Compulsory	R23 OF 13	Quality Control of Oil and Allied Products	4	4	30	70	100
	Elective Foundation	R23 OF 14A	Fluid Mechanics and Mechanical Operations	4	4	30	70	100
		R23 OF 14B	Basic Unit operations in Oil Industry					
		R23 OF 14C	Material and Energy Balance					
	Core Practical-I	R23 OF 15	Technical Analysis of Chemical Compounds	4	6	30	70	100
	Core Practical –II	R23 OF 16	Physical Analysis of Oils, Fats and Fatty Acids	4	6	30	70	100
	Audit Course	*R23 OF 17*	*Human Values and Professional Ethics*	*2*	*2*	*50*	--	--
	Sub-Total			**24**				**600**
SEMESTER – II	Mandatory Core	R23 OF 21	Refining of Oils	4	4	30	70	100
		R23 OF 22	Technology of Speciality Fats	4	4	30	70	100
	Compulsory	R23 OF 23	Oleochemicals and Surfactants	4	4	30	70	100
	Elective Foundation	R23 OF 24A	Principles of Heat and Mass Transfer	4	4	30	70	100
		R23 OF 24B	Elements of Mechanical Technology					
		R23 OF 24C	Chemical Thermodynamics					
	Core Practical-I	R23 OF 25	Unit Operations Lab	4	6	30	70	100
	Core Practical –II	R23 OF 26	Chemical Analysis of Oils, Fats and Fattyacids Lab	4	6	30	70	100
	Skill Development	*R23 OF 27*	*MOOCS Online*	*2*	*2*	*50*	--	--
	Sub-Total			**24**				**600**
SEMESTER – III	Mandatory Core	R23 OF 31	Technology of Soaps and Detergents	4	4	30	70	100
		R23 OF 32	Technology of Essential Oils	4	4	30	70	100
	Core Elective-I	R23 OF 33A	Environmental aspects of Oils and Allied Industries	4	4	30	70	100
		R23 OF 33B	Material Technology					
		R23 OF 33C	Biochemistry of fats and Other Lipids					
	Open Elective-II	R23 OF 34A	Energy Management for Edible oil Refinery	4	4	30	70	100
		R23 OF 34B	Mass transfer Opertions					
		R23 OF 34C	Applied Mechanics					
	Core Practical-I	R23 OF 35	Soaps and Detergents Lab	4	6	30	70	100
	Core Practical –II	R23 OF 36	Processing of Oils, Fats and Fat based Products Lab	4	6	30	70	100
		R23 OF 47	Seminar	4	--	100	----	100
	Skill Enhancement	*R23 OF 27*	*MOOCS Online*	*2*	*2*	*50*	--	--
	Sub-Total			**28**				**700**
SEMESTER – IV	Mandatory Core	R23 OF 41	Technology of Cosmetics	4	4	30	70	100
		R23 OF 42	Packaging of Oils, Fats and Allied Products	4	4	30	70	100
	Core Elective-I	R23 OF 43A	Technology of Petroleum Products	4	4	30	70	100
		R23 OF 43B	Strength of Materials					
		R23 OF 43C	Organic Synthesis Process					
	Open Elective-II	R23 OF 44A	Chemical Process Economics and Industrial Management	4	4	30	70	100
		R23 OF 44B	Biotechnology of oils and fats					
		R23 OF 44C	Industrial Instrumentation					
	Core Practical-I	R23 OF 45	Cosmetic Formulations Lab	4	6	30	70	100
	Core Practical-II	R23 OF 46	Project Work	4	6	--	100	100
	Sub-Total			**24**				**600**
	Grand Total			**100**				**2500**

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SYLLABUS FOR M.Sc. OILS, FATS & PETRO PRODUCTS
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SEMESTER–I

PAPER–I: CHEMISTRY AND COMPOSITION OF OILS AND FATS (R23OF11)

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-I: **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 (4th 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 (R23OF12)
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 Oil seeds, 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 Oil seeds 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 by K.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 (R23OF13)
Max. Marks: 100 (Internal-30M & External-70M)

Learning Objectives:

- To know the elementary methods of analysis of oil seeds, 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 by L.V Cocks
2. Laboratory Hand book for chromatographic methods by O.Milkes.
3. Treatise on Fats, Fatty Acids, Oleo chemicals by O.P.Narula.
4. Instrumentation by D.P Eckmen.
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 canknow 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 (R23OF14[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.
- To get 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-I: **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, orifice meter, venturi meter, 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.

