BMS Institute of Technology & Management

(An Autonomous Institution affiliated to VTU, Belagavi)

Yelahanka, Bengaluru- 560 119

Bachelor of Engineering (B.E.)

Scheme and Syllabus of I & II Semesters
2024 Scheme

AY 2024-25

List of First year Courses for the Academic Year 2024-2025

Sl. No	Course Code	Name of the Course
Applied Science Courses		
1.	BMATCS11	Multivariate Calculus and Linear Algebra
2.	BMATEE11	Calculus and Ordinary Differential Equations
3.	BMATMC11	Calculus and Linear Algebra
4.	BMATCS21	Ordinary Differential Equations and Numerical Methods
5.	BMATEE21	Numerical Methods and Linear Algebra
6.	BMATMC21	Numerical Techniques and Differential Equations
7.	BPHYCS12/22	Quantum Computing and Photonics
8.	BPHYEE12/22	Optoelectronics and Electrodynamics
9.	BPHYME12/22	Material Science and Metallurgy
10.	BPHYCV12/22	Materials and wave properties for structural applications
11.	BCHECS12/22	Materials Chemistry for Energy and Data Processing
12.	BCHEEE12/22	Materials Chemistry for Energy and Display Systems
13.	BCHEME12/22	Chemistry of Engineering Materials
14.	BCHECV12/22	Chemistry of Structural and Functional Materials
Professional Core Courses		
15.	BPOP13/23	Principles of Programming using C
16.	BCED13/23	Computer Aided Engineering Drawing
17.	BBEE13/23	Basic Electronics
18.	BEEE13/23	Elements of Electrical Engineering
19.	BEME13/23	Elements of Mechanical Engineering
20.	BEEM13/23	Elements of Engineering Mechanics
Engineering Science Courses		
21.	BESC14A/24A	Introduction to Civil Engineering
22.	BESC14B/24B	Introduction to Electrical Engineering
23.	BESC14C/24C	Introduction to Electronics Engineering
24.	BESC14D/24D	Introduction to Mechanical Engineering
25.	BESC14E/24E	Introduction to C Programming
Emerging Technology Courses		
26.	BETC15A/25A	Introduction to IoT
27.	BETC15B/25B	Introduction to Cyber Security
28.	BETC15C/25C	Introduction to Cloud Computing
29.	BETC15D/25D	Rapid Prototyping
30.	BETC15E/25E	Introduction to Robotics
31.	BETC15F/25F	Introduction to Green Buildings
32.	BETC15G/25G	Introduction to Intelligent Transportation Systems
33.	BETC15H/25H	Introduction to Bio Sensors

34.	BETC15I/25I	Introduction to Nano Technology
35.	BETC15J/25J	Introduction to Renewable Energy Systems
36.	BETC15K/25K	Introduction to Electric Vehicles
Programming Language Course		
37.	BPLC15A/25A	Introduction to Web Programming
38.	BPLC15B/25B	Introduction to Python Programming
39.	BPLC15C/25C	Basics of JAVA programming
40.	BPLC15D/25D	Introduction to C++ Programming
Humanities and Social Science Courses		
41.	BENGL16	Communicative English
42.	BPWSL26	Professional Writing Skills in English
43.	BSKK17/ 27	Samskrutika Kannada
44.	BBKK17/27	Balake Kannada
45.	BICO17/27	Indian Constitution
46.	BIDTL18/28	Innovation and Design Thinking
47.	BSFH18/28	Scientific Foundations of Health

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DEPARTMENT OF MATHEMATICS

Choice Based Credit System (CBCS)

SEMESTER-I

MULTIVARIATE CALCULUS AND LINEAR ALGEBRA

(Common to CSE, AI&ML and CSBS Branches)

(Effective from the academic year 2024-25)

Course Code	**BMATCS11**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credit distribution (L:T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course objectives:

The goal of the course Multivariate Calculus and Linear Algebra (24MATCS11) is to

- **Know** the importance of partial derivatives in computer science and engineering.
- **Apply** the knowledge of integral calculus for the analysis of wave propagation in various media.
- **Get familiarized** with the concepts of linear algebra, vector space and linear transformation which have applications in the field of engineering and computer graphics.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample strategies which teachers can use to accelerate the attainment of the various courseoutcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with engineering studies and provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short video lectures in the following ways as:
   - An introduction to new topics (pre-lecture activity).
   - a revision of topics (post-lecture activity).
   - additional examples (post-lecture activity).
   - additional material of challenging topics (pre-and post-lecture activity).

Module-1: Partial Derivates (8 hours)
Introduction, Partial differentiation-problems, Homogeneous functions, Euler's theorem for homogeneous functions-derivation and problems (only first order), total derivatives, differentiation of composite functions, Jacobian-problems, Maxima and minima for a function of two variables-problems. **Applications:** Computing errors and approximation. **(RBT Levels: L1, L2 and L3)**
Module-2: Multiple Integrals (8 hours)
Introduction**,** Evaluation of double and triple integrals, Evaluation of double integrals by changing the order of integration, Evaluation of double integrals by changing into polar coordinates, Applications to find area by double integral and volume by triple integral, Problems. Beta and Gamma functions, Definitions, properties, Relation between Beta and Gamma functions, Problems. **Applications:** Evaluating mass, moments and center of mass of an object. **(RBT Levels: L1, L2 and L3)**
Module-3: Linear Algebra-I (8 hours)
Introduction, Elementary row transformation of a matrix, Rank of a matrix, Consistency and Solution of system of homogeneous & non-homogeneous linear equations - Gauss-elimination method, Gauss-Jordan method, LU decomposition method and Gauss-Seidel iterative method. Problems. **Applications:** Traffic Network and Network Analysis **(RBT Levels: L1, L2 and L3)**
Module-4: Linear Algebra-II (8 hours)
Introduction, Eigenvalues and Eigenvectors of a matrix, Cayley-Hamilton theorem (Statement only)-problems, Rayleigh's power method-problems, Diagonalization of matrices of order 2, Quadratic forms, Reduction to canonical form, Nature, Rank, Index and Signature of quadratic forms, Problems. Principal Component Analysis & problems to find the principal components. **Applications:** Data processing. Cryptography **(RBT Levels: L1, L2 and L3)**
Module-5: Linear Algebra-III (8 hours)
Introduction**,** Definition and examples, Subspace and examples, Linear combinations, Linear span, linearly independent and dependent sets, Basis and dimension, Problems. Linear transformations, Definition and examples, Matrix of a linear transformation, Rank-Nullity theorem (Statement only), Problems. Inner product space, orthogonal and orthonormal sets, Problems. **Applications:** Image processing. Computer graphics **(RBT Levels: L1, L2 and L3)**

List of Laboratory experiments (1 hours/week): 10 lab sessions + 1 Lab Assessment

1	Finding partial derivatives and plotting solution graphs.
2	Finding Jacobian of a vector functions.
3	Evaluation of double and triple integrals.
4	Computation of area and volume.
5	Solution of system of linear equations.
6	Solution of system of linear equations using Gauss-Seidel iteration method.
7	Compute eigen values and eigen vectors, finding the largest eigen value by Rayleigh power method.
8	Diagonalization of square matrix.
9	Computation of basis and dimension of a vector space.
10	Computing inner product and orthogonality.

Suggested Software: MATLAB

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang:** "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference Books:

1. **Srimanta Pal & Subodh C.Bhunia**: "Engineering Mathematics", Oxford University Press,3rd Ed., 2016.
2. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
3. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics", McGraw Hill Book Co., New York, 6th Ed., 2017.
4. **James Stewart: "**Calculus", Cengage Publications, 7thEd., 2019.
5. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Course outcomes (COs):

At the end of the course the students will be able to:

CO1	Determine the rate of change of multivariate functions using partial differentiation.
CO2	Evaluate area and volume of a region with the help of double and triple integrals.
CO3	Solve the systems of linear equations using matrix theory.
CO4	Compute eigenvalues and eigenvectors of a matrix.
CO5	Examine the linear dependent & independent sets in the vector space, and linear transformation.
CO6	Execute the concepts of multivariate calculus and linear algebra using MATLAB.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**										
CO2	**3**	**1**										
CO3	**3**	**1**										
CO4	**3**	**1**										
CO5	**3**	**1**										
CO6					**2**							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

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DEPARTMENT OF MATHEMATICS

Choice Based Credit System (CBCS)

SEMESTER-II

ORDINARY DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

(Common to CSE, AI&ML and CSBS Branches)

(Effective from the Academic year 2024-25)

Course Code:	**BMATCS21**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credits distribution (L:T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course Objectives: The goal of the course Ordinary differential equations and numerical methods (24MATCS21) is to

- **Have an insight** into ordinary differential equations to solve problems arising in computer science engineering.
- **Develop** mathematical skills to solve algebraic, transcendental and ordinary differential equation problems numerically.
- **Familiarize** with modern mathematical tools like MATLAB.

Teaching-Learning Process

Pedagogy(General Instructions):

These are sample strategies which teachers can use to accelerate the attainment of various Courseoutcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and appliedmathematical skills.
2. State the need for Mathematics with engineering studies and provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, anddocumenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short video lectures in the following ways as:
   - an introduction to new topics (pre-lecture activity).
   - a revision of topics (post-lecture activity).
   - additional examples (post-lecture activity).
   - an additional material of challenging topics (pre-and post-lecture activity).
   - a model solution of some exercises (post-lecture activity).

Module – 1 Ordinary Differential Equations (ODEs) of first order (8 hours)

Introduction**,** Linear and Bernoulli's differential equations. Exact differential equations and equations reducible to exact differential equations- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$, Orthogonal trajectories.

Nonlinear differential equations: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations, problems.

Applications: Rate of Growth or Decay, Newton's law of cooling.

(RBT Levels: L1, L2 and L3)

Module – 2 Ordinary Differential Equations (ODEs) of higher order (8 hours)

Introduction, solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients $f(D)y = X$ using inverse differential operator $X = ke^{ax}$, $X = ksin(ax+b)$ *or* $kcos(ax+b)$ and X is a polynomial, Method of variation of parameters, problems.

solution of linear ODE with variable coefficients-Cauchy's and Legendre's differential equations, problems.

Applications: Pricing policy for production of goods, Population growth of two countries.

Module - 3 Numerical Methods -1 (8 hours)

Introduction, Finite differences, Interpolation- Newton's forward and backward interpolation formulae, Newton'sdivided difference formula, Lagrange's interpolation formula and Lagrange's inverse interpolation formula (formulae without proofs), problems.

Numerical integration: Trapezoidal rule**,** Simpson's $(1/3)^{rd}$ rule & Simpson's $(3/8)^{th}$ rule (without proofs), problems.

Applications: Estimating distance, velocity, area and volume.

(RBT Levels: L1, L2 and L3)

Module -4 Numerical Methods -2 (8 hours)

Introduction, Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector and Adams-Bashforth formulae (without proofs), problems.

Applications: Error Analysis.

(RBT Levels: L1, L2 and L3)

Module - 5 Numerical Methods -3 (8 hours)

Introduction, Numerical solution of simultaneous first order ODE- Runge-Kutta method of fourth order, Numerical solution of second order ODE - Runge-Kutta method of fourth order and Milne's predictor-corrector formula (only formulae), problems.

Numerical solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae), problems.

Applications: Chemical reaction.

(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (1 hour/week): 10 lab sessions + 1 Lab Assessment

1	Solution of first order differential equation.
2	Solution of differential equations with initial conditions.
3	Solution of homogeneous ordinary differential equations of higher order.
4	Solution of non-homogeneous ordinary differential equations of higher order.
5	Newton's forward and backward difference interpolation formula.
6	Numerical integration using Trapezoidal, Simpson's (1/3)rd and (3/8)th rules.
7	Solution of ODE of first order and first degree by Modified Euler's method.
8	Solution of ODE of first order and first degree by Runge-Kutta 4th order method.
9	Solution of algebraic and transcendental equations by Regula-Falsi method.
10	Solution of algebraic and transcendental equations by Newton-Raphson method.

Suggested software: MATLAB

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018.

Reference Books:

1. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
2. **N.P Bali and Manish Goyal:** "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
3. **C. Ray Wylie, Louis C. Barrett**: "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematics for Semester I and II", McGraw Hill Education (India) Pvt. Ltd, 2015.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program
-

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminar

Course outcomes (COs):

At the end of the Course, the student will be able to:

CO1	Solve higher order ordinary differential equations analytically.
CO2	Identify appropriate numerical methods to interpolate/extrapolate and integrate the given set of data points.
CO3	Solve ODE and algebraic/transcendental equations numerically.
CO4	Familiarize with modern mathematical tools using MATLAB.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**										
CO2	**3**	**1**										
CO3	**3**	**1**										
CO4					**3**							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

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DEPARTMENT OF MATHEMATICS
Choice Based Credit System (CBCS)
SEMESTER - I

CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS

(Common to ECE & EEE Branches)

(Effective from the Academic year 2024-25)

Course Code	**BMATEE11**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credits distribution (L: T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course objectives: The goal of the course Calculus and Ordinary Differential Equations (24MATEE11) is to

- **Familiarize** the importance of calculus associated with one variable and multivariable forElectrical and Electronics engineering.
- **Analyze** Electrical and Electronics engineering problems by applying Ordinary differential Equations.
- **Familiarize** with modern mathematical tools namely MATLAB.

Teaching-Learning Process
Pedagogy (General Instructions):
These are sample strategies which teachers can use to accelerate the attainment various Course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with engineering studies and provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways as:
    - an introduction to new topics (pre-lecture activity).
    - a revision of topics (post-lecture activity).
    - additional examples (post-lecture activity).
    - an additional material of challenging topics (pre-and post-lecture activity).
    - A model solution of some exercises (post-lecture activity).

Module-1: Calculus (8 hours)

Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms (formulae without proof), Problems.

Applications: Communication signals, Image processing.

(RBT Levels: L1, L2 and L3)

Module-2: Partial Derivatives (8 hours)

Introduction, Partial differentiation-problems, Homogeneous functions, Euler's theorem for homogeneous functions-derivation and problems (only first order), total derivative, differentiation of composite functions, Jacobians-problems, Maxima and minima for a function of two variables. Problems.

Applications: Errors and approximations

(RBT Levels: L1, L2 and L3)

Module-3: Vector Calculus (8 hours)

Introduction, Scalar and vector fields. Gradient, unit normal vectors, directional derivative, curl and divergence – physical interpretation, solenoidal and irrotational vector fields, problems, Vector identities – div (curl A), div (grad ϕ), curl (grad ϕ), div (grad ϕ), div (ϕ A) and curl (ϕ A),

Applications: Conservation of laws, Electrostatics, Analysis of streamlines.

(RBT Levels: L1, L2 and L3)

Module-4: Ordinary Differential Equations of first order (8 hours)

Introduction, Linear and Bernoulli's differential equations. Exact differential equation and equation reducible to exact- Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$. Orthogonal Trajectories, Newton's law of cooling, L-R and C-R circuits Problems.

Applications: Rate of Growth or Decay

(RBT Levels: L1, L2 and L3)

Module-5: Ordinary Differential Equations (ODE) of Higher Order (8 hours)

Introduction, solution of Homogeneous Linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficient $f(D)y = X$ using inverse differential operator $X = k\,e^{ax}$, $X = k\,sin(ax+b)$ *or* $k\,cos(ax+b)$and X is a polynomial, Method of variation of parameters, Problems. Solution of linear ODE with variable Coefficients-Cauchy's and Legendre's differential equations, Problems.

Applications: L-C-R series circuits

(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (1 hour/week): 10 lab sessions + 1 Lab Assessment

1	2D plots for Cartesian and polar curves.
2	Finding the curvature and radius of curvature of a given curve.
3	Patial derivatives and plotting the graph.
4	Jacobian of a function.
5	Gradient of a scalar.

6	Divergence and curl of a vector.
7	Solution of first order differential equation and plotting the solution curves.
8	Solution of differential equations with initial conditions.
9	Solution of homogeneous ordinary differential equations of higher order.
10	Solution of non-homogeneous ordinary differential equations of higher order.

