NOTIFICATION

No. 155/2024 Dated : 14 /11/2024

Subject: Implementation of new syllabus of Semester III & IV of the subjects of B.Tech. (Chem.Tech. (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) as per NEP- 2020 Pattern.

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus of Semester III & IV of the subjects of B.Tech.(Chemical Technology) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) as per NEP- 2020 Pattern to be implemented from the academic session 2024-2025 onwards in phase wise manner as mentioned below:

Sd/-
(Dr.A.M.Asanare)
Registrar
Sant Gadge Baba Amravati University

SYLLABI PRESCRIBED FOR FOUR YEAR DEGREE COURSE IN
B. TECH. (CHEMICAL TECHNOLOGY)
(FOOD, PULP & PAPER, OIL & PAINT AND PETROCHEMICAL TECHNOLOGY) (NEP-2020)
SEMESTER: THIRD & FOURTH

SEMESTER: THIRD

3CT01 PROCESS CALCULATION

Subject Code: 3CT1	Title: Process Calculation	Credits = 0 3		
		L	T	P
Semester: III	Total contact hours: 3hrs/week	03	--	--

Course Objectives:

- Students will learn the basic and fundamentals of chemical engineering operations and processes.
- Students will understand the material balance and energy balance of various unit operations and unit processes.
- Students will learn how to formulate and solve the problems related to material and energy balance with or without chemical reaction.

Course Outcomes:

After successful completion of this course student will be able to-

- Understand the concept of basic chemical calculations
- Understand the concept and application of theory of proportions
- Determine the humidity with/without using a psychrometric chart.
- Make the material balance over unit operations and processes.
- Make the energy balance over unit operations and processes.
- Solve the problem of fuels and combustion.

SECTION-A

UNIT I: Introduction to unit operations and unit processes, Units and dimensions, Atoms, moles and molecular weight, mole and mass fraction, Composition of solids, liquids and gases, Concept of Normality, Molarity and Molality, PPM (parts per million), Ideal gas law, Dalton's law, Partial pressure, Amagat's law, Average molecular weight, Density of gas mixture, Raoult's law, Henry's law, Vapour pressure, Cox chart. Humidity and saturation, Humidity chart and their application. (12hrs)

UNIT II: Material balance without chemical reaction stoichiometry and unit operations Distillation, Absorption, Extraction, Crystallization, Drying, Mixing, Evaporation. Recycle, purge and Bypass calculations. (10hrs)

UNIT III: Material balance involves chemical reaction, Principle of stoichiometry, simple oxidation reaction, multiple chemical reaction, percentage Conversion, percentage Yield, and selectivity, calculation involving combustion of gases, liquid and solid fuel. Recycle, purge and bypass calculations. Introduction to unsteady state material balance. (11 Hrs.)

SECTION-B

UNIT IV: Energy balance: open and closed system, heat capacity, calculations of enthalpy changes, enthalpy changes for phases transitions, evaporation, solution and mixing, clausius clapeyron equation. (10hrs)

UNIT V: Energy balance with chemical reaction, calculation of standard heat of reaction, heat of formation, heat of combustion, Hess law, Effect of temperature on heat of reaction; adiabatic flame temperature calculations. (9hrs)

UNIT VI: Heating value of fuels, calculations involving theoretical and excess air, heat and material balance of combustion processes. (8hrs)

Reference Books / Text Books:

- Bhatt, B. I., Vora, S. M., "Stoichiometry",4th Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
- Narayanan K V and Lakshmikutty B, Stoichiometry and Process Calculations, Prentice Hall of India Pvt Ltd, New Delhi 2006.
- Sikdar, D. C., "Chemical Process Calculations", Prentice Hall of India.
- Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", 8th Pearson India Education Services, 2015.
- Hougen. O. A, Watson K.M. and Ragatz R.A. "Chemical Process Principles, Part -I, Material and Energy Balance".

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3CT02 APPLIED THERMODYNAMICS

Subject Code: 3CT2	Title: Applied Thermodynamics	Credits = 03		
		L	T	P
Semester: III	Total contact hours: 3hrs/week	3	-	-

Course Objectives: To learn about work and heat interactions, and balance of energy between system and its surroundings.

1. To evaluate the changes in properties of substances in various processes
2. To learn about of 1st law for systems and heating value of fuels
3. To learn about gas and vapor cycles and their first law and second law efficiencies
4. To familiarize with the terminology associated with IC engines.
5. To understand the basics of IC engines.
6. To understand combustion, and various parameters and variables affecting it in various types of IC engines.

Course Outcomes:

- To understand the fundamentals of various thermodynamic system and devices.
- To analyze the performance and understand the applications of thermodynamic systems.
- To understand applications and working of Boilers and Steam Engines, IC engines

SECTION-A

UNIT I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems. Temperatures, Gas Laws and Ideal gas equation of states, and universal gas constant. Zeroth law of thermodynamics. (10hrs)

UNIT II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy. Property of system, internal energy. Application of first law to non-flow processes. First law applied to flow processes: Steady state, steady flow process, Second law of thermodynamics: Limitations of 1st law. Equivalence Kelvin-Planck and Clausis statements. (09hrs)

UNIT III: Steam Boilers: Classification, Fire tube and water tube boilers, tube, shape and position, firing, heat sources, fuel, fluid, circulation, furnace position, furnace type, general shape. Boiler mountings and accessories. Boiler draught: Types of draught, expression for diameter, height of chimney. (10hrs)

SECTION-B

UNIT IV: Reciprocating Steam Engines: Constructional features of steam engine and its development, expansive and non expansive working. Hypothetical and actual indicator diagrams. Condensers: Construction and working of jet and surface condensers. (8hrs)

UNIT V: I.C. Engines: Classification of I.C. engines, Constructional features and development. Working of two stroke and four strokes. General description of petrol and diesel engine, working of simple carburetor and fuel injector. Valve timing diagram, cooling and lubrication. (10hrs)

UNIT VI: Cycles: Air standard efficiency, Otto and Diesel cycles. Engine H.P., their efficiencies and mean effective pressure, specific fuel consumption. (8hrs)

Reference Books:

- Thermal Engineering, by R. L. Ballaney - Khanna, Pub.
- Engineering Thermodynamics, by Gupta and Prakash, Nemchand and Bros, Roorkee
- Fundamentals of I.C. Engines by Gill, Smith and Ziurys.
- Heat Engines and Thermodynamics by S. Domkundwar, Dhanpat Rai and sons, New Delhi.
- Thermodynamics - An Engineering Approach – Cengel and Boles Mc-Graw Hill Publications.

