Centurion University of Technology and Management Odisha

CHOICE BASED CREDIT SYSTEM

COURSE STRUCTURE & SYLLABUS

BASKET - I

School of Engineering & Technology

2018

BASKET - I
(Basic Sciences)

Course Code	*Course Title*	*Course Type*	*Credits*	*Prerequisite*	*Department Offering*
FCBS0101	*Environmental Science*	*Theory*	*3*	*Nil*	*Chemistry*
FCBS 0102	*Differential Equations*	*Theory*	*3*	*Nil*	*Mathematics*
FCBS 0103	*Linear Algebra & Vector Calculus*	*Theory*	*3*	*Nil*	*Mathematics*
FCBS 0104	*Integral Transform*	*Theory*	*3*	*Nil*	*Mathematics*
FCBS 0105	*Complex Analysis*	*Theory*	*3*	*Nil*	*Mathematics*
FCBS0106	*Discrete Mathematics*	*Theory*	*3*	*Nil*	*Mathematics*
FCBS0107	Calculus	*Theory*	*3*	*Nil*	*Mathematics*
FCBS0108	Probability & Statistics	*Theory*	*3*	*Nil*	*Mathematics*
FCBS0109	Numerical Methods	*Theory*	*3*	*FCBS0102* Differential Equations	*Mathematics*
FCBS0401	*Applied Analytical Chemistry*	*Theory + Practice*	3	*Nil*	*Chemistry*
FCBS0402	*Industrial Chemistry*	*Theory + Practice*	3	*Nil*	*Chemistry*
FCBS0403	*Applied Engineering Materials*	*Theory + Practice*	3	*Nil*	*Chemistry*
FCBS0404	*Electricity and Magnetism*	*Theory + Practice*	*4*	*Nil*	*Physics*
FCBS0405	*Basic Mechanics and Properties of Matter*	*Theory + Practice*	*4*	*Nil*	*Physics*
FCBS0406	*Optics and Optical Fibres*	*Theory + Practice*	*4*	*Nil*	*Physics*

Environmental Science

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Environmental Science	FCBS0101	Theory	3	Nil

Course Objective:

- *To understand the concept of multi-disciplinary nature of Environmental Science where different aspects are dealt with a holistic approach.*
- *Students will develop a sense of community responsibility by becoming aware of environmental issuesin the larger social context.*
- *One must be environmentally educated.*

Learning Outcome:

- *Understand the natural environment and its relationships with human activities.*
- *Characterize and analyze human impacts on the environment.*
- *Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.*
- *Design and evaluate strategies, technologies and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I

Environment and its multidisciplinary nature; Need for public awareness; Renewable and non renewable resources–forest, water, mineral, land, food and energy resources; Structure and function of ecosystems of forest, grass land, desert and aquatic types.

MODULE -II

Biodiversity and its conservation: Biodiversity at global, national and local levels; Threats to biodiversity - Habitat loss; wild life poaching and man - wildlife conflicts; Endangered and endemic species; conservation measures.

Causes, effects and control measures of pollution, air, water and noise pollution; Nuclear hazards; solid-waste management–Causes, effects and control measures; Management of disasters due to natural causes of floods, earthquakes, cyclones and landslides.

MODULE-III

Social issues and the environment; Sustainable environment, Water conservation measures; Rain water harvesting; Resettlement and rehabilitation of people; Climate change and global warming; Acid rain; Ozone layer depletion; water land reclamation; Consumerism and waste products; Features of Environment Protection Act, Air pollution and Control of Pollution Acts; Water Pollution and its Control Act. Effects of Pollution explosion on environment and public health; Need for value education to Protect environment and resources.

Text Book: *Anubhav Kaushik & C.P. Kaushik : Environmental Studies-New age International Publishers.*

Reference Books:

1. *Benny Joseph : Environmental Studies-Tata Mac Graw Hill*
2. *E. Bharucha : Text book of Environmental Studies for Under graduate courses– Universities Press. (Book prepared by UGC Committee.*

Differential Equations

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Differential Equations	FCBS 0102	Theory	3	Nil

Course Objectives:

- *To understand most of the physical phenomena from Science and Engineering which are modeled by differential equations.*
- *To find and interpret the solutions of the ODE & PDE appearing in signal systems, dynamical systems, stability theory and a number of applications to scientific and engineering problems.*
- *To develop the ability to apply differential equations to significant applied and/or theoretical problems.*

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

- *Learn fundamental concepts of ODE & PDE theories and where and how such equations arise in applications to scientific and engineering problems.*
- *Be competent in solving linear/non-linear 1st & higher order ODEs & PDEs using analytical solution methods to obtain their exact solutions.*
- *Recognize the major classification of ODEs & PDEs and the qualitative differences between the classes of equations.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I ***(12 Hours)***

First Order Differential Equations: Separable Equations, Homogeneous & Non- homogeneous Equations, Exact Differential Equations, Integrating Factor, Linear Differential Equations, Bernoulli Equation.