Suggested Software: MATLAB

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books:

1. **Srimanta Pal & Subodh C.Bhunia**: "Engineering Mathematics", Oxford University Press, 3rd Ed., 2016.
2. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
3. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics", McGraw HillBook Co., New York, 6th Ed., 2017.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics", S. Chand Publication, 3rd Ed., 2014.
5. **James Stewart: "**Calculus", Cengage Publications, 7thEd., 2019.

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- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Course outcomes (COs):
At the end of the semester the students are able to:

CO1	Apply calculus to solve problems related to polar curves.
CO2	Determine the rate of change of multivariate functions using partial differentiation.
CO3	Apply vector calculus with reference to solenoidal and irrotational vectors.
CO4	Solve ordinary differential equations by using appropriate techniques.
CO5	Execute the concepts of calculus and ordinary differential equations using MATLAB.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**										
CO2	**3**	**1**										
CO3	**3**	**1**										
CO4	**3**	**1**										
CO5					**2**							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

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DEPARTMENT OF MATHEMATICS

Choice Based Credit System (CBCS)

SEMESTER-II

NUMERICAL METHODS AND LINEAR ALGEBRA

(Common to ECE & EEE Branches)

(Effective from the Academic Year 2024-25)

Course Code:	**BMATEE21**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credits distribution (L:T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course objectives: The goal of the Course Numerical Methods and Linear Algebra (24MATEE21) is to

- **Develop** numerical skills to solve Electronics and Electrical Engineering related problems.
- **Have an insight** into Linear Algebra to solve the system of linear equations arising in the field of Electronics and Electrical engineering.
- **Get familiarized** with the concepts of Vector Space and Linear transformation which are used in Circuit-theory & Computer Graphics.
- **Familiarize** with modern mathematical tool namely MATLAB.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample strategies which teachers can use to accelerate the attainment of various Course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with engineering studies and provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show related short video lectures in the following ways as:
   - an introduction to new topics (pre-lecture activity).
   - a revision of topics (post-lecture activity).
   - additional examples (post-lecture activity).
   - an additional material of challenging topics (pre-and post-lecture activity).
   - a model solution of some exercises (post-lecture activity).

Module-1: Numerical Methods-I (8 hours)
Introduction, Numerical solution of ordinary differential equations of first order and first degree: Taylor's series method, Runge-Kutta method of fourth order, Milne's predictor-corrector method and Adams-Bashforth predictor-corrector method (only formulae). Problems Numerical solution of ordinary differential equations of second order: Runge-Kutta method of fourth order. Problems **Applications:** Finding approximate solutions to ODE related to electrical engineering field. **(RBT Levels: L1, L2 and L3)**
Module-2: Numerical Methods-II (8 hours)
Introduction, Finite differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula and Lagrange's inverse interpolation formula (without proofs). Problems Numerical integration: Trapezoidal rule**,** Simpson's $(1/3)^{rd}$ rule & Simpson's $(3/8)^{th}$ rule (only formulae). Problems Solution of algebraic and transcendental equations: Regula-Falsi & Newton-Raphson methods, Problems. **Applications:** Estimating distance, velocity, area and volume. **(RBT Levels: L1, L2 and L3)**
Module-3: Linear Algebra-I (8 hours)
Introduction, Elementary row transformation of a matrix, Rank of a matrix, Consistency, Solution of homogeneous system of linear equations & Solution of non-homogeneous system of linear equations: Gauss-elimination method, Gauss-Jordan method, LU decomposition method and Gauss-Seidel iterative method. Problems **Applications**: Traffic Network & Network Analysis **(RBT Levels: L1, L2 and L3)**
Module-4: Linear Algebra-II (8 hours)
Introduction, Eigenvalues and Eigenvectors of a square matrix, Rayleigh's Power method to find the dominant eigenvalue and corresponding eigenvector. Diagonalization of a square matrix of order 2, Quadratic Forms, Reduction to canonical forms, Nature, Rank, Index and Signature of Quadratic forms, Problems. Introduction to Principal Component Analysis & problems to find the principal components. **Applications**: Singular value decomposition **(RBT Levels: L1, L2 and L3)**
Module-5: Linear Algebra-III (8 hours)
Introduction**,** Vector space: Definition and examples, Subspace, Linear combination, Linear span, Linearly independent and dependent sets, Basis and dimension. Problems Linear transformation: Definition and examples, Matrix of a linear transformation. Rank and Nullity of a linear operator, Rank-Nullity theorem (Statement only). Problems Inner product space, orthogonal and orthonormal sets. Problems **Applications:** Geometric linear transformation in image processing **(RBT Levels: L1, L2 and L3)**

List of Laboratory experiments (1 hour/week): 10 lab sessions + 1 Lab Assessment

1	Solution of ODE of first order and first degree by 4th order Runge-Kutta method
2	Solution of second order ODE by 4th order Runge-Kutta method
3	Computation of area under the curve using Trapezoidal & Simpson's (1/3)rd rules
4	Solution of algebraic and transcendental equations by Newton-Raphson method
5	Test for consistency, Numerical solution of system of linear equations and its graphical representation
6	Solution of a system of linear equations using Gauss-Seidel iterative method
7	Computation of eigenvalues and eigenvectors and finding the largest eigenvalue and corresponding eigen vector by Rayleigh's Power method
8	Diagonalization of a square matrix of any order
9	Computation of basis and dimension of subspace of a vector space
10	Graphical representation of linear transformation (Rotation, Scaling & Reflection) and computation of the inner product

Suggested software : MATLAB

Suggested Learning Resources:

Text Books

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang:** "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference Books

1. **Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.**
2. **N.P Bali and Manish Goyal:** "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
3. **James Stewart:** "Calculus" Cengage Publications, 7th Ed., 2019.
4. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018. 2017.
5. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed.,

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminar

Course outcomes (COs):

At the end of the Course, the student will be able to:

CO1	Apply various Numerical Methods to solve transcendental equations and problems related to interpolation, integration, its applications to distance, velocity, areas and volumes and linear and non-linear ordinary differential equations which have applications in non-linear analysis.
CO2	Solve the system of linear equations using the theory of matrices.
CO3	Compute eigen values and eigen vectors of a square matrix which have wide range of applications in engineering such as communication system and analysis of networks and circuits.
CO4	Demonstrate the knowledge gained in vector spaces, linear dependence/independence of vectors, basis and linear maps, rank nullity of a matrix / linear map.
CO5	Execute the programmes on Numerical Methods & Linear Algebra using MATLAB.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**										
CO2	**3**	**2**										
CO3	**3**	**2**										
CO4	**3**											
CO5					**2**							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

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DEPARTMENT OF MATHEMATICS
Choice Based Credit System (CBCS)
SEMESTER - I

CALCULUS AND LINEAR ALGEBRA

(**Common to MECHANICAL & CIVIL Branches**)
(Effective from the Academic year 2024-25)

Course Code	**BMATMC11**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credits distribution (L:T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course objectives: The goal of the course Calculus and Linear Algebra (24MATMC11) is to

- **Familiarize** the importance of calculus and vector calculus, as they are essential for applications in Mechanical and Civil engineering.
- **Analyze** Mechanical and Civil engineering problems by applying Partial Differential Equations.
- **Enhance** understanding of linear algebra with a focus on matrices.
- **Familiarize** with modern mathematical tools namely MATLAB.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample strategies which teachers can use to accelerate the attainment of various Courseoutcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and appliedmathematical skills.
2. State the need for Mathematics with engineering studies and provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, anddocumenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways as:
   - an introduction to new topics (pre-lecture activity).
   - a revision of topics (post-lecture activity).
   - additional examples (post-lecture activity).
   - an additional material of challenging topics (pre-and post-lecture activity).
   - a model solution of some exercises (post-lecture activity).

Module-1 Calculus (8 hours)

Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature -

Cartesian, Parametric, Polar and Pedal forms (formulae without proof), Problems.

Applications: Centre and Circle of Curvature, Evolutes and Involutes.
(RBT Levels: L1, L2 and L3)

Module-2 Partial Derivatives (8 hours)

Introduction, Partial differentiation-problems, Homogeneous functions, Euler's theorem for homogeneous functions-derivation and problems (only first order), total derivatives, differentiation of composite functions, Jacobians-problems, Maxima and minima for a function of two variables, Problems.

Applications: Computing errors and approximations.
(RBT Levels: L1, L2 and L3)

Module-3 Vector Calculus (8 hours)

Introduction, Scalar and vector fields. Gradient, directional derivative, unit normal vector, curl and divergence – physical interpretation, solenoidal and irrotational vector fields, problems, Vector identities –div (curl A), div (grad ϕ), curl (grad ϕ), div (ϕ A) and curl (ϕ A).

Applications: Analysis of streamlines in fluid flow.
(RBT Levels: L1, L2 and L3)

Module-4 Linear Algebra - I (8 hours)

Introduction, Elementary row transformation of a matrix, Rank of a matrix, Consistency and solution of system of homogeneous, solution of non-homogeneous linear equations - Gauss-elimination method, Gauss-Jordan method, LU decomposition method and Gauss-Seidel iterative method, problems.

Applications: Problems related to Traffic Network.
(RBT Levels: L1, L2 and L3)

Module-5 Linear Algebra - II (8 hours)

Introduction, Eigenvalues and Eigenvectors of a matrix, Cayley-Hamilton theorem (Statement only)-problems, Rayleigh's power method-problems, Diagonalization of matrices of order 2, Quadratic forms, Reduction to canonical form, Nature, Rank, Index and Signature of quadratic forms, problems. **Applications:** Principal Component analysis, Problems to find Principal component.
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (1 hour/week): 10 lab sessions + 1 Lab Assessment

1	2D plots for Cartesian and polar curves.
2	Radius of curvature of a curve.
3	Partial derivatives and plotting the graph.
4	Jacobian of a function.
5	Gradient of a scalar.
6	Divergence and curl of a vector.
7	Solution of system of linear equations by Gauss Seidel method.
8	Eigen values and eigen vectors of a square matrix.
9	Rayleigh power method to find the largest eigen value and the corresponding eigen vector.
10	Reduction of Quadratic form to Canonical form by orthogonal transformation.

Suggested Software: MATLAB

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **Gilbert Strang:** "Linear Algebra and its Applications", Cengage Publications, 4th Ed., 2022.

Reference Books:

1. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
2. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics", McGraw Hill Book Co., New York, 6th Ed., 2017.
3. **James Stewart: "**Calculus", Cengage Publications, 7thEd., 2019.
4. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
5. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Course Delivery

- Class room teaching using board
- Open discussion and interaction
- Tutorial/Remedial classes

Course outcomes (COs):

At the end of the semester the students are able to

CO1	Apply calculus to solve problems related to polar curves.
CO2	Determine the rate of change of multivariate functions using partial differentiation.
CO3	Apply vector calculus with reference to solenoidal, irrotational vectors.
CO4	Solve the system of linear equations using matrix theory.
CO5	Compute eigenvalues and eigen vectors of a matrix.
CO6	Execute the concepts of calculus and linear algebra using MATLAB.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3	1										
CO3	3	1										
CO4	3	1										
CO5	3	1										
CO6					2							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

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DEPARTMENT OF MATHEMATICS
Choice Based Credit System (CBCS)
SEMESTER - II

NUMERICAL TECHNIQUES AND DIFFERENTIAL EQUATIONS
(Common to MECHANICAL & CIVIL Branches)

(Effective from the academic year 2024-25)

Course Code	**BMATMC21**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Credits distribution (L:T:P:S)	3:0.5:0.5:0	Credits	04
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Exam Hours	03

Course Objectives: The goal of the course Numerical techniques and Differential Equations (24MATMC21) is to

- **Analyze** Mechanical and Civil Engineering problems applying Ordinary Differential Equations.
- **Familiarize** the importance of various numerical techniques essential for Mechanical and Civil Engineering.
- **Develop** the mathematical skill of solving Mechanical and Civil Engineering problems using Partial Differential Equations.
- **Familiarize** with modern mathematical tools namely MATLAB.

Teaching-Learning Process
Pedagogy (General Instructions):

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes

1. In addition to the traditional lecture method, different types of innovative teaching methodsmay be adopted so that the delivered lessons shall develop student's theoretical and appliedmathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways as:
   - an introduction to new topics (pre-lecture activity).
   - a revision of topics (post-lecture activity).
   - additional examples (post-lecture activity).
   - an additional material of challenging topics (pre-and post-lecture activity).

- a model solution of some exercises (post-lecture activity).

Module-1 Ordinary Differential Equations (ODEs) of First order (8 hours)

Introduction, Linear and Bernoulli's differential equations, exact differential equation, equation reducible to exact-Integrating factors on $\frac{1}{N}\left(\frac{\partial M}{\partial y}-\frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right)$.
Orthogonal trajectories, Newton's law of cooling, Growth and Decay.
Applications: Kinematics analysis of rigid body dynamics.
(RBT Levels: L1, L2 and L3)

Module-2 Ordinary Differential Equations (ODE) of Higher Order (8 hours)

Introduction, solution of homogeneous linear ODE, solution of non-homogeneous linear ODE of higher order with constant coefficients $f(D)y = X$ using inverse differential operator where $X = k\,e^{ax}$, $X = k\,sin(ax+b)$ *or* $k\,cos(ax+b)$ and X is a polynomial, Method of variation of parameters, solution of linear ODE with variable coefficients-Cauchy's and Legendre's differential equations, problems.
Applications: Simple harmonic motion**,** oscillations of a spring.
(RBT Levels: L1, L2 and L3)

Module-3 Partial Differential Equations (PDE) (8 hours)

Introduction, Formation of PDE by elimination of arbitrary constants and functions, solution of non-homogeneous PDE by direct integration, solution of homogeneous PDE involving derivatives with respect to one independent variable only, solution of Lagrange's linear PDE, solution of one-dimensional heat and wave equations by the method of separation of variables.
Applications: Problems on heat and wave equations.
(RBT Levels: L1, L2 and L3)

Module-4 Numerical Methods-1 (8 hours)

Introduction, solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation - Newton's forward and backward Interpolation formulae, Newton's divided difference formula, Lagrange's interpolation formula and Lagrange's inverse interpolation formula (formulae without proof), Problems.
Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.
Applications: Estimating the approximate roots by Regula -Falsi and Newton Raphson method
(RBT Levels: L1, L2 and L3)

Module-5 Numerical Methods-2 (8 hours)

Introduction, numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector method and Adams-Bashforth predictor-corrector method (formulae without proofs), Problems.
Applications: Finding approximate solutions to ODE related to Mechanical & Civil Engineering field.
(RBT Levels: L1, L2 and L3)

List of Laboratory experiments (1 hour/week): 10 lab sessions + 1 Lab Assessment	
1	Solution of first order differential equation and plotting the solution curves.
2	Solution of differential equations with initial conditions.
3	Solution of homogeneous ordinary differential equations of higher order.
4	Solution of non-homogeneous ordinary differential equations of higher order.
5	Solution of one-dimensional heat equation.
6	Solution of algebraic and transcendental equations by Regula-Falsi and Newton-Raphson methods.
7	Interpolation/Extrapolation using Newton's forward and backward difference formulae.
8	Computation of area under the curve using Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules.
9	Solution of ODE of first order and first degree by Modified Euler's method.
10	Solution of ODE of first order and first degree by 4^{th} order Runge-Kutta method.

Suggested Software: MATLAB

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44^{th} Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10^{th} Ed., 2018.