Text Books:

- Thermal Engineering : Rajput R.K.8
- Thermal Engineering : RS.Yadav.
- Basic Engineering Thermodynamics : Joel.
- Engineering Thermodynamic : P. K. Nag.
- I.C. Engines : Rajput R.K.

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3CT03: MATERIAL TECHNOLOGY

Subject Code: 3CT03	Title: Material Technology	Credits = 02		
		L	T	P
Semester: III	Total contact hours: 2hrs/week	2	-	-

Course Outcomes: On completion of the course, the student will learn to:
Describe causes of mechanical failure and failure analysis.
Analyses the corrosion problems in process industry and control the corrosion.

SECTION-A

UNIT-I: Engineering Materials: Classification, study of ferrous and nonferrous materials, alloys, Modification and control of material properties (8hrs)

UNIT-II: Polymeric materials , Ceramic materials, Composite materials and Smart materials. Effect of structure on properties: subatomic to macroscopic level (8hrs)

SECTION-B

UNIT-III: Corrosion Engineering: Electrochemical principles, different types of corrosion, Polarisation, mechanisms of corrosion control and prevention, preventive coatings. Corrosion behavior of important alloys such as stainless steels, brass etc. (8hrs)

UNIT-IV: Theory of failure: Crystal defects, plastic deformation. Types of mechanical failure, fracture, fatigue and creep. Criteria for selection of materials in chemical process industry. (6hrs)

Reference Books/ Text Books:

1. The Essence of Materials for Engineers, Robert W. Messler, Jr.
2. Materials Science and Engineering, Raghavan V.
3. Materials Science and Engineering, Van Vlack L.H.
4. Engineering Materials and Applications, Flin R.A., Trojan P.K.

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3CT04 STRENGTH OF MATERIALS

Subject Code: 3CT4	Title: Strength of Materials	Credits = 0 4		
		L	T	P
Semester: III	Total contact hours: 05hrs/Week	03	--	02

Course Objectives:

- To determine the Mechanical behavior of the body and construction materials by determining the stresses, strains produced by the application of loads.
- To apply the fundamentals of simple stresses and strains.
- To make one understand the concept of bending and its theoretical analysis.
- To apply fundamental concepts related to deformation, moment of inertia, load carrying capacity, shear forces, bending moments, torsional moments, principal stresses and strains, slopes and deflection.

Course Outcomes:

At the end of the subject the students will be able -

- To understand the basics of material properties, stress and strain.
- To apply knowledge of mathematics, science, for engineering applications
- To identify, formulate, and solve engineering & real life problems
- To design and conduct experiments, as well as to analyze and interpret action and reaction data.
- To understand specific requirement from the component to meet desired needs within realistic constraints of safety.

SECTION-A

UNIT I: Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

UNIT II: Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.
UNIT III: Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

SECTION-B

UNIT IV: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

UNIT V: Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, principal strains. Combined direct & bending stresses.

UNIT VI: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

3CT10: STRENGTH OF MATERIALS - LAB.

List of Practical's in Strength of Materials Lab (Minimum any eight practical from the list should be performed)

- Tension test on metals.
- Compression test on metals.
- Shear test on metals.
- Impact test on metals.
- Hardness test on metals.
- Torsion test on metals.
- Deflection of beams.
- Modulus of rupture test.
- Buckling of columns.
- Deflection of springs.

Recommended Books:

- E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.
- S.Timoshenko and O. H. Young, 'Elements of Strength of Materials', East West Press Private Ltd., New Delhi.
- Ferdinard L. Singer, 'Strength of Materials', Harper and Row, New York.
- Shames, I. H., 'Introduction to Solid Mechanics', Prentice Hall of India, New Delhi.
- R. K. Bansal, Strength of materials, Laxmi Publications Pvt Ltd.
- Junnarkar, S. B., Mechanics of materials.
- Mubeen, A., Mechanics of solids, Pearson education (Singapore) Pvt. Ltd.
- Beer and Johston, Mechanics of materials, Mc-Graw Hill.
- S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Co Pvt. Ltd.

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3CT05 & 3CT09 CHEMICAL ENGINEERING ANALYSIS [Level 5 (UG-Certificate)]

Subject Code: 3CT05	Title: Chemical Engineering Analysis	Credits = 0 3		
		L	T	P
Semester: III	Total contact hours: 4hrs/week	02	-	02

Course Objectives:

- To understand the electrical properties of fluid.
- To predict the high and low quantum yield photochemical reactions and to know about advanced spectroscopic analysis techniques.
- To know the basic concepts and industrial examples of catalysis and adsorption on surface.

Course Outcomes:
The course will enable the student to:

- Evaluate the specific rate, order and energy of activation of chemical reactions.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and spectroscopic methods for identification of compounds.

SECTION-A

UNIT I: Electro analytical Methods:
Introduction, Application of standard electrode potential, Application of Oxidation/Reduction potential, electro-chemical cells, Types of electro analytical methods; Potentiometry, pH metry, Conductometry. (8Hrs)

UNIT II: Thermal Analysis techniques: Introduction, Principles, Thermal Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA) (6Hrs)

SECTION-B

UNIT III: Kinetics and Separations:
Introduction, Rate of chemical reaction, Introduction to Chromatographic separations, Principles and application of Gas Chromatography (GC), High performance liquid chromatography (HPLC), (6Hrs)

UNIT IV: **Spectroscopic techniques and applications:** Photochemical Reaction, Lambert and Beer' Law, Laws of photochemical equivalence, Principles and applications of UV-Vis spectroscopy and selection rules. Electronic spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules. Principle and applications of Infrared Spectroscopy (IR), Nuclear Magnetic Resonance (NMR) Spectroscopy. (8 Hrs)

3CT09 CHEMICAL ENGINEERING ANALYSIS: - LAB.