MODULE-II ***(15 Hours)***

Second & Higher Order Linear Differential Equations: Linear Dependence and Independence of Solutions, Wronskian, Constant Coefficient Homogeneous Equations, Cauchy-Euler Equation, Nonhomogeneous Equations, Method of Variation of Parameter, Method of Inverse Operator, Legendre Equation.

MODULE-III ***(15Hrs)***

Partial Differential Equation of First Order, Linear and Non-linear Partial Differential Equations, Charpit's Method, Homogeneous and Non-homogeneous Linear Partial Differential Equations with Constant Coefficients, Cauchy Type Differential Equation.

Text Book*:*

1) Higher Engineering Mathematics by B.V. Raman Publisher: TMH
Chapters: 8 (8.1 to 8.10); 9 (9.1 to 9.7), 18 (18.1 to 18.8) ***Reference***
Book*: 1) Advanced Engineering Mathematics by P.V.O' Neil Publisher:*
Thomson

Linear Algebra & Victor Calculus

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Linear Algebra & Victor Calculus	FCBS 0103	Theory	3	Nil

Course Objectives:

- *To apply concepts of Linear Algebra & Vector Calculus to the problems related to models in work, circulation and flux Problems, hydrodynamics and fluid dynamics, electrical circuits, networking, linear programming, graph theory, computer graphics, cryptography, thermodynamics, construction of curves and surfaces through specified points etc.*
- *To solve the system of linear equations appearing in the problems of electrical engineering, mechanical engineering, applied mechanics etc.*
- *To apply vectors in higher dimensional space in experimental data, storage and warehousing, electrical circuits, graphical images, mechanical systems and in physics.*

Course Outcomes:

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

- *Use matrix operations to solve systems of linear equations and be able to determine the nature of the solutions.*
- *Compute with the characteristic polynomial, eigenvalues, eigenvectors and eigenspaces of a matrix as well as the geometric and the algebraic multiplicities of an eigenvalue and then to diagonalise that matrix.*
- *Determine the important quantities associated with scalar and vector fields.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I (14 Hours)

Linear Algebra, Basic Concepts, Linear System of Equations, Solution by Gauss Elimination, Conditions of Existence and Uniqueness of Solutions, Rank of a Matrix, Determinants and Cramer's Rule, Linear Dependence and Independence.

MODULE-II (14 Hours)

Eigen Values and Eigen Vectors, Basis, Symmetric, Skew-Symmetric and Orthogonal Matrices, Complex Matrices, Similarity of Matrices, Diagonalization.

MODULE-III (14 Hours)

Vector Differential Calculus: Vector Algebra, Inner Product, Vector Product, Vector & Scalar Functions and Fields, Derivatives, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.

Text Book*:*

1) Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley & Sons Inc-8th Edition Chapters: 6 (6.1 to 6.6); 7 (7.1, 7.3 to 7.5), 8 (8.1 to 8.4, 8.9 to 8.11) ***Reference Books****:*

1) Advanced Engineering Mathematics by P.V.O' Neil Publisher: Thomson

Mathematical Methods by Potter & Goldberg ; Publisher : PHI

Integral Transform

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Integral Transform	FCBS 0104	Theory	3	Nil

Course Objectives: *To describe the ideas of Fourier and Laplace Transforms and indicate their applications in the fields such as Signal & System, Digital Signal Processing, Image Processing, Theory of Control Systems, Differential Equations and many others.*

- *To use Fourier series for solving boundary value problems appearing in scientific & engineering problems.*
- *To get acquainted with the fact that the Laplace transform is related to the Fourier transform, but the Fourier transform expresses a function or signal as a series of modes of vibration (frequencies),whereas the Laplace transform resolves a function into its moments.*

Course Outcomes: *Upon successful completion of this course, the student will be able to:*

- *Obtain Laplace transform of simple functions, functions expressed in graphical form, integrals and derivatives.*
- *Solve differential & integral equations with initial conditions using Laplace transform.*
- *Compute the Fourier series representation of a periodic function, in both exponential and sine-cosine forms.*
- *Evaluate the Fourier transform of a continuous function and be familiar with its basic properties.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I (16 Hours)

Laplace Transforms, Transforms of Derivatives and Integrals, Derivatives and Integrals of Transforms, Shifting Properties, Unit Step Function, Dirac's Delta Function, Convolution, Inverse Transforms, Solution to Differential Equation, Integral Equation.

