

**INSTITUTE OF CHEMICAL TECHNOLOGY**  
(Deemed to be University under section 3 of the UGC Act 1956)

**DEPARTMENT OF OILS, OLEOCHEMICALS & SURFACTANTS**

**Detailed Syllabus for Second Year B. Tech**

Sr. No.		Hrs
<b>1.</b>	<b>GET 1104 - Engineering Mechanics and Strength of Materials (50 marks) 3hr./week</b>	
	Concepts of forces, their types, Resolution of forces, Composition of forces, Steps in Engineering Design, Different types supports and free body diagram.	3
	Equilibrium of rigid bodies - Conditions of equilibrium. Determinant and indeterminate structures. Equilibrium of beams, trusses and frames problems on analysis of beams and truss.	3
	Concept of moment of Inertia (Second moment of area) its use. Parallel axis theorem. Problems of finding centroid and moment of Inertia of single figures, composite figures. Perpendicular axis theorem, Polar M.I., Radius of gyration.	4
	Shear Force and Bending Moment - Basic concept, S.F. and B.M. diagram for cantilever, simply supported beams (with or without overhang). Problems with concentrated and U.D. loads.	4
	Stresses and Strains - Tensile and compressive stresses, strains, modulus of elasticity, modulus of rigidity, bulk modulus. Thermal stresses and strains. Problems based on stresses and strains. Basics of Engineering Design - Steps in the engineering design, Importance of analysis, 1-D, 2-D and 3-D analysis and interpretation of results. Design philosophies.	4
	Theory of Bending - Assumptions in derivation of basic equation, Basic equation, section modulus, bending stress distribution.	3
	Problems on shear stress - Concept, Derivation of basic formula. Shear stress distribution for standard shapes. Problems of Shear stress distribution	3
	Slope and Deflection of beams - Basic concept, Slope and Deflection of cantilever and simply supported beams under standard loading. Macaulay's method.	3
	Natural Materials, Manmade materials, Materials used for coatings, anticorrosive coatings, special purpose floorings, water proofing compounds, Various polymers and epoxies used for industrial applications. Composite Materials – Types of composite materials and their uses in various industrial applications.	3
	Different types of performance enhancing and special purpose construction chemicals. Plasticizers and super-plasticizers, air entraining agents, accelerators and retarders, viscosity modifying	3

	agents, corrosion inhibitors, Recycling of waste – value addition.	
	<b>Reference Books</b>	
	<ul style="list-style-type: none"> <li>• Engineering Mechanics Vol I Statics by B. N. Thadani, Publisher Wenall Book Corporation</li> <li>• Mechanics of Materials by Ferdinand Beer and E. Russel Johnston, Tata McGraw Hill Publishing Co. Ltd.</li> <li>• Fundamentals of applied Mechanics by Dadhe, Jamdar and Walavalkar, Sarita Prakashan Pune</li> <li>• Strength of Materials by Ferdinand Singer and Andrew Pytel, Harper Colins Publishers</li> <li>• Introduction to Mechanics of Solids by Egor Popov, Prentice Hall of India Pvt. Ltd</li> <li>• Composite Materials by S. C. Sharma, Narosa Publications.</li> <li>• Mechanics of composite Materials by Autar K. Kaw, Publisher CRC Press</li> <li>• Fundamental of Fibre reinforced composite materials by A. R. Busell and J. Renard, Taylor &amp; Francis</li> <li>• Concrete Technology by A. M. Neville, Pearson Education ltd</li> <li>• Concrete Technology – Theory and Practice by M. S. Shetty, S. Chand &amp; Co.</li> <li>• Corrosion and Corrosion Protection Handbook by Philip A. Schweitzer, CRC press</li> </ul>	
2.	<b>GET 1105 – Electrical and Electronics Engineering (50 marks) 3hr./week</b>	
	Basic Laws: Kirchoff’s current and voltage law, Simple series and parallel connections, star and delta transformation. Mesh and nodal analysis, Biot- Savart’s law, Basic elements R, L and C. Concept of self and mutual inductance.	6
	Network theorems: super position, Thevenin’s theorems	2
	A.C. Fundamentals: Equations of alternating voltages and currents, cycle, frequency. Time period, amplitude, peak value average value, R.M.S. value, A.C. through resistance, inductance and capacitance, simple RL, RC and RLC circuits. Power, power factor, series and parallel circuits.	5
	Three Phase systems: Star and delta connections, relationship between line and phase voltages and currents, Power in three phase circuits and its measurement.	3
	Transformer: Introduction, principle of operation, e.m.f. equation, phasor diagrams. Ideal transformer, transformer on no load, Transformer under load, Transformer losses, efficiency, regulation.	5
	Diodes and rectifiers: P-N junction diode characteristics, Zener diode, Half wave and full wave rectifiers, their waveforms, brief introduction to filters	4