List of Experiments: Based on the above syllabus of 3CT9 CHEMICAL ENGINEERING ANALYSIS

Text Books/ Reference Books Recommended:

- Principles of Instrumental Analysis, Skoog Douglas A, F James Holler, Stanley R , Cengage 7th Ed
- Fundamemtals of Analytical Chemisty, Douglas A, Donald M, James F, Stanley R , Cengage 10th Ed
- Physical Chemistry , P.W. Atkins and J.D. Paula, Oxford University Press.
- Physical Chemistry , K.J. Laidler and J.M. Meiser, CBS Publisher
- Chemical kinetics and catalysis , R. J. Masel, John Wiley publications
- Handbook of conducting polymers, Skotheim, Elsenbaumer and Reynolds, Marce Dekker.
- Fundamentals of spectroscopy , Banwell, Tata McGraw-Hill
- Physical chemistry of surfaces, Arthur W. Adamsons, Alice P. Gast, John Wiley
- publications
- Principle of Heterogeneous catalysis, J. M. Thomas, W.J. Thomas, John Wiley publications
- Thermodynamics for students of chemistry, Dr. J. Rajaram & Dr. J. C. Kuriacose, Chand & compound.

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3CT06 VEC: ENVIRONMENTAL SCIENCES

Subject Code: 3CT6	Title: Environmental Sciences	Credits = 02		
		L	T	P
Semester: III	Total contact hours: 2hrs/week	2	-	-

SECTION-A

UNIT-I: (a) The Multidisciplinary nature of environmental studies:
Definition, Principles, Scope and importance, Need for public awareness.
(b) Natural Resources: Renewable and non renewable resources:

Availability, use, overexploitation and associated environmental problems related to following Natural resource:

- Mineral Resources: Use and Over exploitation, environmental effects of extraction
- Food Resources: Use and Over exploitation, deforestation, case study
- Energy Resources: Growing energy needs , renewable and nonrenewable energy sources, case study
- Role of individual in conservation of natural resources (8hrs)

UNIT-II: Ecosystems:

- Concept and components of an ecosystem.
- Types of ecosystem
- Structure and function of forest and pond ecosystem.
- Energy flow in the ecosystems.
- Food chains, food webs and ecological pyramids.
- Ecological succession: General mechanism (7hrs)

SECTION-B

UNIT-III: **Biodiversity and its Conservation:**

- Introduction, definition and types of biodiversity.
- Bio-geographical classification of India.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity. (9hrs)

UNIT-IV: **Environmental Pollution:**

Definition, Causes, effects and control, Case studies
Disaster management: Floods, earth quake, cyclone and landslides. (6hrs)

Reference Books:

- Text Book of Environmental studies, Erach Bharucha, UGC.
- Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd.
- Ecology and Environment, P. D. Sharma.
- Ecology, M. P. Arora, Himalaya Publishing House.

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3CT07 [MDM-1]: AIR POLLUTION AND CONTROL

Subject Code: 3CT07	Title: MDM-I: Air Pollution & Control	Credits =02		
		L	T	P
Semester: III	Total contact hours: 2hrs/week	2	-	-

SECTION-A

UNIT-I: Introduction and Impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies. (8hrs)

UNIT-II: Sources, classification and formation/transformation of air pollutants: Meteorology and Atmospheric Stability. (6hrs)

SECTION-B

UNIT-III: Indoor air pollution: sources, types and health impacts. Sampling, assessment and evaluation of Indoor air quality. (6hrs)

UNIT-IV: Air pollution emission standards, National and international policies, acts, rules and regulations. Emerging technologies and strategies to mitigate air pollution, Current challenges and way forward. (8hrs)

Books and references:

- Wark, K., Warner, C.F., and Davis, W.T., “Air Pollution: Its Origin and Control”, Addison-Wesley Longman. 1998.
- Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., “Fundamentals of Air Pollution”, Academic Press. 2005.
- Seinfeld, J.H., Pandis, S.N., “Atmospheric Chemistry and Physics”, John Wiley. 2006.
- Lodge, J.P. (Ed.), “Methods of Air Sampling and Analysis”, CRC Press. 1988.
- Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), “Air Pollution: Health and Environmental Impacts”, CRC Press. 2010.

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3CT08 Open Elective - -I ACCOUNTING AND TALLY

Subject Code: O.E.- 1	Title: Accounting and Tally	Credits = 0 3		
		L	T	P
Semester: III	Total contact hours: 2hrs/week	02	--	--

This course equips you with the fundamentals of accounting and practical skills using Tally software. You'll learn how businesses record and track their financial activities, analyze results, and use accounting software for efficient management.

Learning Objectives:

- Understand the basic principles of accounting.
- Apply accounting concepts to real-world business transactions.
- Understanding the financial statements.
- Navigate and utilize Tally software for accounting tasks.

Unit I: Introduction to Accounting: Concept, Nature and scope, Importance of accounting, Users of accounting Information, Generally Adopted Accounting Principles and Concepts.

Unit II: Understanding Financial Statements: Introduction, Trial balance, Profit and loss account, Balance sheet.

Unit III: CVP Analysis And Cost sheet: Meaning, Advantages and Limitations, Break even analysis (BEP) Analysis. **Cost sheet:** Meaning, Importance & Application.

Unit IV: Introduction to Tally ERP: Getting Started with Tally (Interface and Navigation), Creating Masters (Accounts, Stocks, Customers, etc.), Recording Transactions in Tally (Sales, Purchases, Payments), Generating Reports (Trial Balance, Balance Sheet, Income Statement), Introduction to Inventory Management in Tally.

SUGGESTED READINGS:

1. Fundamentals of Accounting : R.L. Gupta & V.K. Gupta, Sultanchand & Sons.
2. Fundamentals of Accounting : T.P Ghosh, Sultanchand & Sons.
3. Narayanaswamy, R Gupta, Ambrish, "Financial Accounting for Management - An Analytical Perspective", 4th Edition, Pearson Education.2012.
4. Subramanyam, K. R. and John, J.W, “Financial Accounting – A Managerial Perspective”, 5th Edition, Prentice Hall of India. 2015.
5. M Y Khan, P. K. Jain, Management Accounting, 7th Edition Mc Graw Hill.

Tutorials:

1. Trial Balance: Explain all major accounting items, including assets, liabilities, equity, revenues, expenses, gains, and losses. And format of trial balance.

2. Profit and loss account: Explaining the components of profit and loss account which includes revenue, operating expenses, operating profit, net income.