UNIT-V: **12H**

Description of Mechanical separation equipment: Gyratory screens, vibrating screens, 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 International 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: BASIC UNIT OPERATIONS IN OIL INDUSTRY (R23OF14[B])
Max. Marks: 100 (Internal-30M & External-70M)

Learning Objectives:

- To learn about different liquid extraction techniques
- To understand about different methods of leaching
- To gain knowledge about Adsorption - theory
- To acquire knowledge about Drying
- To know about different crystallization methods

UNIT- I **14H**

Liquid Extraction-Extraction equipment, mixer-settler spray and packed extraction towers, perforated plate towers, baffle towers, agitated tower extractors, principles of extraction, equilibria and phase compositions, system of three liquids one pair partially soluble, two pairs partially soluble, choice of solvent, flow sheets for single stage extraction, cross current and multi stage extractions.

UNIT-II **12H**

Leaching- leaching, lixiviation, decoction, elutriation, leaching equipment, leaching by percolation through stationary solid beds, moving bed leaching, dispersed solid leaching, Bollman extractor, Hildebrand extractor, rotocel extractor, Kennedy extractor, principles of counter current leaching, constant and variable under flow, material balance for constant under flow

UNIT- III **10H**

Adsorption-Theory and types of adsorption, industrial adsorbents, adsorption equilibria, adsorption hysteresis, differential heat of adsorption, adsorption of solute from dilute solution, fecundities equation, single stage and multi stage adsorption processes

UNIT- IV **12H**

Drying equilibria- drying rate curve, batch and continuous drying, direct and indirect dryers, rate of batch drying, time of drying, the mechanism of batch drying, continuous drying, equipment like tunnel dryers, turbo type dryers, through circulation dryers and rotary dryers.

UNIT- V **12H**

Crystallization – magma, crystal size distribution, crystal geometry, crystallographic system invariant crystals, crystal size and shape factors, principles of crystallization, purity, equilibrium and yields, crystallization equipment, vacuum crystallization, continuous crystallizer, draft tube crystallizer.

Reference Books :

1. Unit operations in chemical engineering by Mcabe Smith

Learning outcomes: -

- Student can Learn about different extraction technique of extraction
- Student can Understand about different methods of leaching - leaching
- Student can gain knowledge about Adsorption - theory and types
- Student have knowledge about Drying equilibria- drying rate curve
- Student can Understand about different crystallization methods

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SEMESTER–I

PAPER–IV: MATERIAL AND ENERGY BALANCE (R23OF14[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 values of 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 (R23OF15)

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 thiosulphate ($Na_2 S_2O_3$).
6. Percentage purity of Sodium carbonates (Na_2CO_3).
7 Total Hardness of Water.
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 (R23OF16)

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 for given 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–II

PAPER–I: REFINING OF OILS (R23OF21)

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 Soda ash, 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 by O.P.Narulla
4. Chemistry and Technology of oils and fats by M.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: TECHNOLOGY OF SPECIALITY FATS (R23OF22)
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- I: 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), De Smet, 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-monoester 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, pourable shortenings, dry shortenings, spreads, confectionary fats, specialty fats.

Reference Books:

1. Chemistry &Technology of Oils &Fats by M.M. Chakrabarty
2. Treatise Volume I by O.P. Narulla
3. 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–III: OLEOCHEMICALS AND SURFACTANTS (R23OF23)
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
- To get 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 sweet water 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-Tri hydroxy 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: Oleo chemical 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 by O.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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DEPARTMENT OF OILS, FATS & PETRO PRODUCTS
SYLLABUS FOR M.Sc. OILS, FATS & PETRO PRODUCTS
(*For the students admitted from the academic year 2023-2024 onwards)*
SEMESTER–II

PAPER–IV: PRINCIPLES OF HEAT AND MASS TRANSFER (R23OF24[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 flow in fluids.
- To get knowledge about Equipment for gas liquid operations.