MODULE-II (12 Hours)

Periodic Functions, Trigonometric Series, Fourier Series, Fourier Expansion of Functions of any Period, Even and Odd Functions, Half Range Expansions,

MODULE-III (14Hrs)

Fourier Integrals: Fourier Sine Integral, Fourier cosine Integral.Fourier Transforms: Fourier Sine Transform, Fourier Cosine Transform.

Text Book:

Advanced Engineering Mathematics by E.Kreyszig
Publisher: Johnwilley& Sons Inc-8th Edition Chapters:
5 (5.1 to 5.6); 10 (10.1 to 10.4, 10.8, 10.9) ***Reference***
Books*:*

1) Advanced Engineering Mathematics by P.V.O'Neil .Publisher: Thomson
2) Higher Engineering Mathematics by B.V.Raman .Publisher: TMH

Complex Analysis

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Complex Analysis	FCBS 0105	Theory	3	Nil

Learning Objectives:

- *To understand the application of Complex Analysis to Two-Dimensional problems in Physics including Hydrodynamics and Thermodynamics and also in Engineering fields such as; Nuclear, Aerospace, Mechanical and Civil engineering, signal processing & communications.*
- *To acquire the skill of contour integration to evaluate complicated real integrals appearing in Engineering problems via residue calculus.*

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

- *To get equipped with the understanding of the fundamental concepts of functions of a complex variable along with the concepts of analyticity, Cauchy-Riemann relations and harmonic functions.*
- *Evaluate complex contour integrals applying the Cauchy integral theorem, Cauchy integral formula and Residue theorem.*
- *Illustrate the applications of the calculus of residues in the evaluation of real integrals.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I (14 Hours)

Complex Analysis: Analytic Function, Cauchy-Riemann Equations, Laplace Equation, Harmonic Function, Linear Fractional Transformation.

MODULE-II (14 Hours)

Parametric representation , Line Integral in the Complex plane, Cauchy's Integral Theorem, Cauchy's Integral Formula, Derivatives of Analytic Function.

MODULE-III (14Hrs)

Power Series, Taylor's Series, Maclaurin Series, Laurent's Series, Singularities and Zeroes, Residue Theorem, Residue Integration Method, Evaluation of Real Integrals.

Text Book*:*

1) Advanced Engineering Mathematics by E. Kreyszig Publisher: Johnwilley & Sons Inc-8th EditionChapters:12 (12.1 to 12.4 ,12.9) ; 13, 14 (14.2,14.4) & 15.

Reference Books*:*

1) Advanced Engineering Mathematics by P.V. O'Neil Publisher: Thomson

2) Fundamentals of Complex Analysis (with Applications to Engineering and Science) by E.B. Saff & A.D. Snider Publisher: Pearson

Discrete Mathematics

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Discrete Mathematics	FCBS 0106	Theory	3	Nil

Learning Objectives:

- *To learn a particular set of mathematical facts and to apply their applications in many subjects of Computer Science and Engineering such as Cryptography, Theory of Computation & Data Networking.*
- *To understand mathematical reasoning in order to read, comprehend and construct mathematical arguments as well as to solve problems, occurred in the development of programming languages.*
- *To work with discrete structures such as graphs to study the structure of the world wide web, to model a computer network and to find the shortest path between two places in a transportation network.*

Course Outcomes: *Upon successful completion of this course, the student will be able to:*

- *Evaluate elementary mathematical arguments and identify fallacious reasoning.*
- *Apply the logical structure of proofs and work symbolically with connectives and quantifiers to produce logically valid, correct and clear arguments.*
- *Reformulate statements from common language to formal logic. Apply truth tables and the rules of propositional and predicate calculus.*
- *Model and solve real-world problems using graphs, both quantitatively and qualitatively.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I (12 Hours)

Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Recurrence Relations, Solving Linear Recurrence Relations.

MODULE-II (16 Hours)

Relations and its properties, Representation of Relations, Closure of Relations, Equivalence Relations and Partitions, Partial Ordering, POSet, Hasse Diagram, Maximal & Minimal elements of a Poset, Supremum & Infimum of a Poset, Lattice, Basic properties of Lattices.