Reference Books:

1. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics", Oxford University Press,3^{rd} Ed., 2016.
2. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics", LaxmiPublications, 10^{th} Ed., 2022.
3. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics", McGraw HillBook Co., New York, 6^{th} Ed., 2017.
4. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I andII", McGraw Hill Education (India) Pvt. Ltd, 2015.
5. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics", S. ChandPublication, 3^{rd} Ed., 2014.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Course outcomes (COs):
At the end of the semester the students are able to

CO1	Solve the ordinary differential equations by using appropriate techniques.
CO2	Solve first-order linear and nonlinear PDEs using appropriate methods.
CO3	Apply the knowledge of numerical methods in solving problems which involve physica and engineering phenomena.
CO4	Execute the concepts of ordinary differential equations and numerical methods using MATLAB.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**										
CO2	**3**	**1**										
CO3	**3**	**1**										
CO4					**2**							

Level 3: Highly mapped Level 2: Moderately mapped Level 1: Low mapped

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

Quantum computing and Photonics (3:0.5:0.5) 4

(Effective from the academic year 2024-25)

Course Code	**BPHYCS12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40 (Theory) + 12 (Lab sessions)	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Identify the fundamental concepts related to the theory of quantum mechanics, Quantum computing, photonics and animations.
2. Elucidate the significance of principles of quantum mechanics in quantum computing.
3. Apply the knowledge in solving the problems of quantum mechanics, photonics and animations.
4. Demonstrate and construct the electrical, optical experiments.
5. Learn the conduction of experiments using simulations/virtual mode.

Preamble: Introduction to Quantum Mechanics, Quantum computation, Quantum Gates, Physics of animation, photonics, hands-on and simulation experiments.

Module – 1

Quantum Mechanics

Introduction, Heisenberg's Uncertainty Principle and its significance, Application: Non-existence of electron inside the nucleus (Relativistic condition), Principle of Complementarity, Wave Function and its properties, Physical Significance of a wave function and Born's Interpretation, Expectation value. Time independent (derivation) and time-dependent (qualitative) Schrodinger wave equations, Eigen functions and Eigen Values, Applications of Schrodinger wave equation: Eigen Values and Eigen functions of a particle in a one-dimensional potential well of infinite depth, mapping of wave function and probability density, free particle case, Numerical.

(08Hours)

Module – 2

Quantum computation

Introduction, Moore's law & its end, single particle quantum interference, quantum superposition and entanglement, Qubit: properties of a qubit, representation of qubit by Bloch sphere, Single and Two qubits, Extension to N qubits. Differences between classical & quantum computing. Matrix representation of 0 and 1 States, Identity Operator, Pauli Matrices and its operations on $|0\rangle$ and $|1\rangle$states, Conjugate of a matrix and Transpose of a matrix. Unitary matrix, Inner Product, Probability, normalization rule, Orthogonality, Orthonormality, Numerical.

(08 Hours)

Module – 3

Quantum Gates and Physics of animation

Introduction, Single Qubit Gates: Quantum Not Gate, Pauli-Z Gate Hadamard Gate, Pauli Matrices, Phase Gate (or S Gate), T Gate. Multiple Qubit Gates: CNOT Gate, Swap gate, Controlled-Z gate, Toffoli gate. Applications of quantum gates: Artificial Intelligence and Machine Learning, Cryptography, Model Realizations.

Introduction, Taxonomy of physics-based animation methods, Frames, Frames per Second, Size and Scale, Motion and timing in animations, Constant Force and Acceleration, Slow in Slow out, The Odd rule, Motion graphs, Numerical Calculations based on Odd Rule, Examples of Character Animation: Jumping, Walking, Numerical.

(08 Hours)

Module – 4

LASER and Holography

Introduction, Interaction of radiation with matter, expression for the energy density of the radiation in terms of Einstein's Coefficients (derivation), condition for Laser Action: Population Inversion, Metastable State, Stimulated emission, Requisites of a Laser system, construction and working of Semiconductor Diode Laser, Q- switching, Applications of Lasers: Bar code scanner, data storage, Numerical.

Introduction, Principle of holography, construction and reconstruction of hologram, Applications: Holographic data storage and security.

(08 Hours)

Module – 5

Optical Fiber

Introduction, Propagation mechanism, Acceptance angle, Numerical Aperture (derivation), condition for ray propagation, Modes of propagation and V-number, Classification of Optical Fibers, Attenuation and causes for attenuation: absorption, bending, scattering loss, dispersion losses, distortion losses, expression attenuation coefficient (derivation). Optical wave guides-Types of optical wave guides, guided modes in planar wave guides, guided modes in step-index optical fibers, Attenuation Spectrum of an Optical fiber, Optical Windows. Applications: Fiber Optic networking, Fiber Optic Communication, Fiber optic sensors, optical computers, Numerical.

(08 Hours)

Practical components (10 experiments needed to be completed from the list)

Sl. No.	Experiments
	Physical lab experiments
1	Photo-Diode Characteristics
2	Wavelength of LASER using Grating
3	Numerical Aperture using optical fiber
4	Fermi energy of copper by using Wheatstone's meter bride.
5	Series & Parallel LCR resonance
6	Magnetic field along the axis of a circular coil carrying current
7	Energy gap of a semiconductor by four probe method
	Simulation/Virtual lab experiments
8	Study of motion using spread sheets : Study of projectile motion using Excel sheet/PHET.
9	Interactive simulations: Energy-bandgap of a semiconductor
10	Interactive Simulations: Numerical-aperture-measurement.
11	Creating animated videos using software.
12	Interactive Simulations: Realization of quantum gates using virtual lab software.
13	Interactive Simulations: Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR gates.
14	Interactive Simulations: study of the motion of the simple pendulum
	Demonstration experiments
1	Determination of velocity of ultrasound using interferometer.
2	Determination of spring constant and verification of laws of springs.

Course Outcomes:

The students will be able to:

CO1	Comprehend the principles of the Quantum Mechanics and Quantum Computing.
CO2	Analyse the application of Quantum mechanics, Quantum computation in engineering applications.
CO3	Apply the concepts of physics in Quantum gates and animations.

CO4	Apply the basic principles of Lasers, Holography, Optical fibers and its relevant applications in engineering.
CO5	Examine the physical/virtual experiments for their precise measurements.

Textbooks:

1. A textbook of Engineering Physics by M.N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition, S Chand and Company Ltd. New Delhi-110055.
2. Engineering Physics by S P Basavaraj, 2018 Edition, Subhas Store Publication, Bengaluru.
3. Parag K Lala, "Quantum Computing – A Beginner's Introduction", Indian Edition, McGraw Hill, Reprint 2020.

References:

1. Lasers and Non-Linear Optics, B B Loud, New age international, 2011 edition.
2. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.
3. Quantum Computing, Vishal Sahani, McGraw Hill Education, 2007 Edition. 14.11.2022 4
4. A. Ghatak, "Optics", Tata McGraw Hill Pub., 5th Edition, 2012.
5. Physics for Animators, Michele Bousquet with Alejandro Garcia, CRC Press, Taylor & Francis, 2016.

Alternate Assessment Tools (AATs) suggested:

- Assignment
- Group discussion activity
- Technical report
- Research article report

Web links / e – resources:

1. Physics of Animation: https://www.youtube.com/watch?v=kj1kaA_8Fu4
2. Virtual LAB:https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
3. Virtual LAB: https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

Activity-Based Learning (Suggested Activities in Class)/

4. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html
5. Optical Fiber : https://www.youtube.com/watch?v=N_kA8EpCUQo
6. Quantum Mechanics : https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
7. Quantum Computing : https://www.youtube.com/watch?v=jHoEjvuPoB8
8. Quantum Computing :https://www.youtube.com/watch?v=ZuvCUU2jD30
9. Physics of Animation : https://www.youtube.com/watch?v=kj1kaA_8Fu4

B.E. CIVIL ENGINEERING

Choice-Based Credit System (CBCS) applicable for the 2024 Scheme

SEMESTER – I/II

Materials and wave properties for structural applications (3:0.5:0.5) 4

(Effective from the academic year 2024-25)

Course Code	**BPHYCV12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**3:0:2**	SEE Marks	50
Total Number of Contact Hours	40 (Theory)+12(Lab sessions)	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Impart knowledge in basic concepts of elasticity and shock waves.
2. Apply comprehensive understanding of composites and ceramics, and their applications.
3. Describe the various natural hazards and safety precautions.
4. Estimate the impact of oscillations and acoustics in civil construction.
5. Analyze the experimental results from the lab sessions.

Preamble: Students able to understand the physics of elasticity, new engineering materials, acoustics and shock waves. Preparedness and necessity of life skill techniques during Natural hazards.

Module – 1

ELASTICITY

Introduction, Stress-Strain curve, Poisson's ratio, limiting values of Poisson's ratio, Strain Hardening and Strain softening, Beams, types of beams and their applications, bending moment (derivation), depression produced in a single cantilever (derivation), I-section girder and their Engineering Applications. Factors affecting the elastic properties. Numerical.

(08 Hours)

Module – 2

NEW ENGINEERING MATERIALS

Ceramics – Introduction, Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Properties - thermal, mechanical, electrical and chemical ceramic fibers - ferroelectric and ferromagnetic ceramics, Applications of ceramics in Civil Engineering, Numericals

Composites – Introduction, Definition, and Classification - Fibre-reinforced plastics (FRP) and fiber-reinforced metals (FRM) - Metallic glasses - Shape memory alloys, Applications of composite materials.

(08 Hours)

Module – 3

OSCILLATIONS AND SCHOCK WAVES

Oscillations: Introduction, Free oscillations of Springs, Stiffness Factor and its Physical Significance, series and parallel combination of springs (Derivation).Theory of damped oscillations (Qualitative), Types of damping (Graphical Approach). Theory of forced oscillations (Derivation), resonance, sharpness of resonance. Engineering applications of oscillations, Numerical Problems.

Shock waves: Introduction, Mach number, and Mach Angle, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves – Soil Compaction, Innovative construction techniques and Blasting and Demolition of structures, Numericals.

(08 Hours)

Module – 4

ACOUSTICS

Introduction, Types of Acoustics, reverberation and reverberation time, absorption power and absorption coefficient,

Requirements for acoustics in the auditorium, Sabine's formula (derivation), measurement of

absorption coefficient, factors affecting the acoustics and remedial measures, Noise and its Measurements, Sound absorbing materials, Sound Insulation and its measurements. Impact of Noise in Multi-storied buildings. Numerical problems

Ultrasonic waves: Introduction, Types and production and Ultrasonic waves, Applications of Ultrasonic waves: Non-destructive testing Concrete testing, and structural health monitoring.

(08 Hours)

Module – 5

NATURAL HAZARDS AND SAFETY

Introduction, Earthquake, (general characteristics, Physics of earthquake, Richter scale of measurement and earthquake resistant measures), Tsunami (causes for tsunami, characteristics, adverse effects, risk reduction measures, engineering structures to withstand tsunami), Landslide (causes such as excess rainfall, geological structure, human excavation, etc., types of landslide, adverse effects, engineering solution for landslides). Forest Fires and detection using remote sensing. Fire hazards and fire protection, fire-proofing materials, fire safety regulations, and fire-fighting equipment - Prevention and safety measures. Numerical Problems.

(08 Hours)

Practical components (10 experiments needed to be completed from the list)

Sl. No.	Physical lab experiments
1	Single cantilever - To determine the Youngs Modulus of a given wooden beam.
2	Ultrasonic interferometer - To determine the velocity of ultrasonic waves in a given liquid.
3	Moment of Inertia - To determine the moment of inertia of irregular body and the rigidity modulus of a given wire.
4	Spring Constant by the method of combination of springs
5	LCR resonance - Both series and Parallel resonance
6	To verify the relation between the thermo emf of thermocouple and temperature difference b/w two hot junctions
7	Fermi Energy of copper by measuring resistance variation with temperature.
	Simulation/Virtual lab experiments
8	To verify the relation between the thermo emf of a thermocouple and the temperature difference between two hot junctions.
9	Determination of Viscosity of various liquids using solid ball drop method
10	Rigidity Modulus of The Suspension Wire of A Torsion Pendulum - Virtual
11	PHET Interactive Simulations - Green house effect - Virtual lab
12	Projectile motion studies using Spread Sheet / Excel sheet - Virtual
13	To Determine the Energy Band Gap of the Semiconductor
14	LCR resonance using p-spice software
	Demonstration experiments
1	Reddy's Shock tube- To determine the Mach number
2	Hall effect experiment

Course Outcomes:

The students will be able to:

CO1: Analyze the concepts of elasticity in engineering applications.
CO2: Apply the properties of composites and ceramics for useful applications.
CO3: Utilize the concepts of oscillations, shock waves, and acoustics in civil engineering.
CO4: Use the concepts related to natural hazards and safety precautions.
CO5: Examine the physical/virtual experiments for their precise measurements.

Textbooks:

1. M N Avadhanulu and P G Kshirsagar, "Engineering Physics," S. Chand and company Pvt. Ltd., 11th edition, 2014.
2. R K Gaur & S L Gupta, "Engineering Physics," Dhanpat Rai Publications, 8th edition, 2018.

3. Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd,Delhi,2014

References:

1. Martin H Sadd, Elasticity: Theory, Applications and Numericals. Acadenuc Press in, 2014. https://www.amazon.in/Elasticity-Applications-Martin-Sadd-Ph-D/dp/0124081363
2. M Ghosh and D Bhattacharya, A Textbook of Oscillations, Waves and Acoustics, S Chand, 2016 https://www.amazon.in/Textbook-Oscillations-Waves-Acoustics-ebook/dp/B01G6ZZR8C
3. Budinski / Narasimhulu, Engineering Materials- Properties and Selection, 9th Ed., Pearson, 2016.

Alternate Assessment Tools (AATs) suggested:

- Assignments
- Cooperative learning
- Think, Ink, Pair and Share
- Presentations
- Report submission

Web links / e – resources:

1. Simple Harmonic motion: https://www.youtube.com/watch?v=k2FvSzWeVxQ.
2. Shock waves: https://physics.info/shock/.
3. Shock waves and theirapplications: https://www.youtube.com/watch?v=tz_3M3v3kxk.
4. Stress-strain curves: https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
5. Thermoelecticity:https://www.youtube.com/watch?v=2w7NBuu5w9c&list=PLtkeUZItwHK5y6qy1GFxa4Z4RcmzUaaz6.

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS) applicable for the 2024 Scheme

SEMESTER – I/II

OPTOELECTRONICS AND ELECTRODYNAMICS (3:0.5:0.5) 4

(Effective from the academic year 2024-25)

Course Code	**BPHYEE12**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40(Theory)+12(Lab session)	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand the principles of quantum mechanics and its applications.
2. Study the dielectric and superconducting properties of materials.
3. Understand the fundamentals of Lasers, optical fibers and their application.
4. Understand the fundamentals of vector calculus and EM waves, semiconductors and devices.
5. Apply the concepts required for the measurement of physical parameters related to engineering.
6. Compare and analyze the results of the experiments.

Preamble: Introduction, Quantum Mechanics – Applications, Electrical Properties of Solids, Lasers and Optical fibers, Maxwell's equations and EM waves, Semiconductors and devices.

Module – 1

Quantum Mechanics

Introduction, Heisenberg's Uncertainty Principle and its application: Non-existence of electron inside the nucleus-Relativistic case, Wave Function and its properties,Physical significance of a wave function and Born Interpretation, Probability (Expectation value), Schrodinger wave equations: time independent(derivation)and time dependent (qualitative),Eigen functions and Eigen Values, Particle inside a one-dimensional infinite potential well and free particle, mapping of eigen functions and probability density for a bounded particle. Numerical.

(08Hours)

Module – 2

Lasers and optic fibers

Introduction, Interaction of radiation with matter, Expression for energy density equation and its significance. Requisites of a Laser system. Conditions for Laser action. Principle, Construction and working of Nd-YAG laser. Applications: Laser range finder and Laser Printing. Numericals.

Introduction, Propagation mechanism, angle of acceptance, Numerical aperture (derivation), Fractional index change, Modes of propagation, Number of modes and V-number, Types of optical fibers. Attenuation and attenuation coefficient, Applications:point-to-point communication, Intensity-based fiber optic displacement sensor. Numericals.

(08 Hours)

Module – 3

Semiconductors and devices

Introduction, Fermi energy and Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band & holes concentration in valence band (qualitative), Electrical conductivity in intrinsic semiconductors(derivation) and extrinsic semiconductors (qualitative), relation between Eg and Ef, Hall effect, Expression for Hall coefficient (derivation) and its application. Construction and working: Semiconductor diode Laser, Photodiode and solar cell, Numericals.