Balance sheet: Explain the uses of financial statement that reports a company's assets, liabilities, and shareholder equity at a specific point in time.

3. CVP Analysis: Explain the relationship between Cost-Volume-Profit in profit generation. Also describes break-even point in the form of equation and graph.

Cost sheet: A Cost Sheet includes the following facts:

- Total cost and cost per unit for a product.
- The various elements of cost such as prime cost, factory cost, production cost, cost of goods sold, total cost, etc.
- Calculate and summarize the total cost of the product.

4. Tally ERP: The core purpose of Tally is to manage complex accounting and financial processes effectively. It allows users to track and manage accounts, sales, debts, and various other business aspects. Tally aims to simplify and streamline accounting tasks, making them more efficient and less prone to errors.

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SEMESTER: FOURTH

4FT1 & 4FT08 FOOD TECHNOLOGY Sp. Tech.-I [Level 5.0 (UG-Certificate)]

Subject Code: 4FT01	Title: Food Technology Sp. Tech - I	Credits = 0 4		
		L	T	P
Semester: IV	Total contact hours: 5hrs/week	03	-	02

Course Objectives:
The main objectives of this course is for students to differentiate chemical interactions and reactions of food components and their effect on sensory, nutritional, and functional properties of foods, and how processing influences these properties.

Course Outcomes:
By learning this course students will develop

- Ability to understand the concept and properties of food chemistry, structure and composition of carbohydrates and its metabolism.
- Ability to demonstrate the structure, composition, physical and chemical properties of different types of fats.
- Ability to recognize the function of the proteins understands their practical implications.
- Ability to describe the importance of water, colloidal systems and effect of water activity on shelf life of food products.
- Ability to understand the importance of micro nutrients in food products and able to find the energy value of different foods.
- Ability to understand different micronutrients.

SECTION-A

UNIT-I: History of food chemistry, Importance of food chemistry in food science and technology, Functions of foods. Physical and chemical properties of food, Colloidal properties of food. Sensory perception of tastes, flavor, aroma and texture. Sensory analysis of food. (10hrs)

UNIT-II: Chemistry of Carbohydrates:
Classification, composition / structure, physical and chemical properties of carbohydrates, pectic substances, gums and other polysaccharides. Role of carbohydrates in different food product. Functions of carbohydrate. Digestion of carbohydrate-based food and its metabolism (13hrs)

UNIT-III: Chemistry of Lipids:
Definition and classification of lipids, chemistry of fatty acids and glycerides, physical and chemical characteristics. Chemistry of processing of fats and oils, hydrogenated fats, shortening agents and confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Functional properties of lipids in foods. Metabolism of lipids. (15hrs)

SECTION-B

UNIT-IV: Chemistry of Protein and enzyme:
Importance of proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides and proteins Sources and distribution of proteins. Isolation identification and purity of proteins, denaturation, Functional properties of proteins in food. Metabolism of proteins, Introduction classification and nomenclature of enzymes, specificity. Industrial applications of Enzymes, kinetics, Techniques of immobilization of enzymes. (12hrs)

UNIT V: Water and Ice:
Importance of water in foods. Structure of water and ice. Water Activity and its influence on shelf life of foods. Concept of bound and free water and their implication. (6hrs)

UNIT VI: **Micronutrients of food:**
Vitamins – Classification, sources, functions and deficiency symptoms, assay of vitamins. Minerals – Micro & Macro Minerals, pigments and flavors. (6hrs)

Books Recommended:

1. The Chemical Analysis of Foods, Sixth Edition by David Perason, J.O.A. Churbcill, 104 Gloucester place London. 70
2. Manual of Analysis of Fruits and vegetable products: S. Ranganna, Ph.D. Central Food Technological. Research Institute, Mysore, Publisher, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Food Analysis by A.G. Woodman, 4th Edition, Publishers, Mc.Graw Hill Book Company, INC, New York and London, Latest Edition.
4. Modem Food Analysis by F. Leslie Hart A.N. and Hary John Stone Fishes. Ph.D. Publishers, Springer - Verlag. Berlin Heidelberg, New York, Latest Edition.
5. Food Analysis by R Lees, Published by Leonard Hill Books, London.
6. Food Chemistry: L H Meyer, Van Nostrand Reinhold Co New York 1960
7. Principles of Food Science, Ed. Owen R Fennema Part I, Food Chemistry, Marcel Dekker Inc New York
8. The Chemical analysis of foods and food products : Morris B Jacob, 3rd Edition, Vam Nostrand Co, Princeston, New Jersey
9. Instrumental Methods of Analysis: Peksock and Shield.

4FT08: FOOD TECHNOLOGY Sp. Tech-I- LAB.

Course Objectives:

- To provide an opportunity to the students in developing the concept and to learn various methods of estimation of macro nutrients.
- Learn the various methods of estimation of micro nutrients like minerals and vitamins.
- Able to identify methods and instruments that can be used to study of food chemistry
- To focus on the development of skills to control the quality of food.

List of Experiments:

1. To determine the moisture content in food samples by Oven drying or Karl Fischer titration method.
2. To determine total ash and acid insoluble ash from food product
3. Determination of free fatty acid in oils/fats
4. Determination of Fat rancidity by using peroxide value (fats/oils)
5. Determination of gluten in wheat flour
6. To isolate the starch from potato
7. Analysis of Proteins by Flowrin Lowry Method or Biuret Method
8. Quality evaluation of water (pH, Hardness, Turbidity of water, TDS)
9. To determine the sugar content (e.g., glucose, fructose, sucrose) in food samples by refractometry or titration methods (e.g., Fehling's solution, Benedict's solution).
10. To measure the acidity or alkalinity of food products by pH meter or pH Indicator papers.
11. Estimation of ascorbic acid (vitamin c) by titration method
12. Estimation of iron
13. Estimation of Phosphorus
14. Estimation Of Calcium

(Based on above Minimum 13 Performances expected.)

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4PT01 & 4PT08 PULP & PAPER TECHNOLOGY Sp. Tech-I [Level 5.0 (UG-Certificate)]

Subject Code: 4PT01	Title: Pulp & Paper Technology Sp. Tech- I	Credits = 0 4		
		L	T	P
Semester: IV	Total contact hours: 5hrs/week	03	-	02

Course Objective: After completion of course students would be able to identify different raw materials used as paper making raw material, understand their chemical composition and suitability for paper making.