MODULE-III (14Hrs)

Introduction to Graph Theory, Graph terminology, Representation of graphs, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths, Planar graph, Graph Coloring, ***Text Books****:*

1 *Discrete Mathematics and its Applications by K.H.Rosen Publisher: TMH, Sixth Edition Chapters:1(1.1 to 1.5) ; 6 (6.1, 6.2) ; 7; 8(8.1 to8.5, 8.7, 8.8)*

2 *Elements of Discrete Mathematics by C.L.liu& D.P. Mohapatra Publisher: TMH, Third Edition Chapter: 11 (11.1 to 11.4)* ***Reference Books****:*

Discrete and Combinatorial Mathematics by R.P.Grimaldi Publisher: Pearson

Discrete Mathematics and Applications by Thomas Koshy Publisher: Elsevier

Discrete Mathematical Structures by B. Kolman, R.C. Busby & S. Ross Publisher: PHI

Calculus

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Calculus	FCBS0107	Theory	3	Nil

Objective

- To study how things change. It provides a framework for modeling systems in which there is change, and a way to deduce the predictions of such models.
- To construct a relatively simple quantitative models of change, and to deduce their consequences.
- The fundamental idea of calculus is to study change by studying "instantaneous" change, by which we mean change over tiny interval of time.

Learning Outcome

Upon successful completion of this course, students will be able to:

- Understand the importance of linear functions in mathematics.
- Understand the major problems of differential and integral calculus.
- Understand and recognize other important classes of functions (such as trigonometric and rational functions), and be able to use calculus with these functions.

Evaluation Systems

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I **(6 Hours)**
Asymptotes

MODULE-II **(6 Hours)**
Curve Tracing

MODULE-III **(6 Hours)**
Curvature

MODULE-IV **(6 Hours)**
Reduction Formulae

MODULE-V **(6 Hours)**
Vector Integral Calculus: Line Integrals.

MODULE-VI **(6 Hours)**
Surface Integrals, Green's Theorem

MODULE-VII **(6 Hours)**
Volume Integrals, Gauss's Theorem, Stokes' Theorem (without proof).

Text Books:

1) A Text book of Calculus Part-III : Shantinarayan
   Chapters: 1 (Art 1 & 3), 3(Art 7, 8, 9)
2) A Text book of Calculus Part – II : Shantinarayan
   Chapter: 8 (Art. 24, 25, 26),
3) A Text book of Calculus Part – II : Shantinarayan
   Chapter: 10 (Art.33, 34, 35, 36, 37)
4) A Textbook of Vector Calculus by Shanti Narayan & P. K. Mittal, S. Chand & Co. , 2003
   Chapters: 7 (7.1 to 7.6, 7.8 & 7.11)

Probability & Statistics

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Probability & Statistics	FCBS0108	Theory	3	Nil

Objective

- To translate real-world problems into probability models.
- To motivate in students an intrinsic interest in statistical thinking.
- To recognize the role of and application of probability theory, descriptive and inferential statistics in many different fields of engineering.

Learning Outcome

Upon successful completion of this course, students will be able to:

- Define and illustrate the concepts of sample space, events and compute the probability and conditional probability of events.
- Define, illustrate and apply the concepts of discrete and continuous random variables, the discrete and continuous probability distributions.
- Define, illustrate and apply the concept of the expectation to the mean, variance and covariance of random variables.
- Compute probabilities based on practical situations using the Binomial, Poisson and Normal distributions.

Evaluation Systems

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I **(6 Hours)**

Probability: Sample space and Events, Principles of Counting, Classical definition of probability.

MODULE-II **(6 Hours)**

Axioms of probability, Elementary theorems, Addition and Multiplication rules, Conditional probability.

MODULE-III **(6 Hours)**

Probability Distributions: Discrete and Continuous Random Variables.

MODULE-IV **(6 Hours)**

Probability Density and Distribution functions, Mean and Variance of Distributions. Binomial Distribution.

MODULE-V **(6 Hours)**

Poisson Distribution, Normal Distributions, Poisson and Normal Distributions as Limiting forms of Binomial Distribution.

MODULE-VI **(6 Hours)**

Statistics: Random Sampling, Population and Sample, Sample Mean and Variances.

MODULE-VII **(6 Hours)**

Point and Interval Estimations, Confidence Intervals, Fitting Straight Lines, Correlation and Regression.