	Bi-polar junction transistor: Current components. Modes of operation, Input and output characteristics, Regions of operation, Transistor as an amplifier, classification of amplifiers	6
	Introduction to uni junction transistor, Characteristics, UJT relaxation oscillator, Silicon controlled rectifier, controlled rectification, characteristics, methods of turn-on.	5
	<p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li>• Electrical Technology by B. L. Theraja, A. K. Theraja vol I,II,IV</li> <li>• Electronic devices and circuits by Allen Mottershed</li> <li>• Electrical Machines by Nagrath, Kothari</li> <li>• Electronic devices and circuits by Boylestad, Nashelsky</li> </ul>	
<b>3</b>	<b>CHT 1341 - Physical Chemistry (100 marks) 4hr./week</b>	
	Structure - Property Relationship: Molecular interactions and bonds weaker than covalent bonds, e.g. hydrogen bond, dipole interaction, VDW forces etc., and their effects on various properties such as, refractive index, viscosity, surface tension, density, thermal conductivity, specific heat, diffusivity, melting point, boiling point, vapor pressure, heat of formation, latent heats of fusion and vaporization, non-ideal behavior in solutions, group contribution methods for estimation of these properties (including those of polymers and polymeric solution)	15
	Electrochemistry: Theories of strong and weak electrolytes, activity coefficient, electrochemical cells and electrode potentials, batteries and fuel cells	10
	Reaction dynamics and catalysis: Concept of reaction rates and extent of reaction, simple rate equations, correlation of reaction kinetics and mechanisms, theories of reaction rates, chain reactions, introduction to homogeneous and heterogeneous catalysis, concepts acid-base catalysis, kinetics of reactions on surfaces	15
	Surface and interfacial Chemistry: Concept of surface/interfacial energy and surface/ interfacial tension. Thermodynamics of surfaces Gibbs adsorption equation and isotherms. Curved surfaces- Young, Laplace, Kelvin and Thompson equations contact angle and wetting phenomena, adhesion, cohesion, surface active agents: types and applications, surfactant aggregates, emulsions and microemulsions preparation, stability and applications	20