UNIT-I: **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 exchanger shell 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 flow in 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: ELEMENTS OF MECHANICAL TECHNOLOGY (R23OF24[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-I: 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:

1. 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–II

PAPER–IV: CHEMICAL THERMODYNAMICS (R23OF24[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, Clapeyron 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:

1. Introduction to Chemical Engineering thermodynamics by J.M. Smith and H.G. van Ness.
2. 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 (R23OF25)

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. To determine the optimum time of sieving for a given sample.
5. Determine the co-efficient of Discharge of Rota meter
6. Determine the co-efficient of Discharge of Venturi meter.
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. To separate a mixture of coal into two fractions using sink and float method.
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 (R23OF26)

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 Cotton seed Oil (Halpern's Test)

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

Industrial Training

Students are allotted to work as trainee in different oil and allied industries of the field for a period of 6 weeks

The basic objectives are as follows:

- To aware with the industrial environment, movement of raw materials finished products, human behavior, industrial relation, manpower management & efficient management of the manpower.
- To have a proper knowledge of the manufacturing process of different products, their quality control procedure, utilities and various techniques of quality control in terms of raw material, in process parameters and finished products as per norms of BIS, FSSAI and other statutory bodies.
- To gain knowledge of water treatment, effluent treatment and air pollution control devices. Proper analysis of fuel and other utilities.
- Students are allotted to work on project assign in those particular industries for controlling the losses, utilities consumption & other inputs for reducing cost of production.
- To understand proper maintenance of the equipment in the plants, i. e. regular, preventive and other schedule maintenance.
- To understand the stores activities of procurement, storage & issue of spare-parts, packaging materials and various consumables & raw materials.
- The students must understand the costing of various inputs on different section basis so as to have knowledge of total cost of production.
- To understand the R&D activities being carried out by the industries or intent to carry by the company & share their knowledge.

Seminar- Every student will be required to make a presentation on internship.

Outcomes: -

- This training provides a basic back bone for students for future industrial working environment.
- Gain a proper knowledge of the manufacturing process of different products, their quality control procedures, utilities and various techniques of quality control in terms of raw material, in process parameters and finished products as per norms of BIS, FSSAI and other statutory bodies.
- Students after training can gain knowledge for appearing in campus placement activities.
- Presentation enhances communication skills of the student.

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-I: CHEMISTRY AND COMPOSITION OF OILS AND FATS - R23OF11

Time:3 Hours **Maximum Marks: 70**

SECTION-A 5X4=20 Marks

(Answer any five questions, each question carries 4 marks)

1.Write the nomenclature and structures of the following fatty acids.

(i) Arachidic acid

(ii)Behenic acid

(iii)Linolenic acid

2.Give an account on structures and composition of some fats.

3.Give a short note on non – triglyceride constituents.

4. Give a short account on vitamins and their uses

5.Write short notes on Sunflower oil

6.What are the steps involved in the processing of animal fats and oils.

7.Explain the viscosity of oils and fats.

8. Write short notes on the following;

(i) Flash point

(ii) Fire point.

9.Give a short note on hydrogenation of oils and its applications

10. Explain the chemistry of esterification of oils and its applications

SECTION –B

(Answer all question each question carries 10 marks)

11.(a) Describe the constituents of Natural oils and fats with examples.

(Or)

(b). Give a neat classification of oil and fats with suitable examples

12.(a). Write a short note on the following:

(i) Vitamins

(ii) Waxes

(iii) Anti - oxidants

(Or)

(b). Discuss about the presence of sterols and phospholipids in oils and fasts

13.(a) Write down the characteristics and compositions of Soyabean and Ground nut oil

(Or)

(b). Discuss the characteristics and composition of coconut and cotton seed oil.