Text Book:

1) Advanced Engineering Mathematics by E. Kreyszig
   Publisher: John Willey & Sons Inc-8th Edition
   Chapters: 22(22.1 to 22.8), 23(23.1 to 23.3, 23.9, 23.10)

Reference Books:

1) Statistical Methods By S.P. Gupta (31st Edition); Publisher: Sultan Chand & Sons.
2) Mathematical Statistics By S.C. Gupta & V.K. Kapur (10th Edition); Publisher: Sultan Chand & Sons.

Numerical Methods

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Numerical Methods	FCBS0109	Theory	3	FCBS0102 Differential Equations

Objective

- To understand the limitations of analytical methods and the need for numerical methods and the ability to apply these numerical methods to obtain the approximate solutions to engineering and mathematical problems.
- Ability to decide and to derive appropriate numerical methods for approximating the solutions of various types of problems in engineering and science and analyze the error incumbent in any such numerical approximation.
- Ability to report analysis, solution and results in a standard engineering format.

Learning Outcome

Upon successful completion of this course, students will be able to:

- Perform error analysis to select an appropriate numerical model and to estimate errors in numerical solution of a given problem.
- Derive a variety of numerical algorithms/methods & compare the viability of different approaches to the numerical solutions of various mathematical problems arising in roots of linear and non-linear equations, interpolation and approximation, numerical differentiation and integration, system of linear algebraic equations and differential equations.
- Analyze and evaluate the accuracy of common numerical methods.

Evaluation Systems

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Midterm Test	*30*	Written examination
	Assignment	*05*	Report and Presentation
	Attendance	*05*	Attendance percentage
	Total	***40***	
External Examination		***60***	Written examination
Total		*100*	

MODULE-I **(6 Hours)**

Approximation and round of errors, Truncation error and Taylor's series, Roots of equation using Bisection Method.

MODULE-II **(6 Hours)**

Roots of equation using the false-position method, fixed point iteration, Newton-Raphson method, Secant method.

MODULE-III **(6 Hours)**

Solution of System of Linear algebraic equations: Gauss-Seidel method, Lagrange Interpolation.

MODULE-IV **(6 Hours)**

Newton divided difference interpolation, Inverse Interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.

MODULE-V **(6 Hours)**

Numerical Differentiation, Numerical integration by the trapezoidal rule.

MODULE-VI **(6 Hours)**

Numerical integration by the Simpson's rules, Gauss quadrature rule.

MODULE-VII **(6 Hours)**

Solution of Ordinary Differential Equations: Euler's method, Improvement of Euler's method, Runge-Kutta methods.

Text Book:

1) Advanced Engineering Mathematics by E. Kreyszig
   Publisher: John Willey & Sons Inc-8th Edition
   Chapters: 17 (17.1 to 17.3, 17.5), 18 (18.3), 19 (19.1)

Reference Books:

1) Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar & R.K. Jain; New Age International Publishers.
2) Introductory Methods of Numerical Analysis by S.S. Sastry; Third Edition, Prentice Hall India.

Applied Analytical Chemistry

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Applied Analytical Chemistry	FCBS0401	**Theory + Practice**	3	Nil

Course Objective

- *The aim of this course is to give students that are going to carry out an experimental work the necessary comprehension in analytical chemistry.*
- *The course will also provide the student with knowledge to be able to understand and critically evaluate experimental data produced by others.*

Learning outcome

- *Explain fundamental principles for environmental analytical methods (titration, electrochemistry, instrumentation and basic parameters of water, soil, fuel etc)*
- *Point out suitable analytical techniques for analyzing a specific compounds in an environmental matrix*
  Point out suitable techniques for sampling and handling of environmental samples
- *Apply quality control on chemical analysis and laboratory work and explain its importance*
- *Plan and carry out laboratory experiments, including data analysis and conclusions*
- *Describe simple approaches for troubleshooting*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination	*End Sem*	***30***	Written examination
	Practice	***20***	Experiment followed by Viva
Total		*100*	

Module-1

Water Analysis: Importance of water, different types of water, sources and uses of water, types of water pollutants and domestic and industrial significance of analysis of water. Removal of hardness by Lime-Soda, Zeolite and Ion exchange methods. Removal of DO and dissolved CO_2 from water by De-aeration method. Desalination of brackish water by Reverse osmosis and electro dialysis process. Water disinfection by bleaching powder, liquid Cl_2, and chloramine.

Practice:

1. Determination of total hardness by EDTA method, total dissolved solids, total alkalinity
2. Determination of Turbidity by nephloturbidity meter, pH, Conductivity.
3. Determinations of BOD, COD, DO.