(08 Hours)

Module – 4

Superconductors and dielectrics

Introduction, critical temperature, critical magnetic field and Critical current (Silsbee effect), Meissner's effect, Types of Superconductors, BCS theory (Qualitative), High Temperature superconductivity, Josephson junction, flux quantization. Applications- SQUID, MAGLEV. Numericals**.**

Introduction, Polar and non-polar dielectrics, Types of Polarization, Internal fields in solids (derivation), Clausius-Mossotti equation (Derivation), Solid, liquid and gaseous dielectrics. Application of dielectrics in transformers, Capacitors and Electrical Insulation. Numericals.

(08 Hours)

Module – 5

Maxwell's equations and EM waves

Introduction, Divergence and curl of electric field and magnetic field (static), Gauss' divergence theorem and Stokes' theorem (qualitative). Derivations of four Maxwell's equations and its significance. Current density & equation of Continuity (with derivation); displacement current (with derivation) Maxwell's equations in vacuum. Applications.

EM - wave equation in differential form in free space (derivation), Plane electromagnetic waves in vacuum, and their transverse nature. Numericals.

(08Hours)

Practical components (10 experiments needed to be completed from the list)

Sl. No.	Experiments
	Physical lab experiments
1	Wavelength of laser using grating
2	Black box experiment
3	Photodiode characteristics
4	Charging and discharging of a capacitor
5	Determination of band gap and resistivity by Four probe method
6	LCR resonance experiment
7	Magnetic field intensity at any point along the axis of a circular coil
	Simulation/Virtual lab experiments
8	Design the circuit for series/parallel LCR with different given LCR components.
9	Verification of Stefan's law by electrical method
10	Inductance of a coil using Anderson's bridge
11	Study of projectile motion of a body
12	Determination of charge carrier density and Hall coefficient of a given semiconductor using Hall effect

13	Modelling magnetic hysteresis and producing hysteresis loops.
14	Determination of Spring constants of springs in series and parallel combinations.
Demonstartion experiments	
1	Determination of charge carrier density and Hall coefficient of a given semiconductor using Hall effect

Course Outcomes:

The students will be able to:

CO1: Comprehend the principles of quantum mechanics and photonics.
CO2: Apply the properties of semiconductors in semiconducting devices.
CO3 Analyse the concepts of superconductors, dielectrics in engineering applications.
CO4: Apply the concepts of Maxwell's equations and EM waves in engineering.
CO5: Examine the physical/virtual experiments for their precise measurements.

Textbooks:

1. M N Avadhanulu and P G Kshirsagar, "Engineering Physics," S. Chand and company Pvt. Ltd., 11th edition, 2014.
2. R K Gaur & S L Gupta, "Engineering Physics," Dhanpat Rai Publications, 8th edition, 2018.
3. S. K. Dwivedi, A Textbook of Engineering Physics, I K International Publishing House Pvt. Ltd., 1st edition 2010.
4. Resnick, Walker and Halliday "Principles of Physics, Wiley publisher, 10th edition, 2015**.**

References:

1. S O Pillai, "Solid State Physics," New Age International publishers, 8th edition, 2017.
2. David Jeffery Griffiths, "Introduction to Electrodynamics", Pearson New International Edition, 4th edition, 2017.
3. B B Laud, "Lasers and Non-Linear Optics," New Age International publishers, 3rd edition, 2018.
4. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw-Hill Education, 6th edition, 2010.
5. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003 Edition.
6. Resnick, Walker and Halliday "Principles of Physics, Wiley publisher, 10th edition, 2015.
7. Ben G. Streetman, Sanjay Banerjee, "Solid State Electronic Devices" Pearson Prentice Hall, 6th edition, 2010.
8. C L Arora, "B.Sc. Practical Physics", S CHAND and company Ltd. 1st edition 2010 Worsnop and Flint, "Advanced physics practical for students", Metuen and Co, London 2005.
9. D Chattopadhyay and P C Rakshit, "Advanced course in Practical Physics", New central book agency 8th edition, 2013.

Alternate Assessment Tools (AATs) suggested:

- Assignment
- Co-operative learning
- Think ink pair share
- Technical presentation
- Seminar
- Research article report

Web links / e – resources:

- https://archive.nptel.ac.in/courses/115/107/115107095/
- https://nptel.ac.in/courses/113104090
- https://archive.nptel.ac.in/courses/115/103/115103108/
- https://www.youtube.com/watch?v=FWCN_uI5ygY
- https://www.youtube.com/watch?v=nFtNCPUMoYA
- https://www.rp-photonics.com/lasers.html
- https://www.rp-photonics.com/optoelectronics.html

B.E. MECHANICAL ENGINEERING

Choice-Based Credit System (CBCS) applicable for the 2024 Scheme

SEMESTER – I/II

Material Science and Metallurgy (3:0.5:0.5) 4

(Effective from the academic year 2024-25)

Course Code	**BPHYME12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40 (Theory) + 12 (Lab Sessions)	Exam Hours	3

Course Objectives:

1. Explain the basic concepts of crystallography, crystal structure and imperfections in Solids.
2. Construct the phase diagrams to know the phase transformations and concept of diffusion in solids.
3. Describe the properties of laser and discuss the importance of light as a waveguide in optical fibers.
4. To understand the fundamentals of thermoelectric materials and devices and their application.
5. Learn conduction of experiments using simulations/virtual mode.

Preamble:

The combination of physics, chemistry, and the focus on the relationship between the properties of a material and its microstructure is the domain of Materials Science. The development of this science allowed designing materials and provided a knowledge base for the engineering applications

Module-1

Crystals and Defects

Crystals: Introduction, Types of solids, Crystal systems, crystal planes and Miller indices, Inter-planar spacing (derivation), Bragg's law, Powder X-ray diffraction, crystallite size determination by Scherrer equation. Numerical Problems.

Defects: Crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burger's vector and elastic strain energy- Slip systems.

(8 hours)

Module-2

Physical Metallurgy

Alloy Systems: Classification of Solid solutions, Hume- Rothery Rules, Diffusion Mechanisms: Vacancy Diffusion and Interstitial Diffusion, Fick's laws of diffusion.

Phase Diagrams: Gibbs Phase Rule, Solubility limit, phase equilibrium and Phase Diagrams: Isomorphous systems, Invariant Binary Reactions: Eutectic reaction, Eutectoid reaction and Peritectic reaction, Lever Rule, Iron-Carbon Diagram. Effect of common alloying elements in steel. Numericals.

(8 hours)

Module-3

Lasers & Fiber Optics

Laser: Properties of a laser Beam, Interaction of Radiation with Matter, Condition for laser action- Population Inversion, Metastable State, Requisites of a Laser System, construction and working of Nd:YAG laser, Application: LIDAR.

Fiber Optics: Principle of propagation of light, Types of fibres, Numerical aperture (Derivation). Applications of optical fiber in industry. Numericals.

(8 hours)

Module-4

Thermoelectric Materials and Devices

Introduction, Thermo emf and thermo current, Seeback effect, Peltier effect, Seeback and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Thermo emf in terms of T_1 and T_2 (Derivation), thermo couples, thermopile.

Construction and working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials.

Applications: Exhaust of Automobiles, Refrigerator, Space Program (RTG), Numerical Problems.

(8 Hours)

Module-5

Nanomaterials and Characterization Techniques

Nanomaterials: Nanoscale, quantum confinement, surface to volume ratio, Nano sheets, Nano wires and Quantum dots. Properties of nanomaterials-mechanical, electrical and optical (qualitative). Applications of nanotechnology (qualitative ideas). Synthesis of nanomaterials: ball milling - physical vapor deposition (PVD).

Characterization Techniques: Principle, construction and working of Scanning electron microscopy (SEM) and Atomic force microscopy (AFM). Numericals.

(8 hours)

Practical components (10 experiments needed to be completed from the list)

Sl. No.	Physical lab experiments
1.	n by Torsional Pendulum
2.	Spring Constant
3.	Determination of Young's modulus by Single Cantilever
4.	Wavelength of Laser diffraction
5.	Numerical aperture by Optical Fiber
6.	Resistivity and energy band gap of a semiconductor by Four Probe Method
7.	Thermo Couple-Seebeck Effect
	Simulation/Virtual lab experiments
8.	Rigidity Modulus of The Suspension Wire of A Torsion Pendulum
9.	Young's Modulus-Uniform Bending
10.	Energy Band Gap of Semiconductor
11.	Crystallite size estimation by using Scherrer relation
12.	Basics of Scanning electron microscopy
13.	PHET Interactive Simulations (Verification of Stefan's law)
	Demonstration experiments
1.	Reddy Shock tube
2.	Determination of velocity of ultrasound using interferometer.
3.	Hot-Probe technique to find the type of semiconductor

Course Outcomes:

The students will be able to:

CO1: Comprehend the structural properties of crystalline materials and metallurgy.

CO2: Evaluate the properties of light and their applications in photonics

CO3: Apply the concepts of thermoelectricity for possible applications

CO4: Determine the various properties of materials and processing technologies

CO5: Examine the physical/virtual experiments for their precise measurements.

Textbooks:

1. M N Avadhanulu and P G Kshirsagar, "Engineering Physics," S. Chand and company Pvt. Ltd., 11th edition, 2014.
2. R K Gaur & S L Gupta, "Engineering Physics," Dhanpat Rai Publications, 8th edition, 2018.

References:

1. Callister Jr, W.D., Rethwisch, D.G., (2018), Materials Science and Engineering: An Introduction, 10th Edition, Hoboken, NJ: Wiley.
2. S O Pillai, "Solid State Physics," New Age International publishers, 8th edition, 2017.
3. Heat and Thermodynamics (I-Edition) – D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 1991
4. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.

Alternate Assessment Tools (AATs) suggested:

- Assignment
- Report submission
- Presentation
- Group discussion

Web links / e – resources:

1. https://www3.nd.edu/~amoukasi/CBE30361/Lecture_crystallography_A.pdf
2. https://www.energy.gov/sites/prod/files/2015/02/f19/QTR%20Ch8%20-%20Thermoelectic%20Materials%20TA%20Feb-13-2015.pdf
3. https://alan.ece.gatech.edu/ECE4833/Lectures/Lecture8_ThermoelectricDevices.pdf
4. https://www.elprocus.com/nanomaterials-classifications-and-its-properties/
5. https://www.azom.com/article.aspx?ArticleID=11879
6. https://en.wikipedia.org/wiki/Atomic_force_microscopy

DEPARTMENT OF CHEMISTRY

Choice Based Credit System (CBCS)

SEMESTER – I/II

Materials Chemistry for Energy and Data Processing (3:0:1) 4

CSE Stream

(Effective from the academic year 2024-25)

Course Code	**BCHECS12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand and apply the knowledge of materials to be used in memory devices.
2. Understand the characteristics of materials for application in fabrication of advanced display systems.
3. Understand the basic concepts of electrochemistry and its application in fabrication of sensors.
4. To apply the knowledge of electrochemistry and materials in the development of energy storage systems.
5. Understand the materials characterization to enhance the durability of materials for sustainable E waste management.

Preamble: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application-oriented topics like energy storage devices, materials for memory devices, storage and instrumental methods of analysis etc., Also familiarize the students with topics like sensors, corrosion mitigation, advanced display materials and E-waste management etc., which enable them to develop abilities and skills that are relevant to the study and practice of engineering chemistry.

Module – 1

Materials for Memory Devices:

Memory devices: Introduction, Basic concepts of electronic memory. Classification of electronic memory devices. Types of organic memory materials: Small organic molecules: acene derivatives (Pentacene and perfluoropentacene), charge transfer complexes (Cu-TCNQ). Polymeric materials: Functional polyimides, and polymer containing metal complexes (Ferrocene polymer complex). Organic-inorganic hybrid materials: Au nanoparticle with 8-hydroxy quinoline.

Self-study: Other Types of organic memory materials: naphthalene, anthracene, tetracene and ZnPc: Zn(II) pthalocyanine complex.

(8 Hours)

Module – 2

Materials for Display Systems:

Display Systems: Introduction to Photoactive and electro active materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LCs): Introduction, classification, properties and application in Liquid Crystal Displays (LCD s) Differences between liquid crystal and solid/liquid. Properties and application of Organic Light Emitting Diodes (OLED s) and Quantum Light Emitting Diodes (QLED, Light emitting electrochemical cells.

Self-Study: Properties and functions of Silicon (Si), Germanium (Ge), copper (Cu), Aluminium and Brominated flame retardants in computers.

(8 Hours)

Module – 3

Introduction to Electrochemistry, Smart Sensor Systems and Devices:

Introduction to Electrochemistry: Introduction, Types of electrode systems with examples. Reference electrodes: Advantages of secondary electrodes over SHE. Construction, working and application of calomel electrode to determine electrode potential. Concentration cells: Definition, types, construction and working of electrolyte concentration cell, Numerical problems on concentration cell.

Smart Sensors and Devices: Introduction, types of sensors (Piezoelectric and electrochemical), Nanomaterials for sensing applications: Gas sensors (NOx and SOx), and biosensors (Glucose sensors)

RFID and IONT materials: Synthesis, properties and applications in logistic information and intelligent packaging systems (Carbon nanotubes and polyaniline).

Self-study: Types of sensor systems, and classification of sensor systems.

(8 Hours)

Module – 4

Energy storage system:

Battery technology: Introduction to batteries, Classifications: Primary, Secondary and Reserve batteries with examples. Introduction to redox flow batteries: Classification based on components, construction, working and applications of Vanadium based redox flow batteries. Secondary batteries: Construction, working and applications of Lithium-ion batteries. Introduction to next generation sodium ion batteries and its applications. Advantages of Na –ion batteries with Li-ion battery. Overview of Battery technology for E-mobility and IoT-Based Battery Monitoring System for Electric Vehicle.

Battery management system: Li-ion battery hazardous, Electrochemical recovery of Li from Li spent batteries, best storage and handling practices of Li ion batteries, and their Safe disposal. Temperature sensing for battery management systems using thermocouple technology.

Self-study: E-waste Management: Introduction, sources of e-waste, e-waste management. Health hazards due to exposure to e-waste, recycling and recovery. Extraction of gold metal from e-waste.

(8 Hours)

Module – 5

Management of Computer Metal Components:

Corrosion science and its mitigation: Introduction to corrosion, Electrochemical corrosion (rusting of iron)-Differential metal and differential aeration corrosion with examples. Corrosion Control - Cathodic Protection-Sacrificial anode method and Impressed Current Method, Protective Coatings- Vapour Corrosion Inhibitor and its applications to protect computer circuit boards. Thermal management system of CPU using liquid cooling systems.

Electroless plating: Introduction, Principle, electroless plating in copper for double sided PCBs.

E-waste management: Sources, Hazards and toxicity. Segregation and recycling (Hydrometallurgy, pyrometallurgy and direct recycling). Extraction of valuable metals from E-waste: Extraction of Au.

Self-study: Self- Study: Consequences of corrosion, Inorganic Coating-Anodization, Technological importance of metal plating. Differences between electroplating and electroless plating.

(8 Hours)

Practical component

List of Experiments

	A-Demonstration experiments (Any one experiment):
A1	Chemical structure drawing using software: Chem Draw/Avogadro/Chem Sketch.
A2	Determination of rate of corrosion in mild steel by weight loss method.
A3	Synthesis of metal oxide nanoparticle by combustion method.
A4	Determination of CaO in cement by rapid EDTA method
	B-Exercise (All experiments compulsory):
B1	Conductometric estimation of acid mixture using standard NaOH solution
B2	Potentiometric estimation of FAS using standard K2Cr2O7.
B3	Determination of pKa of vinegar using pH meter.
B4	Estimation of Copper present in PCBs by colorimetery.
	C-Structured Enquiry (All experiments compulsory):
C1	Determination of COD of wastewater sample.
C2	Determination of viscosity of oil sample by Ostwald's viscometer.
C3	Determination of percentage of iron in steel using external indicator method.
C4	Determination of hardness of water by complexometric titration.
	D-Open ended experiments (All experiments compulsory):
D1	Determination of percentage of copper in printed circuit boards-based E-waste solution using redox titration.
D2	Estimation of percentage of available chlorine in the given sample of bleaching powder (Iodometric method).
D3	Determination of fluoride in drinking water by SPANDS method.
D4	Determination of total alkalinity of water samples.