Course Outcomes:

- Knowing the different raw materials used in the manufacture of paper, understanding the source of cellulose and availability.
- Understand the anatomy of different fibrous raw material. Study the various morphological properties relevant to paper manufacture.
- Identify the chemical composition of wood which gives an idea of cellulose, hemicelluloses, lignin and extractives present in the wood.
  Study the chemistry of cellulose and hemicelluloses. Understanding the role played by each wood component, reactions of cellulose and hemicelluloses with chemicals.
- Understanding the relevance of lignin, reactions of lignin with different chemicals and their effect, qualitative and quantitative analysis of lignin, utilization of lignin as different polymeric products

SECTION-A

UNIT-I: Chemistry of Wood And Pulp Of Paper Materials:

Species, anatomy and physical properties of Wood:-

Species used as papermaking raw material, Classification of woods, plants used in pulp and paper, gross structure of trunk, structure elements of wood, fiber dimensions, water conducting system, food conducting system, reactions of wood, bark and its structural elements. (10 hrs)

UNIT-II: Fiber morphology: Cell formation and growth, fiber structure, chemical composition of wood, non-wood fibers used in pulping bast, fruits, grass, leaf, animal, mineral and synthetic fibers, proximate analysis of fibrous raw material, physical properties of fiber, decay of wood, physical properties of wood, extractives and its chemical composition. (10 hrs)

SECTION-B

UNIT-III: Cellulose: Chemistry and location in the cell, isolation molecular constitution, microfibrils, crystalline and amorphoupus Pulp of Paper biogenesis of the cell wall, Polysacchrides, sorption, swelling and solution of cellulose, degradation reactions of pulp of paper. (8 hrs)

UNIT-IV: Identification and formation of hemicelluloses and extractives Hemicelluloses it's structure and characteristics in wood, chemistry of xylan, galacto glucomannans, glucomannan, arabinogalactan, isolation of hemicelluloses. Types of extractives, Terpenoids and Steroids chemistry and analysis, Fats and Waxes chemistry and availability, Phenolic Constituents present in wood. (6hrs)

UNIT-V: Lignin: Structure and location of lignin in wood, laboratory isolation methods, lignin heterogeneity, lignin carbohydrate bonds, biochemical formation of lignin, dehydrogenative polymerization of lignin. (8hrs)

UNIT VI: Various commercial separation methods, qualitative analysis of lignin, quantitative analysis of lignin, structural analysis and utilization of lignin, low molecular weight products, polymeric products from lignin.

Books Recommended:

- "The Chemistry of Cellulose" by Emil Hauser, John Wiley & Sons, New York.
- "The Methods of Cellulose Chern" Charles Dorce, Chapman & Hall, L.
- High Polymers Vol V (Part-I to V) edited by Emil Ott & Others, Interscience Publishers.
- Publishing Processes by S.A.Rydholm, John Wiley & Sons, Inc., New York.
- Pulp & Paper : Chemistry & Chemical Technology by James P. Cascy.

4PT08: PULP & PAPER TECHNOLOGY Sp. Tech-I- LAB.

List of Experiments:

Determination of various components of wood such as moisture content.ash content, Water Solubility, alkali, solubility extractives, lignin Cellulose; hemicellulose, holo cellulose pentosans etc. Microscopic observations of fibrous materials.

(**Based on above minimum 13 Performances expected**)

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4OT01 & 4OT08 OIL AND PAINT TECHNOLOGY Spl. Tech.-I [Level 5.0 (UG-Certificate)]

Subject Code: 4OT1	Title: Oil & Paint Technology Sp. Tech I	Credits = 0 4		
		L	T	P
Semester: IV	Total contact hours: 5hrs/week	03	-	02

Course Objectives:
The main objectives of this course are to know about oil & Paint Technology. The structure of Oils & their uses for human as industrial applications. The importance of paints in living as well as industrial applications are to be studies.

Course Outcomes:
By learning this course students will develop-

- The ability to understand about edible oils as well as nonedible oils, their importance for metabolism oil industrial applications.
- They understand about the knowhow and importune of resins & paints.
- Ability to describe the importance of edible oils as essential fatty acids for growth of body
- Ability to know the adulteration in oils & fats which are dangerous for human life
- Ability to know the recent developments in oils & Paints Technology

SECTION-A

UNIT I: Natural Fats: Their Sources, classification and composition Constituents of natural fats : Glycerides, Phospholipids, Fatty acids, non-glycerides constituents, toxic constituents and detoxication, Nutritional functions of Fats. (10hrs)

UNIT-II: **Glycerides and fatty acids:** Nomenclature, Structure, occurrence in fats. Physical properties of fats and fatty acids. Elementary ideas on their liquid properties, solution properties and spectral properties. (8 hrs)

UNIT-III: Chemical reaction of fats and their fatty acids. Chemistry of hydrogenation, hydrogenolysis, autoxidation, polymerisation dehydration, pyrolysis, halogenation, sulpation and sulphonation , esterification , interesterification and hydrolysis. Chemical Oxidation of fatty acids, Significance and importance of these reactions. Rancidity of Oils & Fats, Oils antioxidant and synergists. (12hrs)

SECTION-B

UNIT-IV: Physical and Chemical characteristics: Indian standards for oils and fats - ISI Specifications of Oilseeds, Oils, DOC, Vegetable Ghee. Identification of fats. Detection of adulteration in fats and Indian standards for oils and fats. (12hrs)

UNIT-V: Introduction of Paints, Types of Paints, Basic Ingredients of paint system, Industrial applications of Paints. (10hrs)

UNIT-VI: Recent development in the field of Oils & Paints. (8hrs)

Books Recommended:

- Industrial Oil and Fat Products Ed.: A. E. Bailey. Interscience & Sons New York, London, Sydney 5th Edn.
- An Introduction of the Chemistry and Biochemistry of Fatty Acids : Gumstone.
- Progress in the Chemistry of Fats and other liquids (Vols. 1 to 11) T. R. Holmann, Pergamon Press.
- Fatty Acids : K. S. Markley, Inter Sc. Publishers, 2nd edition, New York.
- Industrial Chemistry of Fats and Waxes : T. Hilditch Balliere Tindall and Cox, London 2nd Edition.
- Rancidity of Edible Fats : C. H. Lea, His Majesty's Stationary Office, London, Latest Edition.
- Analysis of Fats and Oils : V. V. Mellen Bacher, Garrard Press Publishers, Illinois, Latest Edition.
- Outline of Paint Tech. - H. Hea
- Introduction of paints by Morgan.