NB: The above parameters can also be determined by using water kits and the results are to be compared with those obtained manually.

Module-2

Soil Analysis: Composition of rocks and minerals, soil profile and properties.

Practice:

1. Determination of texture of soil.
2. Determination of moisture content in a soil sample, pH, electrical conductivity,
3. Determination of water holding capacity of soil.
4. Measurement of Calcium and Magnesium Using EDTA methods.

Module-3

Chemistry of fuels: Classification of fuels, composition and properties of Petroleum, LPG, Water gas, producer gas, CNG. Knocking – Mechanism of knocking, harmful effects, Anti knocking agents – TEL, Catalytic converters – Principle & working, Unleaded petrol, Power alcohol & Biodiesel. Photovoltaic cells - construction & working of a PV cell **Practice:**

1. Proximate analysis of fuel (Coal, biomass etc.) Moisture, Volatile content, Ash, fixed carbon
2. Testing of fuel properties of the plastic oil and bio diesel: Specific gravity by picnometer, flash point and fire point by pesky-Marten flash point apparatus, viscosity by Redwood viscometer, calorific value by bomb calorimeter

Industrial Chemistry

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Industrial Chemistry	FCBS0402	Theory + Practice	3	Nil

Course Objective

Students may also explore in depth specialized areas of chemistry of materials, including ores, metals, cemenas well as dyes, oils, soaps

- *Introduce the students to industrial processing principles as applicable to chemical and allied industries.*
- *Provide the students with the knowledge of how raw materials are sourced for various chemical industries and how these materials are processed.*
- *Provide students with advanced technical skills in Chemical Engineering that will enable them to (a) translate fundamental discoveries in materials and other high technology areas to commercial exploitation, and (b) adapt readily to the challenges presented in a diverse range of industrial sectors that can benefit from process engineering approaches.*

Learning outcome

- *Appreciate better their future roles as chemists in Industrial establishments*
- *Be able to explain the origin of raw materials used in the chemical and allied industries*
- *Have a good understanding of how chemical raw materials are processed into finished*
- *products.*
- *Graduates find employment in, quality control, oil and petroleum industry, textile industry, dyes and paints industry, cement industry, just to name a few.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination	*End Sem*	***30***	Written examination
	Practice	***20***	Experiment followed by Viva
Total		*100*	

Module 1: Preparation of soap, dyes and oil analysis :

Introduction: Types of soap (soft and hard soap), methods of preparation of soap, mechanism, difference between fats and oils**,** physical properties of fats and oil, general introduction to chemistry of dye, various example of dyes, types of dyes.

Practice:

- Preparation of soap by saponification
- Determination of the properties different type of soap
  1. pH test
  2. Foam test
- Hard water test
- Determination of iodine number of oil
- Preparation of dyes (azo dyes): 2- naphthol + 4 - nitro aniline: salicylic acid + 4- nitro aniline
- Preparation of Phenyle.

Applications: Effect of water hardness in cleansing action of soap. Application of dyes to cloth

Module 2: Metals estimation from ores

Introduction: General introduction on ores, types of ore, important ore minerals, application of ores.

Practice:

- Estimation of Cu in copper ore
- Determination of Fe as ferrous iron in an ore sample
- Determination of Zn in Zinc ore by EDTA complex metric method

Module 3: Analysis of cement

Introduction: what is cement? types of cement, composition of cement, preparation of cement, applications.

Practice:

- Estimation of calcium in Portland cement
- Cement hydration and pH evaluation during caving
- To check the quality of cement (colour, texture, smell test, float test, shape test and strength test)

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Applied Engineering Materials

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Applied Engineering Materials	FCBS0403	Theory + Practice	3	Nil

Course Objective

- *To understand the importance of the chemical approach to nanomaterials*
- *To study the preparation, analysis and applications of metal nanoparticles*
- *To develop an understanding of conjugated polymers and their applications*
- *To understand how polymer composition and architecture imparts unique properties and behavior*
- *To study organic-inorganic hybrid materials(COMPOSITES) and how the incorporation of metals in the polymer architecture leads to new properties and applications*

Learning outcome

- Know what it takes to have a career in nanotechnology
- Understand the need to increase Nanotechnology awareness
- Understand the definition of Nanotechnology
- Know the processing of Nanoparticles and Nanomaterials Know the application of Nanotechnology and nanomaterials

Evaluation System

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination			
	End Sem	*30*	Written examination
	Practice	*20*	Experiment followed by Viva
Total		*100*	

Module 1: Nano Materials:

Introduction, nano scale, applications in various fields**.**

Practice:

- Synthesis of Ag, Au nano particles by wet chemical methods. Synthesis of ZnO Nanoparticles by Precipitation Method Synthesis of Cu nano particles Sonochemical method.
- Synthesis of Fe nano particles Co-precipitation method.
- Thickness measurement by sol-gel process of coating.