Course Outcomes:

The students will be able to:

CO1: Understand and apply the knowledge of materials to be used in memory devices.

CO2: Understand the characteristics of materials for application in fabrication of advanced display systems.

CO3: Understand the basic concepts of electrochemistry and its application in fabrication of sensors.

CO4: To apply the knowledge of electrochemistry and materials materials in the development of energy storage systems.

CO5: Understand the materials characterization to enhance the durability and sustainable E waste management.

Text Books:

1. A Textbook of Engineering Chemistry, R.V. Gadagand Nityananda Shetty, I. K. International Publishing house. 2ndEdition,2016.
2. Textbook of Polymer Science, F.W. Billmeyer, JohnWiley&Sons,4thEdition,1999.
3. Handbook of Electronic Waste Management, International Best Practices and Case Studies, 1st Edition - November 21, 2019
4. A Textbook of Engineering Chemistry, SS Dara & Dr. SSU mare, S Chand & Company Ltd., 12thEdition, 2011.

References:

1. Battery Technologies: Materials and Components *2021 by Jianmin Ma*
2. Battery Technology Crash Course: A Concise Introduction *2020 by Slobodan Petrovic*
3. Applied Chemistry, Sunita Rattan, Kataria5.Engineering Chemistry, Baskar, Wiley
4. Engineering Chemistry–I, D. Grour Krishana, Vikas Publishing
5. Optical, electronic and magnetic Materials: Advanced memory technology: Functional materials and devices, volume1, DOI: https://doi.org/10.1039/9781839169946, ISN:978-1-83916-994-6, Special Collection: 2023 ebook collection, Series: Optical, Electronic and Magnetic Materials, No. of Pages:752,Publisher :RSC.

Alternate Assessment Tools (AATs) suggested:

- Power point presentations/ Seminar
- Scientific report writing
- Industrial visit-report writing
- Minor project
- Assignment

Web links / e–resources:

https://aissmsioit.org/wonders-of-chemistry-in-engineering/
https://leverageedu.com/blog/engineering-chemistry/

DEPARTMENT OF CHEMISTRY

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

Chemistry of Structural and Functional Materials (3:0:1) 4

CV Stream Only

(Effective from the academic year 2024-25)

Course Title	Chemistry of Structural and Functional Materials		
Course Code	**BCHECV12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand electroanalytical processes that evaluate the performance and durability of civil engineering materials.
2. Understand the impact of corrosion on civil structures and to develop its mitigation methods.
3. Apply water chemistry principles for innovative solutions through nanotechnology.
4. Understand, evaluate, and apply various construction materials for different engineering projects.
5. Impart knowledge on performance, durability and sustainability of engineering materials.

Preamble: Relevance of chemistry in day today activities, Importance of materials in industrial, defence and research applications and its economic implications. Influence of new materials for the technological development, study and use of environment friendly materials for healthier society.

Module – 1

Electrochemistry & Analytical Techniques

Electrochemistry: Introduction, Galvanic cell, Electrode potential i) Single electrode potential ii) Standard electrode potential, Electrochemical series and its Significance, Electromotive force (EMF), Derivation of Nernst equation for Single Electrode Potential, Numerical on E_{cell}.

Reference Electrodes: Primary and Secondary reference electrodes with examples. Construction, working and applications of Calomel electrode, Ion-selective electrodes, construction, working and applications of Glass electrode.

Analytical techniques: Introduction, Potentiometric sensors for the estimation of iron in FAS, Conductometric sensors for the determination of the strength of strong and weak acid mixture.

Self-study: Concentration cells construction and numerical on E_{cell}. SHE Electrode.

(8 Hours)

Module – 2

Corrosion Science & Control Methods

Corrosion Science: Introduction to corrosion, Electrochemical theory of corrosion taking iron as example, differential metal corrosion, differential aeration corrosion (waterline and pitting corrosion). Factors affecting corrosion: Nature of metal, nature of corrosion product, ratio of anodic area to cathodic area, nature of environment (pH, temperature, conductivity).
Corrosion control: Cathodic protection- Sacrificial anode method and Impressed current method. Protective metal coatings – Anodization and Galvanization,

Electroplating: Principle, Electroplating of Chromium- Hard and Decorative Cr plating, applications.

Self-study: Consequences of Corrosion, corrosion inhibitors, recent organic and inorganic corrosion inhibitors.

(8 Hours)

Module – 3

Water Chemistry & Nano Technology

Water technology: Introduction, water parameters, hardness of water, determination of temporary, permanent and total hardness by EDTA method, numerical problems, softening of water by ion exchange method and reverse osmosis, Sewage treatment by primary, secondary and tertiary processes, determination of COD by redox titration, numerical problems.

Nanotechnology: Introduction, Size dependent properties of nanomaterial (thermal and catalytic properties), Properties and applications of graphene and carbon nanotubes, Softening of industrial wastewater by Nanofiltration. Advantages of nanomaterials in water treatment.

Self-study: Applications of nanomaterials in various industries. Carbon nanowires, and nanocomposites.

(8Hours)

Module – 4

Construction Materials

Metals and Alloys: Introduction, properties and application of Iron and its alloys. Aluminium and its alloys.

Cement: Introduction, general composition, Types – Portland and Aluminate Cement, manufacturing process of Portland cement, Process of setting and hardening of cement, Applications of cement, Special Cements-High alumina cement, White Portland: Sorel cement, Water proof cement.

Refractories: Introduction, classification of refractories based on chemical composition, Properties and application of refractory materials.

Self-study: Criteria of a Good Refractory Material; Causes for the failure of a Refractory Material.

(8 Hours)

Module – 5

Polymers in Civil Engineering

Polymers: Introduction, Definition of polymer, polymerization, Types of Polymers (based on source, synthesis, and molecular forces), Preparation, properties, and applications of polyurethane, polyvinyl chloride, and epoxy resins.

Biomaterials: Introduction, Synthesis and applications of polylactic acid (PLA), properties and applications of seashells in civil structures.

Fiber Reinforced Polymers: Composition, synthesis, properties and their engineering applications in sandwich panels, advantages, disadvantages.

Geo polymer concrete: Introduction, synthesis, constituents, properties and applications.

Self-study: Basics of Composite Materials and Other Polymer Applications in Civil Structures.

(8 Hours)

Practical Component

List of Experiments

A - Demonstration (any one) offline/virtual	
A1	Synthesis of metal oxide nanoparticle by combustion method.
A2	Estimation of sulphate using precipitation method.
A3	Determination of rate of corrosion in mild steel by weight loss method.
A4	Determination of total alkalinity of water samples.
B – Instrumental Analysis (All compulsory)	
B1	Conductometric estimation of acid mixture using std. NaOH solution.
B2	Potentiometric estimation of FAS using std. $K_2Cr_2O_7$.
B3	Determination of pK_a of vinegar using pH meter.
B4	Estimation of Copper present in PCBs by colorimetry.
C - Structured Enquiry (All compulsory)	
C1	Determination of COD of waste water sample.
C2	Determination of viscosity of oil sample by Ostwald's viscometer.
C3	Determination of percentage of iron in steel using external indicator method.
C4	Determination of hardness of water by complexometric titration.
D - Open Ended Experiments (any one)	
D1	Determination of percentage of CaO in cement by EDTA method.

D2	Determination of percentage of available chlorine in bleaching powder by Iodometry.
D3	Determination of fluoride in drinking water by SPANDS method.
D4	Determination of percentage of copper in Brass using redox titration.

Course outcomes:

The students will be able to:

CO1: Understand electroanalytical processes that evaluate the performance and durability of civil engineering materials.

CO2: Understand the impact of corrosion on civil structures and to develop its mitigation methods.

CO3: Apply water chemistry principles for innovative solutions through the nanotechnology.

CO4: Understand, evaluate, and apply various construction materials for different engineering projects.

CO5: Impart knowledge on performance, durability and sustainability of engineering materials.

Textbooks:

1) Jain, P. C. and Jain, M. "Engineering Chemistry (For VTU)", Dhanpat Rai & Sons, Delhi, 43rd Edition, 2018.
2) O.G. Palanna. "Engineering Chemistry", Tata McGraw Hill Education, Pvt. Ltd, New Delhi, 4th Edition, 2015. Reference Books
3) Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2nd Edition.
4) Chemistry for Engineering Students, B.S. Jai Prakash, R. Venugopal, Sivakumaraiah & Dr. Pushpa Iyengar., Subash Publications, 5th Edition, 2014
5) A Textbook of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.

References:

1) Engineering chemistry, Satyaprakash & Manisha Agrawal, Khanna book publishing, Delhi
2) Textbook of Engineering Chemistry, S Dara & Dr.S S Umare, S Chand & Company Ltd.,12th Edition, 2011
3) Engineering Chemistry, Edited by Dr. Mahesh B and Dr.Roopashree B , Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
4) Engineering Chemistry, PC Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.

Alternate Assessment Tools (AATs) suggested:

- Assignment
- Scientific Report Writing
- Seminars/Presentations
- Mini Projects
- Case Study Reports

Reference Web Links:

- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM
- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

DEPARTMENT OF CHEMISTRY

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

CHEMISTRY OF ENGINEERING MATERIALS (3:0:1) 4

ME Stream Only

(Effective from the academic year 2024-25)

Course Title	CHEMISTRY OF ENGINEERING MATERIALS		
Course Code	**BCHEME12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand the basis of electroanalytical processes that evaluate the performance and durability of materials.
2. Determine the various properties of materials and processing technologies for fabricating different materials.
3. Impart knowledge on existing and future fuels for conservative approach.
4. Understand current and futuristic energy sources and devices for energy storage.
5. Understand the process of materials selection suitable for engineering requirements.

Preamble: Relevance of chemistry in day today activities, Importance of materials in industrial, defence and research applications and its economic implications. Influence of new materials for the technological development, study and use of environment friendly materials for healthier society.

Module – 1

Chemical- and Bio-fuels

Chemical Fuels: Introduction, Characteristics of a good fuel, Calorific value- gross and net calorific values, determination of calorific value of a fuel using Bomb calorimeter, numerical problems.

Petrol as chemical fuel – Refining, process of preparation (cracking, reforming). Octane number. Petrol knocking: Mechanisms and adverse effects. Anti-knocking agents: Leaded, Unleaded petrol and power alcohol.

Bio-Fuels: Introduction. Biogas-Production, advantages and disadvantages. Biodiesels: Synthesis by trans esterification, advantages and disadvantages. Applications.

Self-study: Diesel Knocking, cetane number, CNG, LPG, extraction of ethanol from molasses.

(8Hours)

Module – 2

Electrochemistry and Corrosion

Introduction to Electrode Systems: Introduction, Types of electrodes, Nernst equation for single electrode potential, derivation and numerical.

Corrosion and Control: Introduction. Types – Dry and wet corrosion, Electrochemical theory of corrosion (rusting of iron). Differential metal corrosion and differential aeration corrosion.

Cathodic protection- Sacrificial anode method and impressed current method. Anodic Protection – Anodization.

Electroplating: Principle. Electroplating of Chromium- Hard and Decorative Cr plating. Electroless plating: Principle. Electroless plating of Ni. Differences between electroplating and electroless platting.

Self-Study: Concentration cell and numerical, Na-ion batteries.

(8 Hours)

Module – 3

Sustainable Energy and Storage devices

Photovoltaics: Introduction, construction and working of solar cell. Advantages and disadvantages.

Green hydrogen: Hydrogen as future fuel. Green hydrogen production from photocatalytic method. Advantages and disadvantages of hydrogen as a fuel.

Fuel cell: Introduction, construction, working of H_2-O_2 fuel cell, solid oxide fuel cell. Advantages and disadvantages.

Battery: Introduction, classification of batteries. Construction, working and applications of Zn-air (primary) and Li-ion Battery (secondary). Types of batteries in e-mobility, Li-ion battery – Hazards and safety concerns.

Self-Study: Doping, semiconductors – n and p type, band structure of semiconductor, classification of semiconductor – 1, 2 and 3 dimensions. Electrocatalytic method of production of green hydrogen. Uses of green hydrogen in automobiles. Solid electrolyte, anode less battery.

(8 Hours)

Module – 4

Surface Coating Technologies

Coating Technologies: Introduction, coating materials, coating technologies, types of coating: Chemical Vapor Deposition (CVD), Physical Vapor Deposition (PVD), High Velocity Oxy-Fuel Coating, advantages and disadvantages of surface coating.

Powder metallurgy: Introduction, Powder Production Techniques: Different Mechanical methods: Chopping or Cutting, Abrasion methods, Machining methods, Ball Milling and Chemical method: Chemical reduction method.

Characterization of powders (basic P-XRD, Particle Size & Shape Distribution), Powder Shaping: Particle Packing Modifications, Powder Compaction & Process, Sintering and Application of Powder Metallurgy.

Self -study: Thermal Paints.

(8 Hours)

Module – 5

Engineering Materials

Smart Materials: Introduction – Types of smart materials, self-healing materials, shape memory alloys and uses of smart materials.
Nanomaterials: Introduction to Nanomaterials, classification and properties (catalytic and electrical properties). Chemical synthesis of nanomaterials: top-down and bottom-up approach. Synthesis techniques: Sol-gel method, Chemical Vapor Deposition. Graphene, carbon nanotubes – properties and applications in mechanical stream.
Self- Study: Applications of Engineering materials nanomaterials in various industries. Properties and applications of Carbon nanowires, and nanocomposites, nano lubricants. (8 Hours)

Practical Component

List of Experiments

PRACTICAL MODULE

A- ***Demonstration (any two) offline/virtual*:**
A1. Synthesis of metal oxide nanoparticle.
A2. Chemical structure drawing using software: ChemDraw/Avogadro/ChemSketch.
A3. Estimation of hardness of water by EDTA method.
A4. Determination of COD of wastewater sample.

B- ***Exercise (compulsorily any 3 to be conducted)*:**
B1. Conductometric estimation of acid mixture.
B2. Potentiometric estimation of FAS using $K_2Cr_2O_7$.
B3. Determination of pK_a of vinegar using pH meter.
B4. Determination of rate of corrosion of mild steel by weight loss method.

C- ***Structured Enquiry (compulsorily any 3 to be conducted)*:**
C1. Estimation of Copper present in electroplating effluent by colorimeter.
C2. Determination of viscosity of oil sample by Ostwald's viscometer.
C3. Determination of percentage of iron in steel using external indicator method.
C4. Estimation of Fluoride content using SPADNS by colorimetric estimation.

D- ***Open ended Experiments (any two)*:**
D1. Determination of percentage of CaO in cement.
D2. Determination chloride content of water in Argentometry.
D3. Analysis of mineral content and acidity of soil.
D4. Determination of percentage of copper in Brass using redox titration.

Course outcomes:

The students will be able to:

CO6: Understand the basis of electroanalytical processes that evaluate the performance and durability of materials.

CO7: Determine the various properties of materials and processing technologies for fabricating different materials.

CO8: Impart knowledge on existing and future fuels for conservative approach.

CO9: Understand current and futuristic energy sources and devices for energy storage.

CO10: Understand the process of materials selection suitable for engineering requirements.

Textbooks:

1. Jain, P. C. and Jain, M. "Engineering Chemistry (For VTU)", Dhanpat Rai & Sons, Delhi, 43rd Edition, 2018.
2. O.G. Palanna. "Engineering Chemistry", Tata McGraw Hill Education, Pvt. Ltd, New Delhi, 4th Edition, 2015. Reference Books
3. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013-2nd Edition.
4. Kent, J. A. "Riegel's Handbook of Industrial Chemistry", CBS Publishers New Delhi, 11th Edition, 2003.