4OT8: OIL AND PAINT TECHNOLOGY Sp. Tech-I- LAB.

- Preparations & Standardization of Solutions,
- Determination of various physical and chemical characteristics of oils, fats and waxes, colour, solubility and thermal test for purity.
- Analysis of oilseeds and cakes,
- Estimation of rancidity.
- Analysis of nickel catalysts and acid oils determination,
- Physical and chemical characteristics of vanaspati, margarine and ghee.
- Detection of adulteration in oils & fats
- Testing of readymade Paints & Raw materials of paints systems like pigments, Solvents, additives, Resins.

(Based on above minimum 13 performances expected)

4PC1 & 4PC8 PETROCHEMICAL TECHNOLOGY Sp.Tech-I [Level 5.0 (UG-Certificate)]

Subject Code:4PC1	Title: Petrochemical Tech Sp.Tech- I	Credits=04		
		L	T	P
Semester: IV	Total contact hours:05hrs/week	03	-	02

Course Objectives:

- Basic Concepts of Chemistry of Hydrocarbons
- Introduction to Basic Refinery Processes
- Formation Theories of Petroleum
- Exploration and prospecting for petroleum and gas field, Drilling, Transportation, Storage of Petroleum & Products and future Energy Sources.

Course Outcomes:

- Students will be able to understand
- The chemistry and composition of petroleum.
- Importance petroleum as a source of energy and petrochemicals
- Technology involved in exploration and prospecting for petroleum and gas field, as well as drilling for petroleum.

SECTION-A

UNIT-I: Origin, Occurrence, and Formation of crude petroleum. History of Indian Petroleum and Refining Industry and future trends. Hydrocarbon resources in India, history. World Petroleum Scenario, world Petroleum Reserves and Deposits. Crude Oil and Natural Gas Production and Consumption in India. Petroleum refineries in India, their location, year of commissioning, and organizations, Refining Capacity& throughput, Production& Consumption of Petroleum Products.Advantages and disadvantages of petroleum. (10hrs)

UNIT-II: Composition, Chemistry, Classification of Petroleum Hydrocarbon composition of petroleum and petroleum products (liquid and gas).Non-hydrocarbon compounds in petroleum. Properties of hydrocarbons and non-hydrocarbons. Classification and description of crude oils and petroleum gases. (10hrs)

UNIT-III: Refining Processes and Operations Various refining processes, operations and chemistry involved. Principle involved in dehydration, desalting and conditioning of crude oil. Thermodynamics, kinetics and reaction mechanism, principle involved in thermal and catalytic processes such as thermal and catalytic cracking, hydro cracking, reforming, isomerisation, polymerization, alkylation. (10hrs)

SECTION-B

UNIT-IV: Exploration and prospecting for petroleum and gas field Structure of earth and of the earth crust, formation of Sedimentary rocks, Exploration and prospecting for petroleum and gas field, Geological, Geophysical, Geochemical prospecting methods, geophysical borehole logging methods. Migration of petroleum and gas deposits and commercial petroleum accumulations. Petroleum traps and their classifications. Development of an oil or gas field. (10hrs)

UNIT -V: Drilling for Petroleum Drilling operation, Cable tool method, Rotary drilling, Turbo drilling, types of drill bits, mud fluids, casing off formations, Deviation of holes, Directional drilling, Offshore drilling rigs, Well control systems. (10hrs)

UNIT-VI: Other Sources of Hydrocarbons, Transportation& Storage of Petroleum Sources of hydrocarbons other than crude oil, future automotive fuel resources, new and future energy sources. Transportation and storage of crude oil, petroleum gases, and petroleum products. Shipping tankers, Pipelines: Materials and Corrosion, Onshore and offshore pipeline construction. Pipeline network in India. (10hrs)

Reference Books:

- Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri
- Modern Petroleum Technology Volume-I Upstream Edited by Richard A. Dawe
- Geology of Petroleum Vol. 5, Edited by Heinz Beckmann.

Text Books:

- Modern Petroleum Refining Processes by B. K. Bhaskara Rao, Latest Edition.
- Petroleum Refining Technology by Dr. Ram Prasad
- Chemistry of Petrochemical Processes by Sami Matar, Lewis F. Hatch
- The Chemistry and Technology of Petroleum by James G. Speight
- Handbook of Petroleum Product Analysis byJames G. Speight.

4PC8: PETROCHEMICAL TECHNOLOGY SP.TECH-I - LAB.

List of Experiments:

- Determination of Flash point of given petroleum sample by Abel's method.
- Determination of Flash point of given petroleum sample by Pensky Marten's method.
- Determination of Flash and fire point of given petroleum sample by Clevland's Open Cup method.
- Determination of Smoke Point of given petroleum sample.
- Determination of Cloud & pour Point of given petroleum sample.
- Determination of Aniline point of given petroleum sample.
- Determination of Copper Strip corrosion test.
- Determination of API gravity of given petroleum sample.
- Determination of Needle penetration of grease sample and cone penetration index of bitumen sample.
- Determination of melting point of wax by cooling curve method.
- Determination of drop melting point of wax.
- Determination of congealing point of wax.

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4CT02 & 4CT09 MACHINE DESIGN & DRAWING [Level 5.0 (UG-Diploma)]

Subject Code: 4CT02	Title: Machine Design & Drawing	Credits = 04		
		L	T	P
Semester: IV	Total contact hours: 5 hrs/week	03	-	02

Course Objectives: This course seeks to provide an introduction to the design of machine elements commonly encountered in engineering practice through,

- A strong background in mechanics of materials based failure criteria underpinning the safety-critical design of machine components.
- An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations.
- An overview of standards and design guidelines for different elements
- Overview of the design methodologies employed for the design of various machine components.