Module 2: Polymers

Introduction, types of polymers, Polymerisation mechanisms.

Practice:

- Synthesis of Thiokol Rubber
- Synthesis of a Rubber Ball from Rubber Latex
- Synthesis of Polystyrene (PS)
- Synthesis of Polymethyl Methacrylate (PMMA) Synthesis of Nylon-6:6.
- Determination of molecular weight of polymers by visometry method.

Module 3: Composites

Introduction :Biopolymers or synthetic polymers reinforced with natural or biofibers(termed as bio composites) as a viable alternative to glass fibre composites.Biocomposites‟ refers to those composites that can be employed in bioengineering.Biocomposites are composite materials, that is, materials formed by a matrix (resin) and a reinforcement of natural fibers (usually derived from plants or cellulose). Bio composites are the combination of natural fibers (biofibers) such as wood fibers (hardwood and softwood) or non - wood fibers (e.g., wheat, kenaf, hemp, jute, sisal, and flax) with polymer matrices from both renewable and non-renewable resources.

Practice:

- Synthesis of bio composite materials by using jute fibres and wood fibres

Electricity and Magnetism

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Electricity and Magnetism	FCBS0404	Theory + Practice	4	Nil

Course Objective

- *To understand electric circuit components and their use.*
- *To learn and verify the fundamental laws of electricity, learn how to use certain electrical devices. Understanding magnetic properties of matter and performing experiments to realize magnetism.*

Learning outcome

- *Realizing the importance and use of electrical components in a circuit.*
- *Learning how to do different connections and their purpose.*
- *Understanding magnetism of matter and its applications*

Evaluation Criteria

Internal Examination	***Component***	***% of Marks***	***Method of Assessment***
	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination			
	End Sem	*30*	Written examination
	Practice	*20*	Experiment followed by Viva
Total		*100*	

Practice I Theory:

Electric field, Potential, EMF, capacitance, resistance, series connection, parallel connection, Kirchhoff's laws, RC circuits, LC circuits.

Lab:

1. Use a Multi-meter for measuring (a) Resistance, (b) AC and DC Voltages, (c) DC Current, (d) Capacitance and (e) Checking electrical fuses.
2. To determine an unknown Low Resistance using Potentiometer. 3. To determine an unknown Low Resistance using Carey Foster's Bridge.

Practice II

Theory: Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

Lab:

1. To verify the Superposition, and Maximum power transfer theorems.
2. To determine self-inductance of a coil by Anderson's bridge.
3. To study response curve of a Series LCR circuit and determine its (a) Resonant Frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
4. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.

PRACTICE III

Theory: Magnetic Properties of Matter: Magnetization vector (**M**). Magnetic Intensity (**H**). Magnetic Susceptibility and permeability. Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis. Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field.

Lab:

2. To study the induced e.m.f. as a function of the velocity of the magnet.
3. Measurement of field strength B and its variation in a solenoid.
4. Determination of □□□ ratio.

Text Book:

1. *Electricity and Magnetism By K. K. Tiwari, S. Chand Publishing References:*
2. *Electricity and Magnetism, By M. C. Saxena, Satya Prakash, V. P. Arora, Publisher: Pragati Prakashan*
3. *Introduction to Electrodynamics, by David J. Griffiths Prentice-Hall; 3 edition (2011) 4. Electricity and Magnetism by - D. C. Tayal, Himalaya Publishing, 2009.*

Basic Mechanics and Properties of Matter

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Basic Mechanics and Properties of Matter	FCBS0405	Theory + Practice	4	Nil

Course Objective

- *To give the students overall idea about material properties and also hands on experience to measurethem.*
- *To make them realize the applications of material properties.*
- *To expose them to phenomena like hydrostatics, elasticity, viscosity, surface tension and theirapplications in various places.*
- *Encouraging them to build simple models to explain the mechanical properties.* **Theory:**

Learning outcome

- *To understand material properties and perform experiments on them.*
- *To understand the applications of material properties in real life.*
- *To be able to make small models for explain few mechanical properties.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination			
	End Sem	*30*	Written examination
	Practice	*20*	Experiment followed by Viva
Total		*100*	

Elasticity: Elastic constants, Relation among elastic constants, torsion of right circular cylinder, **b**ending of beams, Vibration of loaded cantilever.