14.(a). Write down the following

(i). Surface tension

(ii). Refraction

(iii). Thermal properties

(Or)

(b). Write short note on the following:

(i). Adsorption spectra

(ii). Dielectric constant

(iii). Viscosity

15. (a) Explain the chemical reactions and process involved in hydrogenation of oils and fats

(Or)

(b). Describe polymerization, dehydration, pyrolysis and auto-oxidation of fats and oils.

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-II: Extraction Techniques of Oil bearing Materials - R23OF12

Time:3 Hours **Maximum Marks: 70**

SECTION-A 5X4-20 Marks

(Answer any five questions, each question carries 4 marks)

1. What is the necessary of pretreatment of oil seeds?

2. Explain the grinding and evaluation of OBM.

3. Write about the grading methods in oils.

4. Explain preparation of soya flakes.

5. Explain the counter current solvent extraction process.

6. Discuss "low and high oil-bearing materials".

7. Explain briefly about the solvent recovery system.

8. Explain the solvent losses and utilities requirements.

9. What are the different methods of reading?

10.write short notes rendering of animals' fats.

SECTION-B

(Answer all questions each question carries 10 marks)**5X10-50 Marks**

11.(a) Explain different types of conveyors and elevators and feed cleaning machines with neat sketches.

(OR)

(b) Explain the cooking oil seed and their effect on oil yield and quality.

12.(a) Explain the hydraulic pressure and screw pressure with neat sketches.

(OR)

(b) Discuss the working of filter presses and centrifuges in oil recovery.

13 (a) How do you select a solvent for extraction of oil from seeds? Discuss the availability, advantages and limitations.

(OR)

(b) Discuss different batch extraction equipment for the extraction of oil from oil seeds.

14.(a) Discuss the effect of various operating parameters on the quality of oil and meal after desolventization of miscella.

(OR)

(b) Discuss the equipment and plants employed for desolventization of meals.

15.(a) write notes on

(1) Spoilage during storage of oils

(2) Production of fish oils.

(OR)

(b) write long notes on production of tallow, lard and fish liver oils.

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-III: QUALITY CONTROL OF OIL AND ALLIED PRODUCTS - R23OF13

Time:3 Hours **Maximum Marks: 70**

SECTION- A 5X4-20 Marks

(Answer any five questions, each question carries 4 Marks)

1. Discuss the elementary methods of analysis of oil seeds
2. Write short note on the evolution of stability of oils
3. Discuss the urea addict.
4. How does urea addict process help to assess oils and fats?
5. Explain the TLC technique?
6. Write a note on chromatography
7. Write few applications of IR spectroscopy with analysis of oils and fats
8. Write the principle of NMR spectroscopy
9. With short note on wet bulb temperature
10. What is the dilatometric measurements and what is its significance

SECTION –B 5X10=50 Marks

(Answer all question each question carries 10 marks)

11.(a). Explains the methods of detection of adulteration oils and fats.

(Or)

(b). Discuss the BIS and AG mark specification of oils and fats.

12.(a). What is counter current distribution? By using this technique how the fatty acids are Separated

(b). Write a brief note on separation of fatty acids

(i). Low temperature crystallization

(ii). Esterification

13.(a). Explain chromatographic methods for the separation of oils and fats.

(Or)

(b). Discuss on TLC with principle and applications in organic chemistry

14.(a). What is NMR shift? Explain principle, instrumentation of NMR spectroscopy

(Or)

(b). Explain the principle of instrumentation and application of UV spectroscopy

15. (a) With various methods of determining humidity in oils and how the humidity effects oils and fats

(Or)

(b) Any two quality control methods for oils and fats

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-IV: FLUID MECHANICS AND MECHANICAL OPERATIONS - R23OF14(A)

Time:3 Hours **Maximum Marks: 70**

SECTION- A 5X4-20 Marks

(Answer any five questions, each question carries 4 marks)

1. Explain about the Laminar flow.

2.Write about the shear rate, and shear stress.

3. Derive the Bernoulli equation.

4.What is friction?