	<p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li>Physical Chemistry, P.W. Atkins and J. D. Paula, 8<sup>th</sup> Edition, Oxford University Press.</li> <li>Physical Chemistry, K.J. Laidler and J.M. Meiser, 2<sup>nd</sup> Edition, CBS Publishers</li> <li>Physical Chemistry: A Molecular Approach, D.A. Mcquarrie and J.D. Simon</li> <li>Chemical Kinetics and Catalysis, R.J. Masel, John Wiley and Sons</li> <li>Chemical Kinetics and Reaction dynamics, Paul H. Houston, McGraw Hill</li> <li>Catalytic Chemistry, Bruce C Gates, John Wiley and Sons</li> <li>Principles of Heterogeneous Catalysis, J.M. Thomas and W.J. Thomas, John Wiley and Sons.</li> <li>Properties of Gases and Liquids Reid R.C. and Sherwood T.K.</li> </ul>	
<b>4</b>	<b>OLT 1101 Chemistry of Oils (100 marks) 4hr./week</b>	
	Introduction to Oil chemistry – whys and whats; use in everyday life. Oils: classification, Natural derivatives of fatty acids, triglycerides, waxes, phosphoglycerides, phosphatidic esters, sphingolipids.	4
	Fatty acids: Nomenclature and classification Different types of naturally occurring fatty acids. Physical properties of fatty acids and their esters, melting point and boiling point. Polymorphism and crystal structure, solubility, refractivity, optical activity, spectroscopic properties.	8
	Separation and isolation of fatty acids; Distillation, crystallization and counter current distribution. Methods of structure determination, physical methods (spectroscopic) and chemical methods.	8
	Chemical properties of fatty acids and their esters. Reduction and hydrogenation. Oxidation – chemical and autoxidation. Polymerization. Stereomutation, double bond migration and cyclization. Other olefinic reactions. Reaction of the carboxylic acid groups.	30
	Chemical methods and analysis of oils. Acid value, saponification value, hydroxyl value, peroxide value, iodine value, acetyl value, p-anisidine value, titre, halphen test, baudoin test, RM, P & K values, dilatometry, micro penetration tests.	10
	<p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li><u>Chemical constitutions of natural fats</u> by T. P. Hilditch and P.N. Williams 4<sup>th</sup> ed., Chapman and Hall (1964)</li> <li>Treatise on Analysis of Foods, Fats and Oils by A. R. Sen, N. K. Pramanik and S. K. Roy, Oil Technologists Association of India (Eastern Zone) (2001)</li> <li>Baileys industrial oil and fat products by Daniel Swern, Wiley Interscience publication (1979)</li> </ul>	

	<ul style="list-style-type: none"> <li>• Chemistry and technology of oils and fats by Prof. M. M. Chakrabarti, allied publishers (2003)</li> <li>• Official and tentative methods of American Oil Chemists Society by W. E. Link, AOCS publishing (1973)</li> <li>• Fatty Acids by Markley K. S. Vol. I to IV, Robert E. Krieger publishing Co. (1973)</li> </ul>	
<b>5</b>	<b>BST 1101 - General Microbiology (50 Marks) 3hr./week</b>	
	Introduction to microbiology and its significance in foods- pathogenic and spoilage organisms, beneficial organisms; Prokaryotes and Eukaryotes- morphology, structure and function of microbial cells and their components; mode of reproduction in microorganisms	04
	Major groups of microorganisms - bacteria, yeasts, molds and viruses; Growth curve (lag phase, log phase, stationary phase, death phase); concept of generation time; nutrient requirements and physiology of microorganisms	04
	Physical and chemical factors affecting growth and destruction of microbes –aerobic, microaerophilic, anaerobic, psychrophilic, psychrotrophic, mesophilic, thermoduric, thermophilic, halophilic, osmophilic, extremophilic, and spore formers	03
	Microscopic study of bacteria, yeasts and molds with respect to morphology, Gram character and staining techniques, Isolation, preservation and maintenance of pure cultures,	07
	Methods of sterilization, disinfection, sanitation, asepsis	02
	Composition, preparation and sterilization of microbiological media; Classification of media;	02
	Enumeration of microorganisms (TPC, Yeast and molds count, MPN, turbidometry, rapid methods etc.); clinical tests for pathogenic microorganisms commonly associated with food	03
	Introduction to genetics; mutation, mutagens and mutants and their effects, Principles of immunology	05
	<b>Reference Books:</b> <ul style="list-style-type: none"> <li>• Food Microbiology: Pelzar M J et al.</li> <li>• Textbook of Pharmaceutics :- A C Bentley</li> <li>• Microbiology Fundamentals and Applications: S S Purohit</li> <li>• Medical Microbiology Infections: Mackie &amp; McCartney</li> </ul>	
<b>6</b>	<b>BST 1103 - Biochemistry (50 Marks) 3hr./week</b>	
	Digestion and absorption of carbohydrates; metabolic pathways and energy yield for breakdown of carbohydrates – glycolysis, gluconeogenesis, citric acid cycle; pentose phosphate pathway, glycogen metabolism; electron transport chain and coupled oxidative phosphorylation	07