Lab:

1. Young's modulus by single/double cantilever
2. Young's modulus by Searle's method
3. Rigidity modulus using Barton's apparatus
4. Poisson's ratio

Practice II Theory:

Hydrostatics: hydrostatic force on a body, buoyancy, metacentric height, hydrostatic pressure, pressure measurement: manometer

Viscosity: Viscosity of fluids,Stoke's law, terminal velocity, Poiseulle's equation, Searle's viscometer.

Surface tension & surface energy: Pressure difference across curved liquid surface. **Lab:**

1. Viscosity by Stokes method
2. Viscosity by Poiseulle's method
3. Metacentric height of floating body
4. Measurement of Pressure by manometer
5. Surface tension by capillary rise method
6. Determination of surface tension by Quincke's method

Practice III:

Basic Mechanics

Theory: Kinematics and Kinetics, Effort amplification using levers and pulleys, Friction, Laws of friction.

Rotational Motion: Moment of Inertia, Theorem of Parallel and Perpendicular axes. Moment of inertia of circular disc.

Lab:

1. Effort-output ratio using combination of pulleys
2. Verification of laws of static and dynamic friction
3. Moment of inertia of fly wheel

Text Book:

1. Elements of Properties of Matter, Dec 2010 by D.S. Mathur, S.Chand (G/L) & Company Ltd Reference Books:

1. *A Text Book of Fluid Mechanics by R.K. Bansal, Laxmi Publishers, 2005*
2. *Engineering Mechanics Statics and Dynamics by A. K. Tayal, Umesh Publications.*

Optics and Optics Fibre

Subject Name	Code	Type of course	T-P-Pr (Credit)	Prerequisite
Optics and Optics Fibre	FCBS0406	Theory + Practice	4	Nil

Course Objective

To understand optical phenomena.

- *To understand different light sources and their use*
- *Understand designing of microscope and artificial light sources*
- *Understanding optical fiber and its applications*

Learning outcome

- *Students should understand optical phenomena.*
- *Students should learn about different light sources and their use*
- *Students should be able to understand optical fiber principle, operations and its applications.*

Evaluation System

	Component	***% of Marks***	***Method of Assessment***
Internal Examination	Internal	*20*	Written examination
	Assignment	*30*	Report and Presentation
External Examination	*End Sem*	*30*	Written examination
	Practice	*20*	Experiment followed by Viva
Total		*100*	

Practice I

Theory: Reflection and refraction of light. Mirror formula, lens maker's formula. Refraction through a prism. Dispersion, light sources: Principle and operations of sodium lamp, mercury lamp and LASER.

Lab:

1. To determine refractive index of the Material of a prism using sodium source.
2. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
3. To determine the refractive index of glass slab using travelling microscope.
4. Designing of a compound microscope.

Practice II

Theory: Interference. Young's experiment, conditions for interference, Intensity distribution of fringes, Interference in thin films, Newton's rings.

Diffraction: types of diffraction, Fraunhofer diffraction at a sinle slit, diffraction at N-parallel slits and plane diffraction grating.

Polarization: Polariser and analyser, optical rotation and Polarimeter

Lab:

1. Determination of wavelength of light by Newton's ring method.
2. Determination of wavelength of LASER source by diffraction grating method
3. Thickness of thin paper by wedge-shaped films
4. Dispersive power and resolving power of a plane diffraction grating.
5. Polarimetry

Practice-III

Theory: Optical properties–scattering, refraction, reflection, transmission & absorption. Introduction, principle of Laser, stimulated and spontaneous emission, Coherence (temporal and spatial) Ruby Laser, Application of Lasers.

Optical Fibres: Introduction, numerical aperture, step index and graded index fibres, attenuation &dispersion mechanism in optical fibers (Qualitative only), application of optical fibres, optical communication (block diagram only)

Lab:

1. Measurement of attenuation and bending losses of an optical fibre.
2. Measurement of numerical aperature of a optical fibre
3. Study of spatial and temporal coherence of LASER
4. Making of a light guide

Text Book:

1. *A Text Book of Optics by M.N. Avadhanulu, Brij Lal, N. Subrahmanyam, S Chand; 23rd Rev. Edn.*

References:

2. *Optics by Ajoy Ghatak, McGraw Hill Education; 5 edition*
3. *Physics-I for engineering degree students byB.B. Swain and P.K.Jena.*
4. *Concepts in Engineering Physics byI Md. N. Khan.*