5. Difference between the gate valve and globe valve.

6. Explain the characteristic of centrifugal pump?

7. What is the objective of agitation?

8. Describe in detail about the mixers used for cohesive solids.

9. What is the effectiveness of a screen?

10. Define Work index.

SECTION – B 5X10=50 Marks

(Answer all question each question carries 10 marks)

11. (a). Explain the Newtonian fluids and non-Newtonian fluids.

(or)

(b). Explain about the different types of manometers.

12. (a) Derive Bernoulli's equation alone with limitations limitations and pump work.

(or)

(b). What is Hagen-Poiseuille equation?

13.(a). Explain about the working of a centrifugal pump.

(or)

(b). Explain NPSH and Cavitation.

14.(a). Explain how various size reduction machines are classified.

(Or)

(b) . Explain the flow patterns in agitated vessels

15.(a).Whar are the various mechanisms of filtration.

(or)

(b). What is the use of the screens? What are the various types of screens?

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-IV: BASIC UNIT OPERATIONS IN OIL INDUSTRY - R23OF14(B)

Time:3 Hours **Maximum Marks: 70**

SECTION-A 5X4-20 Marks

(Answer any five questions, each question carries 4 marks)

1.Define the agitated tower extractors.

2. Explain the principles of extractions.

3.write about the moving bed leaching process.

4.Brief explain the Hildebrand extractor process.

5.Explain the adsorption equilibria process.

6. Define the single stage adsorption processes.

7.Explain about continuous drying process.

8.Breif about the time of drying

9.Explain the crystal geometry.

10.Define the vacuum crystallization process.

SECTION-B 5X10=50 Marks

(Answer all questions each question carries 10 marks)

11.(a) write a brief note on liquid Liquid Extraction-Extraction equipment.

(OR)

(b) Explain cross current and multi stage extractions.

12.(a) What is Leaching- leaching process.

(OR)

(b) Explain the material balance for constant under flow.

13. (a).To explain Adsorption-Theory and types of adsorption.

(OR)

(b) . Write about single stage and multi stage adsorption processes.

14. (a) Explain the different methods of drying process.

(OR)

(b) write about the mechanism of batch drying.

15.(a) Brief about the crystallographic system invariant crystals.

(OR)

b) Explain the equilibrium and yields.

MODEL PAPER

ANDHRA KESARI UNIVERSITY

M.Sc. Oils, Fats & Petro Products Examination

Semester-I

Paper-IV: MATERIAL AND ENERGY BALANCE - R23OF14(C)

Time:3 Hours **Maximum Marks: 70**

SECTION-A 5X4=20 Marks

(Answer any five questions, each question carries 4 marks)

1. Write about Dalton's law and Amagat's law.

2. Define heat capacity.

3. What is Dew point.

4. Differentiate between recycle and purge.

5. Write about Density and specific gravity.

6. What is Limiting reactant.

7. Write about theoretical flame temperature.

8. What are the Laws of Thermo Chemistry.

9. What is the Degree of Completion

10. Write about Gram mole and Pound mole.

SECTION-B 5X10=50 Marks

Answer all questions each question carries 10 marks

11. (a) Explain briefly about

(1) Excess Reactants.

(2) Degree of completion.

(3) Density and specific gravity.

(Or)

(b) An aqueous solution K:CO, contain 25% salt and the specific gravity of the solution is 1.53. Determine the following

(1)The mole percent of the salt in the solution

(2) The molarity of the solution

(3) The molality of the solution

(4) The normality of the solution

12. (a) Explain in detail about various types of soaps and cleaning preparations.

(Or)

(b) A natural gas has the following composition by volume C*H_{4} = 83.5% C. H_{K} = 12.5% and N_{2} = 4%

Calculate the following:

(1) Composition in mole %

(2) Composition in weight%

(3) Average molecular weight

(4) Density at standard condition in kg / (m ^ 3)

13. (a) Define the following terms

Humidity, Saturated gas, Relative humidity and Percentage humidity.