	Digestion and absorption of lipids Pathways for breakdown and synthesis of fatty acids and lipids; control; <i>de novo</i> synthesis of cholesterol Synthesis of steroid hormones and metabolic regulation	05
	Amino acids and proteins- structure and properties, isolation and purification. Metabolism of proteins (digestion and absorption), catabolic reactions of amino acids, urea cycle, in-born errors in metabolism	06
	Nucleic acid chemistry, synthesis and involvement in protein biosynthesis; genetic code, effects of mutations Protein biosynthesis and regulation	03
	Enzymes- definition, function, nomenclature, classification. Enzyme kinetics, enzyme inhibition and regulation. Co-enzymes; mechanism of enzyme action; specificity	09
	<b>Reference Books:</b> <ul style="list-style-type: none"> <li>• Principles of Biochemistry, Lehninger AL, Nelson DL and Cox MM, 2008, MacMillan.</li> <li>• Biochemistry, Stryer L, Berg JM and Tymoczko JL, 2002, Freeman &amp; Co.</li> <li>• Fundamentals of Biochemistry – Voet DJ and Voet JG, 1999, John Wiley &amp; Sons.</li> </ul>	
<b>7.</b>	<b>CET 1105 – Transport Phenomena (100 marks) 4hr./week</b>	
<b>8.</b>	<b>DYT 1411 - Colour Chemistry and Introduction</b>	
	<b>To be given by Dr. Sekar, Dyes Department</b>	
<b>9.</b>	<b>OLT 1102 - Chemistry of Surfactants</b>	
	Nature of surfactants, introduction to surfactants, natural surfactants, synthetic surfactants. Types of. Hydrophilic groups and hydrophobic groups. Surface activity – self association, hydrophobic effect.	4

	Adsorption at liquid interfaces; introduction, measurement of amount absorbed. Adsorption at liquid/liquid interfaces, ultra low interfacial tensions, prediction of emulsion type from packing geometry, phase inversion, micelle formation, structure of micelles, general phase behaviour of surfactants, Kraft and Cloud point, mesomorphic phases, dispersion of surfactant aggregates, vehicles/liposomes.	5
	Surfactant bilayers foams and emulsions. Soap films, film drainage, foam and foam stability, formation and stability of emulsions, de-emulsification, microemulsions, definition, use of cosurfactants, characteristics.	5
	Synthesis of various surfactants used commercially, their properties and applications. Analysis of surfactants.	16
	<p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li>• Handbook of surfactants by Porter, M. R. Ed. 2<sup>nd</sup>, Academic &amp; Professional Publishers (1994)</li> <li>• Surfactants in consumer products theory, technology and applications by Falbe J., Springer Verlag (1987)</li> <li>• Industrial applications of surfactants by Karsa D. R., Royal society of chemistry (1990)</li> <li>• Anionic surfactants by Linfield W.M. (1976)</li> <li>• Surfactants by Tadros F., Academic press Inc. (1984)</li> <li>• Cationic surfactants by Jungermann E., Marcel Dekker Inc. (1970)</li> </ul>	
<b>10.</b>	<b>PYT 1203 - Colour Physics &amp; Colour Harmony</b>	
	<b>To be given by Dr. V. D. deshpane, Physics Department</b>	
<b>11.</b>	<b>OLT 1103 - Nutrition</b>	
	Metabolic rate and caloric needs	4
	Requirements and role of nutrients in human health, RDAs, nutritional fibres	10
	Biological value of proteins	8
	Energy value of foods	2
	Techniques of diet and health surveys	4
	Formulation of diets and foods for specific needs.	2
	<p><b>Reference Books:</b></p> <ul style="list-style-type: none"> <li>• Biochemistry by Lehninger</li> </ul>	