References:

1. Battery Technologies: Materials and Components 2021 by Jianmin Ma
2. Battery Technology Crash Course: A Concise Introduction 2020 by Slobodan Petrovic

Alternate Assessment Tools (AATs) suggested:

- Power point Presentation.
- Literature Survey - Research Article Review Writing.
- Industrial Visit – Report writing.
- Minor Project.

Reference Web Links:

- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM
- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

DEPARTMENT OF CHEMISTRY
Choice Based Credit System (CBCS)
SEMESTER – I/II

Material Chemistry for Energy & Display systems (3:0:1) 4
EEE Stream - (Effective from the academic year 2024-25)

Course Title	**Material Chemistry for Energy & Display Systems** (For ECE and EEE Branches)		
Course Code	**BCHEEE12/22**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students:

CO1: To develop the knowledge of electroanalytical techniques and their real-world applications in technology development.

CO2: To highlight the use of applied materials in developing energy systems

CO3: To identify and solve various complex problems associated with material corrosion and prevention.

CO4: To apply the knowledge of advanced materials in the fabrication and design of memory and display devices

CO5: To interpret various environmental issues through a quantitative approach.

Preamble: Relevance of chemistry in day-to-day activities, Importance of materials in industrial, defence, and research applications, and its economic implications. Influence of new materials for the technological development, study, and use of environment-friendly materials for a healthier society.

Module – 1

Electrochemistry: Introduction, types of electrodes. Primary and secondary Reference electrodes. Construction and working of calomel electrode, Determination of electrode potential using calomel electrode. Ion selective electrode – definition, construction, and working of glass electrode. Determination of pH using a glass electrode.

Concentration cell – Definition, types, construction, and working of electrolyte concentration cell, numerical problems on Ecell.

Batteries: Introduction, Components, Classification of batteries – Primary, secondary, and reserve batteries with examples. Construction, working, and applications of Zn-air, Li-ion battery. Battery technology for e-mobility. Advances in battery technology.

Self-Study: Characteristics of battery: cell potential, current, capacity, electricity storage density, energy efficiency, cycle life, and shelf life. Lead – acid Battery, Solid state electrolyte battery (Li-polymer battery), Sodium battery.

(8 Hours)

Module – 2

Advanced Energy Systems:

Fuel Cells: Introduction, Classification, difference between conventional cell and fuel-cell, limitations & advantages, applications. Construction & working of H_2-O_2 fuel cell, Construction, working and applications of solid oxide fuel cell.

Supercapacitors: Definition, classification and characteristics: Electrostatic Double Layer Capacitors, Pseudo Capacitors and Hybrid Capacitors with examples and applications.

Photovoltaics: Introduction, Construction and working of PV cell, advantages and disadvantages of Si-solar cells. Perovskite solar cells.

Self-Study: Classification of fuel cells, CH_3OH-O_2 fuel cells, 3rd generation solar cells **(8Hours)**

Module – 3

Corrosion Science and Solution:

Corrosion: Introduction, Types- Chemical corrosion and Electrochemical corrosion (rusting of iron)-Differential metal and differential aeration corrosion with examples. Factors affecting the rate of corrosion-Nature of the metal, Nature of the corrosion product, the relative size of anode and cathode, Temperature, pH, and conductivity. Corrosion Control - Cathodic Protection-Sacrificial anode method and Impressed Current Method, Protective Coatings- Metal Coatings-Anodic coating (Galvanization) and Cathodic coating (Tinning).

PCB: Electroless plating: Introduction, Principle, electroless plating of copper for the manufacture of double-sided PCB.

Self-study: Consequences of corrosion, Inorganic Coating-Anodization, Technological importance of metal plating. Differences between electroplating and electroless plating.

(8 Hours)

Module – 4

Materials for Electronics:

Nanomaterials: Introduction to Nanomaterials, classification - 0D, 1D, 2D and 3D Nanomaterials, Properties- thermal, electrical, catalytic, optical properties. Synthesis of nanomaterials by chemical vapor deposition (CVD) Method, sol-gel method. Application of Nanomaterials in electrical and electronic devices: CNTs, Quantum dots and graphene. Use of nanomaterials in chips and Lighting/Displays.

Conducting Polymers: Introduction, Synthesis, mechanism of conduction in poly-acetylene, applications.

Semiconductors: Introduction, principle, Silicon as a semiconducting material: manufacture of silicon by Czocharlski method, applications of GaAS, SiGe semiconducting materials.

Self-Study: Applications of nanomaterials in various industries. Perovskite material and its application in optoelectronic devices.

(8 Hours)

Module – 5

Materials for memory and display systems:

Electronic memory device: Introduction, Basic concepts of electronic memory. Classification of electronic memory devices, and types of memory devices (organic, polymeric, and charge transfer based).

Liquid crystals: Introduction, Classification: Thermotropic liquid crystal and Lyotropic liquid crystals-Subphases. Differences between liquid crystal and solid/liquid. Criteria for Liquid crystalline behavior, Applications of liquid crystals in display systems (LCD) and its advantages.

Self-Study: Properties and functions of Silicon (Si), Germanium (Ge), copper (Cu), Aluminium, and Brominated flame retardants in computers. LED, OLED, and QLED.

(8 Hours)

PRACTICAL COMPONENTS

List of Experiments

A- ***Demonstration (any one) offline/virtual)*****:**

A1. Chemical structure drawing using software: Chem Draw/Avogadro/Chem Sketch.
A2. Determination of rate of corrosion in steel by weight loss method.
A3. Synthesis of metal oxide nanoparticle by combustion method.
A4. Determination of CaO in cement by rapid EDTA method.

B- ***Exercise (All compulsory)*****:**

B1. Conductometric estimation of acid mixture using standard NaOH solution.
B2. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$.
B3. Determination of pKa of vinegar using pH meter.
B4. Estimation of Copper present in PCBs by colorimetry.

C- ***Structured Enquiry (All compulsory)*****:**

C1. Determination of COD of wastewater sample.
C2. Determination of viscosity of oil sample by Ostwald's viscometer.
C3. Determination of percentage of iron in steel using external indicator method.
C4. Determination of hardness of water by complexometric titration.

D- ***Open-ended Experiments (anyone)*****:**

D1. Determination of percentage of copper in printed circuit boards-based E-waste using redox titration.
D2. Estimation of the percentage of available chlorine in the given sample of bleaching powder (Iodometry)
D3. Determination of fluoride in drinking water by SPANDS method.
D4. Determination of total alkalinity of water samples.

Course Outcomes:

At the end of the course, students will be able:

CO1: To develop the knowledge of electroanalytical techniques and their real-world applications in technology development.
CO2: To highlight the use of applied materials in developing energy systems
CO3: To identify and solve various complex problems associated with material corrosion and prevention.
CO4: To apply the knowledge of advanced materials in the fabrication and design of memory and display devices.
CO5: To interpret various environmental issues through a quantitative approach.

Textbooks:

1. Jain, P. C. and Jain, M. "Engineering Chemistry (For VTU)", Dhanpat Rai & Sons, Delhi, 43rd Edition, 2018.
2. O.G. Palanna. "Engineering Chemistry", Tata McGraw Hill Education, Pvt. Ltd, New Delhi, 4th Edition, 2015.

References:

1. Kent, J. A. "Riegel's Handbook of Industrial Chemistry", CBS Publishers New Delhi, 11th Edition, 2003.
2. P.W. Atkins. "Physical Chemistry", Oxford publishers, 8th Edition, 2006.

3. Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. "Electrochemical Methods", New Age International (P) Ltd. Pub., 3rd Edition, 2015.

Alternate Assessment Tools (AATs) suggested:

- Scientific Report Writing
- Seminars/Presentations
- Mini Projects
- Case Study Reports

Reference Web Links:

- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM
- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php

Program Core Courses

1. Principles of Programming using C
2. Computer Aided Engineering Drawing
3. Basics Electronics
4. Elements of Electrical Engineering
5. Elements of Mechanical Engineering
6. Elements of Engineering Mechanics

B.E. in Computer Science and Engineering
Choice Based Credit System (CBCS) applicable for 2024 Scheme
SEMESTER – I / II

Principles of Programming Using C (2:0:2) 3
(Effective from the academic year 2024-25)

Course Code	**BPOP13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 hours of theory + 14 hours of Practical	Exam Hours	3

Course Objectives:
This course will enable students to:
- Gain proficiency in the syntax and semantics of the C programming language.
- Understand the structure and components of a C program, including functions, data types, operators, and control & Looping structures.
- Learn to analyse problems, design algorithms, and implement solutions using C.
- Apply C programming skills to real-world problems and projects.

Preamble:
In the ever-evolving landscape of technology and computer science, understanding the foundational principles of programming is crucial for aspiring developers and engineers. The C programming language, known for its efficiency, versatility, and influence on many modern languages, serves as an excellent medium for learning these principles. This course, "Principles of Programming Using C," aims to equip students with a solid understanding of core programming concepts, including algorithms and data structures. Through a combination of theoretical knowledge and practical exercises, students will learn to write efficient, maintainable, and robust code. The course will emphasize problem-solving techniques and critical thinking, fostering a mindset of continuous learning and adaptation. By the end of the course, students will have a strong foundation in programming that can be applied to real time problems and advanced study in computer science.

Module 1

Basic Definitions of programing: Algorithm, Flowchart, Programs.
Introduction To The C Language: Structure of a C Program, Your First C Program, Comments, The Greeting Program, Identifiers, Types, Void Type, Integral Type, Floating-Point Types. **Variables:** Variable Declaration, Variable Initialization
Constants: Constant Representation, Coding Constants
Input/Output: Streams, Formatting Input/Output
Textbook 1: Chapter 1(1.1 to 1.4), Chapter 2(2.1-2.7) (05 Hours)

Module 2

Type Conversion: Implicit Type Conversion, Explicit Type Conversion **Logical Data and Operators**: Logical Data in C, Logical Operators, Evaluating Logical Expressions, Comparative Operators **Two-Way Selection**: if… else, Null else Statement, Nested if Statements, Dangling else Problem, Simplifying if Statements, Conditional Expressions. **Multiway Selection**: The switch Statement, The else-if **Concept of a loop**: Pretest and Post-test Loops, Initialization and Updating, Loop Initialization, Loop Update **Loops in C**: The while Loop, The for Loop, The do…while Loop, The Comma Expression, Other Statements Related to Looping
Textbook 1: Chapter 3 (3.5 to 3.6), Chapter 5 (5.1 to 5.3), Chapter 6 (6.1 to 6.7)
(05 Hours)

Module 3

FUNCTIONS: Designing Structured Programs, Functions in C **User-Defined Functions**: Basic Function Designs, Function Definition, Function Declaration, The Function Call, Function Examples Inter-Function Communication: Basic Concept, C Implementation**. Scope**: Global Scope, Local Scope. **Recursion**: Iterative Definition, Recursive Definition, Iterative Solution, Recursive Solution. Designing Recursive Functions, Fibonacci Numbers

Textbook 1: Chapter 4 (4.1 to 4.6), Chapter 6(6.9) (05 Hours)

Module 4

ARRAYS: Concepts, Using Arrays in C, Declaration and Definition, Accessing Elements in Arrays, Storing Values in Arrays, Precedence of Array References, Index Range Checking Inter-Function Communication: Passing Individual Elements, Passing the Whole Array **Two-Dimensional Arrays**: Declaration, Passing A Two-Dimensional Array **STRINGS**: C Strings: Storing Strings, The String Delimiter, String Literals, Strings and Characters. Declaring Strings, Initializing Strings, Strings and the Assignment Operator, Reading and Writing Strings String Manipulation Functions: String Length, String Copy, String Concatenate,

Textbook 1: Chapter 8 (8.1-8.3, 8.7), Chapter 9 (9.2), Chapter 11 (11.1 to 11.5)

(06 Hours)

Module 5

POINTERS: Pointer Constants, Pointer Values, Pointer Variables, Accessing Variables Through Pointers , Pointer Declaration and Definition, Declaration versus Redirection, Initialization of Pointer Variables **The Type Definition (typedef) Structure**: Structure Type Declaration, Initialization, Accessing Structures Operations on Structures, Complex Structures **Unions**: Referencing Unions, Initializers

Textbook 1: Chapter 8(8.5 to 8.6), Chapter 9(9.1), Chapter 12(12.1 to 12.4)

(05 Hours)

Experiments

1.	Compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages
2.	An electricity board charges the following rates for the use of electricity: for the first 200 units 80 paise per unit: for the next 100 units 90 paise per unit: beyond 300 units Rs 1 per unit. All users are charged a minimum of Rs. 100 as meter charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of total amount is charged. Write a program to read the name of the user, number of units consumed and print out the charges
3.	Write a C Program to display the following by reading the number of rows as input, 1 1 2 1 1 2 3 2 1 1 2 3 4 3 2 1 1 2 3 2 1 1 2 1 1
4.	Implement Binary Search on Integers.
5.	Implement Matrix multiplication and validate the rules of multiplication.
6.	Compute sin(x)/cos(x) using Taylor series approximation. Compare your result with the built-in library function. Print both the results with appropriate inferences.

7.	Using functions sort the given set of N numbers (Bubble sort).
8.	Write user defined functions to implement string operations such as compare, concatenate, and find string length. Use the parameter passing techniques.
9.	Implement structures to read, write and compute average- marks of the students, list the students scoring above and below the average marks for a class of N students.
10.	Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real numbers.

Course Outcomes:

The students will be able to:

CO1: **Define** key concepts and terminology related to C programming, including data types, operators, control structures, and functions.

CO2: I**mplement** fundamental algorithms and use C programming constructs to solve simple and moderately complex problems.

CO3: **Examine** code to identify and correct logical, syntax, and runtime errors.

CO4: **Design** and **develop** a functional C program that integrates multiple concepts learned throughout the course, demonstrating an understanding of program structure, data management, and problem-solving techniques.

TEXTBOOKS:

1. Computer Science : A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F .Gilberg,Third Edition, Cengage India Private Limited,ISBN 9788131503638, January 2007.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The 'C' Programming Language, Prentice H all of India..
2. Computer fundamentals and programming in c, "Reema Thareja", Oxford University, Second edition, 2017.

Alternate Assessment Tools (AATs) suggested:

- Certification courses on Infosys springboard/NPTEL etc.
- Presentation

Web links / e – resources:

1. E-learning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
2. https://nptel.ac.in/courses/106/105/106105171/ MOOC courses can be adopted for more clarity in understanding the topics and verities of problem solving methods.

DEPARTMENT OF MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Computer Aided Engineering Drawing (2:0:1) 3
B.E(Common to all branches)
(Effective from the academic year 2024-25)

Course Code	**BCED13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2: 0: 2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:
This course will enable students to:
1. Illustrate skills of visualizing points and lines to represent the same in two dimensions as per international standards, by manual and computational methods.
2. Apply orthographic projections of planes and simple three-dimensional objects.
3. Construct isometric projections of solids and development of lateral surfaces

Preamble: Importance of learning Engineering Graphics, Industrial /defence application, research in the field of ME, Impact of the course on societal and sustainable solutions.

Module – 1

Introduction to Engineering graphics
Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing. Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.
Orthographic Projections: Planes of projection.

Projection of points in all the four quadrants.

Projection of Straight Lines: Projection of straight line inclined to both the planes. True length and True inclinations of a line, Apparent length and apparent inclinations of a line.

(8 Hours)

Module – 2

Projection of Plane Surfaces:
Introduction to projection of plane surfaces, Projection of Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to horizontal plane and vertical plane.

(8 Hours)

Module – 3

Projection of Solids:
Introduction to projections of Solids, Prisms, Pyramids, Cones, Tetrahedron and Hexahedron (cube) inclined to both the planes.

(12 Hours)

Module – 4

Isometric Projection:

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron (cube), right regular prisms, pyramids, cylinders, cones, Hemisphere and spheres. Isometric projection of combination of two solids.

(8 Hours)

Module – 5

Development of Lateral Surfaces:

Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones.

(4 Hours)

Course Outcomes (COs):

The students will be able to:

CO1: Understand the concepts of orthographic projection for projecting points and lines.

CO2: Apply the concept of orthographic projection for drawing the TWO dimensional (2D) views of planes and solids.