(Or)

(b) A mixture of acetone vapor and nitrogen contains 14.8% acetone by volume. Calculate the relative saturation and percentage saturation of the mixture at a temperature of 20°C and the pressure of 745 mm Hg. Vapor pressure of acetone at 20°C is 184.8 mmHg.

14. (a) Determine the flue gas analysis and air fuel ratio by weight when a medium Fuel oil with 84% carbon, 11.4% H2, 3.2% S, 0.4% O2 and 0.1% ash by weight is burnt with 20% excess air. Assume complete combustion.

(Or)

(b) A solution of potassium dichromate in water contains 15% by weight of K,Cr,O,. Calculate the amount of K,Cr,O, that can be produced from 1500 kg of solution of 700 kg of water is evaporated and remaining solution is cooled to 293° K (20° C) data solubility of K,Cr,O, at 20° C is 115 kg per 1000 kg of water.

15. (a) Write notes on the following:

(1) Classification of coal and calorific value.

(2) Energy balance with chemical reaction.

(Or)

(b) (i) What are the advantages of gaseous fuels over solid fuels.

(ii) What are the different types of gaseous fuels and write their composition.

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SEMESTER–II

PAPER–I: REFINING OF OILS (R23OF21)
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 Soda ash, 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 by O.P.Narulla
4. Chemistry and Technology of oils and fats by M.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: TECHNOLOGY OF SPECIALITY FATS (R23OF22)
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), De Smet, 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-monoester 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, pourable shortenings, dry shortenings, spreads, confectionary fats, specialty fats.

Reference Books:

1. Chemistry &Technology of Oils &Fats by M.M. Chakrabarty

2. Treatise Volume I by O.P. Narulla

3. 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–III: OLEOCHEMICALS AND SURFACTANTS (R23OF23)
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
- To get 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 sweet water 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-Tri hydroxy 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: Oleo chemical 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 by O.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–IV: PRINCIPLES OF HEAT AND MASS TRANSFER (R23OF24[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 flow in 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 exchanger shell 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 flow in 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: ELEMENTS OF MECHANICAL TECHNOLOGY (R23OF24[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–II

PAPER–IV: CHEMICAL THERMODYNAMICS (R23OF24[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, Clapeyron 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. van Ness.

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 (R23OF25)

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. To determine the optimum time of sieving for a given sample.
5. Determine the co-efficient of Discharge of Rota meter
6. Determine the co-efficient of Discharge of Venturi meter.
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. To separate a mixture of coal into two fractions using sink and float method.
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 (R23OF26)

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 Cotton seed Oil (Halpern's Test)

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

Industrial Training

Students are allotted to work as trainee in different oil and allied industries of the field for a period of 6 weeks

The basic objectives are as follows:

To aware with the industrial environment, movement of raw materials finished products, human behavior, industrial relation, manpower management & efficient management of the manpower.

To have a proper knowledge of the manufacturing process of different products, their quality control procedure, utilities and various techniques of quality control in terms of raw material, in process parameters and finished products as per norms of BIS, FSSAI and other statutory bodies.

To gain knowledge of water treatment, effluent treatment and air pollution control devices. Proper analysis of fuel and other utilities.

Students are allotted to work on project assign in those particular industries for controlling the losses, utilities consumption & other inputs for reducing cost of production.

To understand proper maintenance of the equipment in the plants, i. e. regular, preventive and other schedule maintenance.

To understand the stores activities of procurement, storage & issue of spare-parts, packaging materials and various consumables & raw materials.

The students must understand the costing of various inputs on different section basis so as to have knowledge of total cost of production.

To understand the R&D activities being carried out by the industries or intent to carry by the company & share their knowledge.

Seminar- Every student will be required to make a presentation on internship.

Outcomes: -

- This training provides a basic back bone for students for future industrial working environment.
- Gain a proper knowledge of the manufacturing process of different products, their quality control procedures, utilities and various techniques of quality control in terms of raw material, in process parameters and finished products as per norms of BIS, FSSAI and other statutory bodies.
- Students after training can gain knowledge for appearing in campus placement activities.
- Presentation enhances communication skill of the student.