Course Outcomes: The prime objective of this course is to introduce design and drawing as a process and as a final product. Basic contents are:

- Introduction to the design assignment, their aims and objectives, scope, special emphasis and limitation. Application of design standards for the proposed design safety.
- Planning and design data collection, design analysis, and design synthesis.
- Major designs and drafting of the parts or modification in the existing part for better result and efficiency.

SECTION-A

UNIT I: Sectional Views Conversion of pictorial view in to sectional orthographic projections, Sectional views with different types of projections, Missing views (12 Hrs)

UNIT II: (a) Development of surfaces: Development of surfaces of cubes, prisms, cylinders, pyramids, cones and their cut sections.
(b) Intersection of solids: prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism. (12 Hrs)

SECTION-B

UNIT III: (a) Engineering Materials: Mechanical Properties of materials I.S. designation of materials, selection of materials. Selective assembly and Interchangeability.
(b) Traditional design methods, Design process, Design analysis, Design synthesis. Design consideration: Limits, Fits and tolerances.
(c) Design of Riveted joints: Caulking and Fullering, failures, strength and efficiency of riveted joints. Eccentric loaded riveted joint. (12 Hrs)

UNIT IV: (a) Design of Welded joints: Symbolic representation, Strength of transverse and parallel fillet welded section. Circular fillet welded section.
(b) Belt and Chain Drives: Types of belts, material and construction of belt, types of belt drives, slip, and creep of belt. Flat belts and V-belts. Construction and type of Chains. (12 Hrs)

Reference Books:

- Machine Design by Dr. P. C. Sharma & Dr. D. K. Agrawal, Katsons Books publication
- Design of Machine elements by C. S. Sharma, Kamlesh Purohit, PHI publication
- Design of Machine elements by V. B. Bhandari, Tata McGraw Hill Publication
- Machine Design, Jindal, Pearson publications
- Design Data Book by- P.S.G. Coimbatore
- Design Data Book by Mahadevan.

(Use of any data book from the above will be permitted during the examination).

Text Books:

- Machine Drawing by N. D. Bhatt, Charator Publication
- Machine Design by R. S. Khurmi and J. K. Gupta , S. Chand Publication.

4CT09: MACHINE DESIGN & DRAWING - PRACTICAL

Minimum 6 to 8 practical's/sheets based on the Syllabus 4CT9 MACHINE DESIGN & DRAWING thereof should be submitted by each student.

4CT03 & 4CT10 MECHANICAL OPERATION [Level 5.0 (UG-Diploma)]

Subject Code: 4CT03	Title: Mechanical Operation	Credits = 03		
		L	T	P
Semester: I V	Total contact hours: 4 hrs/week	02	-	02

Course Outcomes:

After successful completion of this course student will be able to-

- Perform the size reduction and screening operation in industry
- Understand the principle, construction and working of various classifier and thickeners used for solid separation.
- Select the suitable transportation system for different types of solids.
- Understand the principle construction and working of various filtration equipments for solid separation form liquid.
- Understand the principle of centrifuges and cyclones.
- Understand the adsorption mechanism and application of adsorption.

SECTION-A

UNIT I: Relevance of mechanical operations in industry.

1. Size reduction, stages of reduction, Equipments operating variables, laws of energies, energy requirements.
2. Screening: Screen analysis, Particle size distribution
3. Unit operation design, basis concepts. (8Hrs)

UNIT II:

1. Classification: Equal falling particles, equipments, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity.
3. Sedimentation: Continuous thickeners.
   Mixing, mixers, agitation, types of equipments, 3D design of equipments. (7Hrs)

SECTION-B

UNIT III:

1. Filtration: Theory, operation, types, Flotation agents, flotation cells.
2. Filter Calculations, filtration equation for compressible and non-compressible cakes,
3. Specific cake resistance.
4. Filtration - Constant pressure and constant rate and their equipments.
5. Centrifuges: Theory, Equipments, types and calculations. (8Hrs)

UNIT IV:

- Adsorption, theory, type and application, nature of adsorbents, industrial adsorbents.
- Adsorption in fixed bed, fluidized beds, adsorption equilibria calculations for vapor, gas and liquid adsorption. Adsorption, operation such as single stage, multi stage, cross current & multistage counter current operation & equipments.
- Recent developments in mechanical operation equipments, animation. (7Hrs)

4CT10: MECHANICAL OPERATION- PRACTICALS: Based on the above syllabus.

Text Books / Reference Books:

- Momentum Transfer Operation : S .K. Gupta, TMC, Latest edition.
- Unit Operations of Chemical Engineering :McCabe and Smith, TMC
- Chemical Engineering Vol. I : Coulson & Richardson, Pergamon, Latest edition.
- Principles of Unit Operations :A. S. Foust *et al*.
- Unit Operations :C. G. Brown.
- Introduction to Chemical Engg. : Beder & Bachero.
- Mass Transfer Operations : R.E. Treybal
- Mechanical OperationsVol-I :R. S. Hiremath &A. P .Kulkarni.

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4CT04 ECONOMICS & MANAGEMENT [Level 5.0 (UG-Diploma)]

Subject Code: 4CT04	Title: Economic & Management	Credits = 0 3		
		L	T	P
Semester: IV	Total contact hours: 3 hrs/week	3	-	-

Course Objectives: Understanding types of demand and its analysis for forecasting

- Knowledge about calculation of economic viability of projects
- Understanding markets assessment and survey
- Awareness about business and finances of chemical industry

SECTION-A

UNIT-I: Nature and scope of economic, Concept, Scope, Techniques of managerial economics, Demand analysis, Demand function, Elasticity of demand and demand fore casting. (10hrs)

UNIT-II: Production concept, Production planning and control: Objective, Function. Essential factors for the success of production planning and control. (10hrs)

UNIT-III: The concept of management, Principles of management, Delegation of authority oganizational Conflict management. (10hrs)

SECTION-B

UNIT-IV: Instruments of long term and short term financing, cost of different sources of raising capital. (8 Hrs.)