CO3: Apply the concepts of orthographic projection for drawing the development of lateral surfaces of solids.

CO4: Analyze the 2D orthographic drawings to generate isometric drawings.

CO5: Apply Solid works/Solid edge/Auto cad commands for creating 2D and 3D drawings.

Textbooks:

[1] K.R. Gopalakrishna, *Engineering Graphics*, 32nd ed. Bangalore: Subhas Publications, 2013.

[2] N.D. Bhatt, *Engineering Drawing*, 48th ed. Gujarat: V. M. Panchal Charutha Publishing House, 2005.

References:

1. A Primer on Computer Aided Engineering Drawing, 2nd edition, Published by VTU, Belagavi.
2. Luzadder Warren J., Duff John M Eastern, 2009, Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 7th edition, Best Publications.
3. Parthasarathy N. S., Vela Murali, Engineering Drawing, Oxford University Press, 2015.

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B.E ELECTRONICS AND COMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Basic Electronics (For ECE and Allied Branches)

Course Code:	**BBEE13/23**	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives: Students will be taught

- Operation of Semiconductor diode, Zener diode and Special purpose diodes and their applications.
- Biasing circuits for transistor (BJT) as an amplifier.
- Study of linear Op-amps and its applications.
- Logic circuits and their optimization.
- Principles of Transducers and Communication.

Teaching-Learning Process
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Lecture method (L) does not mean only the traditional lecture method, but a different type ofteaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various analog and digital circuits.
3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
4. Show the different ways to solve the same problem and encourage the students to come up withtheir own creative ways to solve them.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.

Preamble: This course highlights the Evolution of Electronics system and industrial development, research. The impact of electronics on society and its economic growth, scope and career prospective in the field of electronics are discussed.

Module-1

Semiconductor Diodes: Introduction, PN Junction diode, Characteristics and Parameters, Diode Approximations, DC Load Line analysis (Text 1: 2.1,2.2,2.3,2.4)
Diode Applications: Introduction, Half Wave Rectification, Full Wave Rectification, Full Wave Rectifier Power Supply: Capacitor Filter Circuit, RC **π** Filter (includes numerical)
(Text 1: 3.1,3.2,3.4,3.5)
Zener Diodes: Junction Breakdown, Circuit Symbol and Package, Characteristics and Parameters,Equivalent Circuit, Zener Diode Voltage Regulator. (Text1:2.9, 3.7)

(8 Hours)

Module-2

Bipolar Junction Transistors: Introduction BJT Voltages & Currents, BJT Amplification, Common BaseCharacteristics, Common Emitter Characteristics, Common Collector Characteristics, BJT Biasing: Introduction, DC Load line and Bias point(Text 1: 4.2, 4.3, 4.5,4.6, 5.1)
Field Effect Transistor: MOSFETs: Enhancement MOSFETs, Depletion Enhancement MOSFETs, CMOS as an inverter (Text 1: 9.1,9.2,9.5)

(8 Hours)

Module-3

Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol, Op-Amp parameters - Gain, input resistance, Output resistance, CMRR, Slew rate, Bandwidth, input offset voltage, Input bias Current and Input offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp configurations, Differential Amplifier, Inverting & Non Inverting Amplifier.

Op-Amp Applications: Inverting Configuration, Non-Inverting Configuration, Differential Configuration, Voltage Follower, Integrator, Differentiator (Text 2: 1.1, 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.6, 6.5.1, 6.5.2, 6.5.3, 6.12, 6.13).

(8 Hours)

Module-4

Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates (Text 3: 1.2, 1.3, 1.4, 1.5,2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7)
Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder (Text 3:4.1, 4.2, 4.3)

(8 Hours)

Module-5

Introduction to Transducers: Introduction, Resistive Transducers, Inductive Transducers, Capacitive Transducers, Thermal transducers, Optoelectronic transducer, and Piezoelectric transducers (Text 4: Chapter 18: 18.1, 18.2, 18.3, 18.4, 18.5)
Communications: Introduction to communication, Communication System, Modulation (Text book 5: 1.1, 1.2, 1.3

(8 Hours)

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Describe characteristics, working principles of semiconductor devices, logic circuits, Op-amps.
CO2: Apply the acquired knowledge to construct basic electronics circuits for different applications.
CO3: Analyze different analog and digital circuits.
CO4: Perform in group to demonstrate the working of electronic circuits for different applications with the help of modern tools and write the report.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016
2. Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 4th Edition
3. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-8
4. Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, Oxford University Press,2013
5. Electronic Communication Systems, George Kennedy, 4th Edition, TMH.

Alternate Assessment Tools (AATs) suggested:

- Simulation of electronic circuits using modern tools.

Web links and Video Lectures (e-Resources):

1. http://vlabs.iitkgp.ernet.in/be/index.html#
2. https://de-iitr.vlabs.ac.in/List%20of%20experiments.html
3. https://ae-iitr.vlabs.ac.in/List%20of%20experiments.html
4. https://he-coep.vlabs.ac.in/List%20of%20experiments.html
5. https://onlinecourses.nptel.ac.in/noc21_ee55/preview
6. https://nptel.ac.in/courses/122106025
7. https://nptel.ac.in/courses/108105132
8. https://nptel.ac.in/courses/117104072

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I / II

ELEMENTS OF ELECTRICAL ENGINEERING (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**BEEE13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Perform calculations in electrical circuits to analyse the behaviour of the circuit by knowing current, voltage, power, energy and frequency.
2. Understand and identify the wiring system and basic protection scheme of electrical systems for domestic applications.
3. Select the type of generator and motor required for a particular application.
4. Appreciate the importance of transformers in the electrical power system

Preamble: Significance and Scope of the Electrical Engineering, Importance of the Course in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Innovations (Current), Research status/trends.

Module – 1

D. C. Circuits: Introduction, Ohm's Law and Kirchhoff's Laws, analysis of series, parallel and series- parallel circuits excited by independent voltage sources. Power and Energy. Illustrative examples.

Single-phase A.C. Circuits: Introduction, generation of sinusoidal voltage, definition of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current, phasor representation of alternating quantities**.** **(8 hours)**

Module – 2

Analysis of Single-phase A.C. Circuits: Analysis with phasor diagrams, of R, L, C, R-L, R-C and R-L-C circuits, real power, reactive power, apparent power and power factor. Resonance of Series RLC circuit. Illustrative examples involving series, parallel and series- parallel circuits.

Domestic Wiring: Service mains, meter board and distribution board. Two-way and three-way control of a lamp. Elementary discussion on fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock –Earthing: Pipe and Plate.

(**8 hours**)

Module – 3

Three Phase Circuits: Introduction to three phase systems, Necessity and advantages of three phase systems, generation of three phase power, definition of Phase sequence, 12 balanced supply and balanced load. Relationship between line and phase values of balanced star and delta connections. Power in balanced three-phase circuits, measurement of power by two-wattmeter method. Illustrative examples.

Synchronous Generators: Introduction, principle of operation. Types and constructional features. EMF equation. Concept of winding factor (excluding derivation of distribution and pitch factors). Illustrative examples on EMF equation. Hands-on: Identification of various parts

of stator and rotor through cut section models of machines.

(8 hours)

Module – 4

Transformers: Introduction, Principle of operation and construction of single-phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation (Open Circuit and Short circuit tests, equivalent circuit and phasor diagrams are excluded). Illustrative problems on EMF equation and efficiency only.

Three Phase Induction Motors: Introduction, Concept of rotating magnetic field. Principle of operation. Types and Constructional features. Slip and its significance. Applications of squirrel - cage and slip - ring motors. Necessity of a starter, star-delta starter. Illustrative examples on slip calculations.

(8 hours)

Module – 5

DC Machines: Introduction, working principle of DC generator. Types and constructional features. EMF equation of generator. Illustrative examples. DC motor working principle, Back EMF and its significance, torque equation. Types of D.C. motors, characteristics (shunt and series only) and applications. Necessity of a starter for DC motor and three-point starter. Illustrative examples on back EMF and torque, Electric Braking in DC motors.

(8 hours)

Summary: The student will be able to explore Electrical circuits and their behaviour with DC and AC supply. Students will be able to evaluate the performance of Electrical machines.

Course Outcomes:

The students will be able to:

CO1: Comprehend the concepts of domestic wiring and protective devices.

CO2: Apply the fundamental principles of electrical science to know the working of AC and DC machines.

CO3: Analyze DC and AC circuits.

CO4: Analyze the performance of Electrical machines.

Textbooks:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2nd edition, June 2019.
2. V.K. Mehta, Rohit Mehta, "Principles of Electrical Engineering & Electronics", S. Chand Publications, 2nd edition, 2019.

References:

1. E. Hughes, "Electrical and Electronics Technology", Pearson Education, 12th edition, 2016.
2. S.S. Parker Smith and N.N Parker Smith, "Problems in Electrical Engineering "CBS publishers & Distributors Pvt Ltd, 9th edition, 2018.
3. D.P. Kothari and I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI learning Private Limited, 2nd edition, 2017.

Alternate Assessment Tools (AATs) suggested:

- Tabulating the power ratings of various domestic appliances (Electrical)
- Calculating the total energy bill of one's residence

Web links / e – resources:

1. https://libguides.lib.fit.edu/OEREng/electrical
2. https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/dgdashboard/committee_sso/

DEPARTMENT OF MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)

Elements of Mechanical Engineering (3:0:0) 3
(Effective from the academic year 2024-25)

Course Code	**BEME 13/23**	Semester	I/II
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Contact Hours	40	SEE Marks	50
Examination Nature (SEE)	Theory	Exam Hours	03

Course objectives:

This course will enable students to:

1. Acquire a basic understanding about scope of mechanical engineering, fundamentals about nonconventional energy sources, convectional machine tool, power transmission elements.
2. Study various types of robotics and industrial automation.
3. Develop skills for material selection for different devices/ components hands-on exposure on selection of material, robots and machining operations.
4. Develop students' ability to analyze the problems involving forces, moments with their applications.

Preamble: Importance of Mechanical Engineering in the current scenario, industrial /defense application, research in the field of Mechanical Engineering, impact of Mechanical Engineering on societal and sustainable solutions. World energy outlook

Module – 1

Conventional Energy Sources: Fossil fuels, liquid and gaseous fuels.

Non-conventional Energy Sources: Solar power: principle of conversion, flat plat collector, Wind energy: conversion, wind mill and Hydro power: hydro power station.

Steam Formation and Application: Formation of steam and thermodynamic properties of steam (Simple Problems using Steam Tables), Applications of steam in industries namely, Sugar industry, Dairy industry, Paper industry, Food processing industry for eating/Sterilization, Propulsion/Drive, Motive, Atomization, Cleaning, Moisturization, Humidification.

(8 Hours)

Module – 2

Power Transmission Elements: Belt Drives: Open and cross belt-drives, pulleys and its types, velocity ratio of pulleys, creep and slip in the belts, derivation for length of belt, numerical problems on length of belt and tension in a belt.

Gear Drives: Types of gear drives, advantages and disadvantages of gear drives over belt drives.

Conventional Machine Tool: Lathe, engine lathe, specification, major parts; Lathe operations: plain turning, taper turning by swivelling compound rest, facing, thread cutting, drilling, knurling. (Sketches to be used only for explaining the operations)

(8 Hours)

Module – 3

Industrial Automation: Types of automation: Fixed, programmable and flexible automation: basic elements with block diagram: Control systems: Closed loop and open loop.

Robotics: Elements of robotic system, type of robotic joints; robotics configuration: polar, cylindrical, cartesian; applications of robots: material handling, process operation and assembly and inspection; advantages and disadvantages of industrial robotics.

(8 Hours)

Module – 4

Fundamentals Engineering mechanics: Basics of concepts - Particle, Continuum, Rigid body and Point force; fundamental lows of mechanicals, System of forces, resolution and resultant forces, moment of forces and couple.

Equilibrium of system of forces: equations of equilibrium, free body diagram, graphical method – conversation of law of triangle and conversation of law of polygon.

(8 Hours)

Module – 5

Beams: types of beams, types of forces, types of supports, statically determinate beams, Numerical problems on equilibrium of coplanar non-concurrent force system and support reactions for statically determinate beams. Analysis of plane trusses by method of joints and method of sections.

(8 Hours)

Course outcomes: The students will be able to:

CO1. Summarize the working of conventional machine tools, machining processes and its accessories and advanced manufacturing systems.

CO2. Identify and comprehend the different sources of energy, their conversion processes, power transmission elements and their applications in an engineering industry.

CO3. Analyze mechanical energy conversations and power transmission systems performing intended task.

CO4. Demonstrate ability to acquire the knowledge by self-learning and communicate the same with lager group.

CO5. Comprehend the action for forces, moments, and other types of loads on rigid bodies and compute the reactive forces.

Textbooks:

1. Elements of Mechanical Engineering, K R Gopalakrishna, Subhas Publications, Bangalore.
2. Elements of Mechanical Engineering, R K Rajput, Firewall Media, 2005.
3. Engineering Mechanics by T Vijaya Krisna and Madhu Mohan, Cengage Publications, 2017.

References:

1. Manufacturing Technology- Foundry, Forming and Welding, P.N.Rao Tata McGraw Hill 3rd Ed., 2003.

2. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition, 2012.
3. Mechanics for Engineers: Statics by Ferdinand P. Beer and E. Russet Johnston Jr., McGraw-Hill Book Company, New York.
4. Engineering Mechanics by Timoshenko and Young, McGraw-Hill Book Company, New Delhi.

B.E. CIVIL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – I/II

Elements of Engineering Mechanics (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**BEEM13/23**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. To develop students' ability to analyze the problems involving forces, moments with their applications.
2. To make students to learn the effect of friction on different planes.
3. To develop the student's ability to find out the centre of gravity and moment of inertia and their applications.
4. To make the students learn about kinematics and kinetics and their applications.

Module-1

Resultant of Coplanar Force System: Basic dimensions and units, Idealizations. Classification of force system, Principle of transmissibility of a force, Composition of forces, Resolution of a force. Free body diagrams, Moment, Principle of moments, Couple, Resultant of coplanar concurrent force system, Resultant of coplanar non-concurrent force system. Numerical examples.

Module-2

Equilibrium of Coplanar Force System: Equilibrium of coplanar concurrent force system, Lami's theorem, Equilibrium of coplanar parallel force system.

Types of beams, Types of loadings, Types of supports. Equilibrium of coplanar non-concurrent force system, Support reactions of statically determinate beams subjected to various types of loads. Numerical examples.

Module-3

Friction: Introduction, Laws of Coulomb friction, Equilibrium of blocks on horizontal plane, Equilibrium of blocks on inclined plane, Ladder friction. Numerical examples.

Centroid of Plane Areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, Centroid of composite areas and simple built-up sections. Numerical examples.

Module-4

Moment of Inertia of Plane Areas: Introduction, Rectangular moment of inertia, Polar moment of inertia, Product of inertia, Radius of gyration, Parallel axes theorem, Perpendicular axis theorem, Moment of inertia of rectangular, triangular and circular areas from the method of integration, Moment of inertia of composite areas and simple built-up sections, Numerical examples.

Module-5

Kinematics: Linear motion: Introduction, Displacement, Speed, Velocity, Acceleration,

Acceleration due to gravity, Numerical examples on linear motion. Projectiles: Introduction, Numerical examples on projectiles.

Kinetics: Introduction, D Alembert's principle of dynamic equilibrium and its application in-plane motion and connected bodies. Numerical examples.

Course Outcomes

The Students will be able to:

CO 1: Determine the composition of forces and resultant of a force system

CO 2: Compute the unknowns in coplanar force system using equilibrium conditions

CO 3: Determine the force of friction and centroid of plane areas

CO 4: Calculate the moment of inertia of the sections

CO 5: Compute the dynamic variables subjected to linear, projectile and plane motion

Text Books

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering Engineering and Mechanics, Laxmi Publications,2015
2. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics, EBPB, 2014.
3. Shesha Prakash M.N and Ganesh. B. Mogaveer, "Elements of Civil Engineering and Engineering Mechanics", 3rd Revised edition, PHI Learning, 2014.