UNIT-V:
Business Environment, External and Internal Environment, controllable and Uncontrollable Environment, Socio-cultural environment, Health hazards of chemical industries, Business in post LPG, WTO. (10hrs)

UNIT-VI:
Entrepreneur and Entrepreneurship, Entrepreneurial competencies, institutional interface for SSE opportunity scanning and identification, market assessment for SSE. Main features of Indian factories act & minimum wage act. Brief idea of Taxation in India. (12hrs)

Books Recommended:

- Managerial Economics :K. K. Seo, Richard D. Irwin Inc.
- Engineering Economics : J. L. Riggs, McGraw Hill, New York, Latest Edition.
- Managerial Economics :Adhikary M., Khosla Pub. House, New Delhi.
- Small Business Management Fundamentals: Dan Strenhoff and J. F. Burgess, McGraw Hill Book Company.
- Effective Small Business Management: Richard M. Hodgills, Academic Press Incorporated, Harcourt, Brace Jovanovich.
- Marketing Management: Analysis, Planning, Implementation and Control: Kotler, Phillip, Prentice Hall of India Pvt. Ltd., Latest Edition.
- International Economy, Liberalization Process : V.K. Bhalla Anmol, New Delhi
- Marketing Management for Small Units: Jain Vijay K., Management Publishing Co., Latest Edition.
- Management: Koonts H and Wechrich H, Mc Graw Hill.
- Production and Operations Management: Cherry S. N., Tata McGraw Hill.

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4CT05 VEC: ENVIRONMENTAL SCIENCES [Level 5 (UG-Diploma)]

Subject Code: 4CT05	Title: Environmental Sciences	Credits =02		
		L	T	P
Semester: IV	Total contact hours: 2hrs/week	2	-	-

SECTION-A

UNIT-I: Social issues and the Environment:

- Unsustainable to sustainable development
- Urban problems related to energy
- Water conservation: rain water harvesting, water shed management
- Environmental ethics: issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion and nuclear accidents (8 Hrs.)

Unit-II: Environmental Legislation:
Environment protection Act (1986); Air (prevention and control of pollution) Act (1981-82); Water (prevention and control of pollution) Act (1974); Wildlife protection act (1972);
Forest conservation act (1980), Issues involved in enforcement of environmental legislation (7 Hrs.)

SECTION-B

Unit-III: **Human population and the environment:**

- Population growth and variation among nations
- Population explosion- family welfare program
- Environment and human health
- Human rights
- HIV / AIDS
- Women and child welfare
- Role of information technology in environment and human health (10hrs)

Unit-IV: **Field work: Project report / Survey**

- Visit to a local area to document environmental assets - river / forest / grassland / hill / mountain.
- Visit to a local polluted site - urban / rural / industrial / agricultural.
- Study of local plants, insects, birds.
- Study of local ecosystems - pond, lake, river, forest, etc. (5hrs)

Reference Books:

- Text Book of Environmental studies, Erach Bharucha, UGC.
- Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd.
- Ecology and Environment, P. D. Sharma.
- Ecology, M. P. Arora, Himalaya Publishing House.

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4CT07 Open Elective -II INVESTMENT MANAGEMENT

Subject Code: O.E.-II	Title: Investment Management	Credits = 0 4		
		L	T	P
Semester: IV	Total contact hours: 3hrs/week	03	01	--

Course Description:

This course introduces students to the fundamental principles of investment management. It explores various investment vehicles, risk-return analysis and portfolio construction Students will gain the knowledge and skills necessary to make informed investment decisions for their future financial goals.

Learning Objectives:

- Understand the basic concepts of investment management.
- Analyze different asset classes and investment vehicles.
- Apply risk-return analysis to investment decisions.
- Construct diversified portfolios based on individual risk tolerance.
- Recognize ethical considerations in investment management.

Unit I: Investment Management:

- Meaning, Characteristics, objectives and significance of investment.
- Investment Process.
- Various Investment Avenues.

Unit II: Regulatory Framework for Investment:

- SEBI: Roles and Function.
- Indian Stock Market: Primary Market & Secondary Market.

Unit III: Fundamental & Technical Analysis:

- Fundamental analysis: Economy-Industry-Company(E-I-C) Analysis.
- Technical analysis: Tools & Techniques.

Unit IV: Portfolio Management:

- Concept, Objectives and Significance of Portfolio making.
- Portfolio Investment Process: Performance and Evaluation.

Unit V: Risk Management:

- Principles, Aims, Objectives of risk management.
- Types of risks.
- Risk-Return trade-off.

Unit VI: Ethics in Investment Management:

- Code of Ethics.
- Market Integrity and Insider Trading
- Investor Protection and Regulatory Framework.

Suggested Readings:

1. S. Kevin, Securities Analysis and Portfolio Management, PHI Learning.
2. Prasanna Chandra, Investment analysis and Portfolio Management, Tata McGraw Hill
3. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage Learning .
4. Punithavathy Pandian, Securities Analysis and Portfolio Management, Vikas Publishing House.

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1. **Investment process**: It includes

Step 1: Assessing the risk tolerance. (High, low Moderate)
Step 2: Diversifying the investment. Balancing risk and return in long run.
Step 3: Making plan for asset allocation. Setting investment targets appropriately.
Step 4: Assess investment performance.
Step 5: Rebalance your investment portfolio.

1. Investment Avenues: Investments options like stocks, bonds, mutual funds, property, money market funds, retirement plans, and insurance policies.

1. Primary Market: Primary market issues include an initial public offering (IPO), a private placement, a rights issue, and a preferred allotment.

Secondary Market: The Bombay Stock Exchange (BSE), National Stock Exchange (NSE) as well as all other stock exchanges as well as the bond markets, are secondary markets.

1. **Fundamental (E-I-C) Analysis**: Fundamental analysis involves:

Step 1: Economic and Market Analysis.
Step 2: Analysis of Financial Statements.
Step 3: Forecasting relevant payoffs.
Step 4: Formulating a security value.
Step 5: Making a recommendation.
Technical Analysis: There are three rules that form the foundations of technical analysis. Firstly, the market discounts everything. Secondly, prices move in trends. And lastly, history repeats itself. Chart patterns and technical (statistical) indicators are the two main types of technical analysis.

1. **Processes of Portfolio Management**:

Step 1 – Identification of objectives.
Step 2 – Decisions about asset allocation.
Step 5 – Selecting of profitable investment and securities.
Step 6 – Implementing portfolio.
Step 7 – Revision
1. Risk Management: There are two types of risks when making decisions: Systematic and Unsystematic. There are three main types of risk management: Financial risk management, Operational risk management, and Strategic risk management.

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