References:

1. Timoshenko and Young, "Engineering Mechanics", McGraw Hill Publishers, 5th edition 2013.
2. Nelson A, "Engineering Mechanics-Statics and Dynamics", 1st edition, Tata McGraw Hill Education PrivateLtd, 2009.
3. Russell C Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics,11th Edition, Published by Pearson Education Inc., Prentice Hall,2010.
4. Beer, Johnston, Cornwell and Sanghi,"Vector Mechanics for Engineers: Statics andDynamics", 10th Edition, McGraw-Companies, Inc., New York, 2013.
5. Bhavikatti, S.S, "Elements of Civil Engineering and Mechanics", 6th edition, New Age International Publisher, 2019.

Engineering Science Courses – I/II (ESC I/ESC II)

1. **Introduction to Civil Engineering (BESC14A/24A)**
2. **Introduction to Electrical Engineering (BESC14B/24B)**
3. **Introduction to Electronics Engineering (BESC14C/24C)**
4. **Introduction to Mechanical Engineering (BESC14D/24D)**
5. **Introduction to C Programming (BESC14E/24E)**

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Introduction to Civil Engineering (3:0:0) 3
(Effective from the academic year 2024-25)

Course Code	**BESC14A/24A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

5. To make students learn the scope of various specializations of civil engineering.
6. To make students learn the concepts of sustainable infrastructure
7. To develop students' ability to analyse the problems involving forces, moments with their applications.
8. To develop the student's ability to find out the center of gravity and moment of inertia and their applications.

Module-1

CIVIL ENGINEERING DISCIPLINES AND BUILDING SCIENCE

Introduction to Civil Engineering: Surveying, Structural Engineering, Geotechnical Engineering, Hydraulics & Water Resources, Transportation Engineering, Environmental Engineering, Construction planning & Project management.

Basic Materials of Construction: Bricks, Cement & Mortars, Plain, Reinforced & Pre-stressed Concrete, Structural steel, Construction Chemicals.

Structural elements of a building: Foundation, Plinth, Lintel, Chajja, Masonry wall, Column, Beam, Slab and Staircase.

Module-2

SOCIETAL AND GLOBAL IMPACT OF INFRASTRUCTURE

Infrastructure: Introduction to sustainable development goals, Smart city concept, Clean city concept, Safe city concept.

Environment: Water Supply and Sanitary systems, Urban air pollution management, Solid waste management, Identification of Landfill sites, Urban flood control.

Built-Environment: Energy efficient buildings, Recycling, Temperature and Sound control in buildings, Security systems, Smart buildings.

Module-3

Analysis of Force Systems: Concept of idealization, system of forces, Principles of superposition and transmissibility, Resolution and composition of forces, Law of Parallelogram of forces, Resultant of concurrent and non-concurrent coplanar force systems, Moment of forces, Couple, Varignon's theorem, Free body diagram, Equations of equilibrium, Equilibrium of concurrent and non-concurrent coplanar force systems.

Module-4

Centroid: Importance of centroid and centre of gravity, Methods of determining the centroid, Locating the centroid of plane lamina from first principles, Centroid of built-up sections. Numerical

examples.

Module-5

Moment of inertia: Importance of Moment of Inertia, Method of determining the second moment of area (moment of inertia) of plane sections from first principles, Parallel axis theorem and perpendicular axis theorem, Section modulus, Radius of gyration, Moment of inertia of built-up sections, Numerical Examples.

Course Outcomes

The Students will be able to:

CO 1: Gain knowledge on various disciplines of civil engineering specialization and to understand the materials and structural elements of buildings.

CO 2: Comprehend on the societal and global impact of Infrastructure developments.

CO 3: Apply the equilibrium concept of forces to solve for the different force systems.

CO 4: Use the basics of geometry and mathematics principles to calculate the centroid of plane and built-up sections.

CO 5: Compute the moment of inertia of plane and built-up sections using the fundamental theorems.

Text Books

1. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering Engineering and Mechanics, Laxmi Publications, 2015,
2. Kolhapure B K, Elements of Civil Engineering and Engineering Mechanics,EBPB, 2014.

Reference Books

1. Beer F.P. and Johnston E. R., Mechanics for Engineers, Statics and Dynamics, McGraw Hill.1987,
2. Irving H. Shames, Engineering Mechanics, Prentice-Hall.,2019,
3. Hibbler R. C., Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2017,
4. Timoshenko S, Young D. H., Rao J. V., Engineering Mechanics, 5th Edition, Pearson Press,2017.
5. Bhavikatti S S, Engineering Mechanics, New Age International ,2019.
6. Reddy Vijaykumar K and Suresh Kumar K, Engineering Mechanics, BS Publications, 2011

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

INTRODUCTION TO ELECTRICAL ENGINEERING (3:0:0)3

(Effective from the academic year 2024-25)

Course Code	**BESC14B/BESC24B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. To explain the sources of electric energy and its generation.
2. To explain the behavior of circuit elements in single-phase circuits.
3. To explain the construction and operation of transformers, DC generators and motors and induction motors.
4. To introduce concepts of circuit protecting devices and earthing.
5. To explain electric power generation, transmission and distribution, electricity billing, equipment and personal safety measures.

Preamble: Significance and Scope of the Electrical Engineering, Importance of the Course in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Innovations (Current), Research status/trends.

Module – 1

Introduction: Conventional and non-conventional energy resources; General structure of electrical power systems using single line diagram approach.

Power Generation: Hydel, Nuclear, Solar & wind power generation (Block Diagram approach).

DC Circuits:

Ohm's Law and its limitations. KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical.

(08 Hours)

Module – 2

A.C. Fundamentals:

Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor. (only definitions) Voltage and current relationship with phasor diagrams in R, L, and C circuits. Concept of Impedance. Analysis of R-L, R-C, R-L-C Series circuits. Active power, reactive power and apparent power. Concept of power factor. (Simple Numerical).

(08 Hours)

Module – 3

DC Machines:

DC Generator: Principle of operation, constructional details, induced emf expression, types of generators. Relation between induced emf and terminal voltage. Simple numerical.

DC Motor: Principle of operation, back emf and its significance. Torque equation, types of motors, characteristics and applications. Simple numerical.

(08 Hours)

Module – 4

Transformers: Necessity of transformer, principle of operation, Types and construction of single-phase transformers, EMF equation, losses, variation of losses with respect to load. Efficiency and simple numerical.

Three-phase induction Motors: Concept of rotating magnetic field, Principle of operation, constructional features of motor, types – squirrel cage and wound rotor. Slip and its significance. simple numerical.

(08 Hours)

Module – 5

Domestic Wiring: Requirements, Types of wiring: casing, capping. Two-way and three-way control of load.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits.

Personal Safety Measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, calculation of electricity bill for domestic consumers.

(08 Hours)

Course Outcomes:

The students will be able to:

CO1: Understand the concepts of various energy sources and power generation.
CO2: Apply the basic electrical laws to solve DC circuits.
CO3: Apply the basic electrical laws to solve AC circuits..
CO4: Explain the working of various electric machines.
CO5: Explain the concepts of domestic wiring, circuit protective devices and personal safety measures.

Textbooks:

1. Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, First Edition 2019.
2. A text book of Electrical Technology by B.L. Theraja, S Chand and Company, reprint edition 2014

References:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill 4th edition, 2019.
2. Principles of Electrical Engineering & Electronics by V. K. Mehta, Rohit Mehta, S. Chand and Company Publications, 2nd edition, 2015.

3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.
4. Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanapat Rai and Co. edition, January 2015

Alternate Assessment Tools (AATs) suggested:

- Tabulating the power ratings of various domestic appliances (Electrical)
- Calculating the total energy bill of one's residence

Web links / e – resources:

1. https://libguides.lib.fit.edu/OEREng/electrical
2. https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/dgdashboard/committee_sso/

BMS Institute of Technology & Management
(An Autonomous Institute under VTU, Belagavi, Karnataka - 590018)
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B.E ELECTRONICS AND COMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Introduction to Electronics Engineering (3:0:0) 3
ESC-I
(Common to: CSE/ME/EEE/CIV/AIML/CSBC)
(Effective from the Academic Year 2024-25)

Course Code:	**BESC14C/BESC24C**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives:
This Course will enable students to:

1. To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.
2. To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.
3. Professionalism & Learning Environment: To inculcate in first-year engineering studentsan ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Preamble:

Introduction to electronics course equip with the knowledge of exploring fundamental concept in the field of electronics. It deals about diodes, BJTs, FET's and digital electronics concepts such as gates and Boolean algebra. It also highlights the amplifiers, oscillators and operational amplifiers.

Module-1

Semiconductor Diodes: Introduction, PN Junction diode, Characteristics and Parameters, Text 1: 2.1,2.2)

Diode Applications: Introduction, Half Wave Rectification, Full Wave Rectification, Full Wave Rectifier Power Supply: Capacitor Filter Circuit, RC π filter (Text 1: 3.1,3.2,3.4,3.5)
Zener Diodes: Zener Diode, Characteristics and Parameters,Zener Diode Voltage Regulator. (Text1:2.9, 3.7)

(8 Hours)

Module-2

Bipolar Junction Transistors: Introduction, BJT Voltages & Currents, Common Emitter Characteristics, BJT as a Switch. (Text 1: Chapter 4)

Field Effect Transistor: MOSFETs: Enhancement MOSFETs, Depletion Enhancement MOSFETs, CMOS as an inverter (Text 1: 9.1,9.2,9.5)

(8 Hours)

Module-3

Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol, Op-Amp parameters - Gain, input resistance, Output resistance, CMRR, slew rate, Bandwidth, input offset voltage, Input bias Current and Input offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp configurations, Differential Amplifier, Inverting & Non Inverting Amplifier.

Op-Amp Applications: Inverting Configuration, Non-Inverting Configuration, Differential Configuration, Voltage Follower, Integrator, Differentiator (Text 2: 1.1, 1.2, 1.3, 1.5, 2.2, 2.3, 2.4, 2.6, 6.5.1, 6.5.2, 6.5.3, 6.12, 6.13).

(8 Hours)

Module-4

Boolean Algebra and Logic Circuits: Binary numbers, Number Base Conversion, octal & HexaDecimal Numbers, Complements, Basic definitions, Boolean Algebra, Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms,Other Logic Operations, Digital Logic Gates (Text 3: 1.2, 1.3, 1.4, 1.5,2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7) .

Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder (Text 3:4.1, 4.2, 4.3)

(8 hours)

Module-5

Embedded Systems – Definition, Embedded systems vs general computing systems, Classificationof Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC.

Sensors and Interfacing – Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 4) **(8 hours)**

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016
2. Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 4th Edition
3. Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008 ISBN-978-81-203-0417-8
4. K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India),Private Limited, 2016

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Apply the acquired knowledge to construct basic electronic circuits

CO2: Analyze acquired knowledge of semiconductor physics in electronic system for a given application

CO3: Design the basic electronics circuits for a given specification to address engineering applications

CO4: Demonstrate the working of electronic circuits for different applications with the help of modern tools and write report in a group.

Alternate Assessment Tools (AATs) suggested:

- Virtual lab program execution and report submission.
- Simulation of electronic circuits using modern tools.

Web links and E-resources:

1. http://vlabs.iitkgp.ernet.in/be/index.html#
2. https://de-iitr.vlabs.ac.in/List%20of%20experiments.html
3. https://ae-iitr.vlabs.ac.in/List%20of%20experiments.html
4. https://he-coep.vlabs.ac.in/List%20of%20experiments.html
5. https://onlinecourses.nptel.ac.in/noc21_ee55/preview
6. https://nptel.ac.in/courses/122106025
7. https://nptel.ac.in/courses/108105132
8. https://nptel.ac.in/courses/117104072

B.E MECHANICAL ENIGINEERING
Choice Based Credit System (CBCS)

Introduction To Mechanical Engineering (3:0:0) 3
(Effective from the academic year 2022-2023)

Course Code	**BESC14D/24D**	Semester	I/II
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Lecture Hours	40	SEE Marks	50
Examination nature (SEE)	Descriptive	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Identify different sources of energy and their conversion process.
2. Explain the working principle of IC engines, EV's, Hybrid electric vehicles, refrigerator and air conditioner.
3. Recognize various metal joining processes and power transmission elements.
4. Discuss the working of advanced machine tools and automation.
5. Describe the functions of robotics and concepts of IoT.

Preamble: Importance of Mechanical Engineering in the current scenario, impact of Mechanical Engineering on societal and sustainable solutions.

Module – 1

Energy sources: Fossil Fuels: Solid, liquid and gaseous fuels; Solar power: principle of conversion, flat plate collector; wind energy: conversion, wind mill and Hydro power: hydro power station.

Refrigeration and air-conditioner: Refrigerants and its properties, parts of refrigerator, terminology, principle of vapour compression refrigeration, concept of air conditioning, working of room air conditioner.

(08 hours)

Module-2

Internal Combustion Engines: Parts, terminology, working of 4 stroke petrol and diesel engine, comparison between petrol and diesel engine.

Electric vehicles (EV) and Hybrid Electric vehicles (HEV): Basic principles of EV and HEV. Components of EV and HEV. Power transmission in EV and HEV. **(08 hours)**

Module-3

Metal Joining Processes: Types of joining processes: Permanent and temporary joining, Soldering: method, types, advantages; Welding: Principle of Arc, TIG and MIG welding.

Power Transmission: Types of belts, Open and cross belt-drives, pulleys and its types; Types of gear drives, advantages and disadvantages of gear drives over belt drives.

(08 hours)

Module-4

Computer Numerical Control (CNC) machines: Elements of a CNC system, salient features of CNC controls, advantages and disadvantages of CNC.

Industrial Automation: Types of automation: Fixed, programmable and flexible automation; basic elements with block diagrams. **(08 hours)**

Module-5

Robotics: Elements of robotic system, type of robotic joints; robotics configuration: polar, cylindrical, cartesian; applications of robots: material handling, process operation and assembly and inspection; advantages and disadvantages of industrial robotics.

Internet of Things (IoT): Fundamental concept, definition and characteristics, things in IoT, IoT functional blocks and IoT communication models.

(08 hours)

Suggested Learning Resources

Textbooks :

1. K R Gopala Krishna, "Elements of Mechanical Engineering", Subhash Publications, 2008.
2. Hazra Choudhry and Nirzar Roy, "Elements of Workshop Technology" (Vol. 1 and 2), Media Promoters and Publishers Pvt. Ltd., 2010.

References

1. Jonathan Wickert and Kemper Lewis, "An Introduction to Mechanical Engineering", 3rd Edition, 2012.
2. P.N.Rao, "Manufacturing Technology- Foundry, Forming and Welding", 3rd Edition, Tata McGraw Hill, 2003.
3. Appu Kuttan KK, "Robotics", volume 1, International Pvt Ltd, 2008.
4. Husain, Iqbal, "Electric and Hybrid Vehicles: Design Fundamentls", CRC Press, 3rd Edition, 2021.
5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things a Hands on Approach", Hydrabad Universities Press, 2020.

Course Outcomes:

The students will be able to:

CO 1: Summarize various energy conversions, refrigeration system and air conditioners.

CO 2: Describe working principles of power transmission systems and advanced mobility systems.

CO 3: Identify suitable conventional and advanced manufacturing processes for real world applications.

CO 4: Demonstrate ability to work as an individual and a team member to investigate the recent technologies by self-learning.

B.E. in Computer Science and Engineering

Choice-Based Credit System (CBCS) applicable for the 2024 Scheme

SEMESTER – I/II

Introduction to C Programming (2:0:2) 3

(Effective from the academic year 2024-25)

Course Code	**BESC14E/24E**	CIE Marks	50
Teaching Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 Hours Theory + 14 Hours Practical	Exam Hours	03

Course Objectives: This course will enable students to:

- Design solutions to simple engineering problems by applying the basic programming principles of C language and basic mathematical knowledge.
- Enables the Choice of a suitable C-construct to develop C code for a given problem.
- Apply the C-language syntax rules to Recognize and correct the bugs in the C program.
- Develop C programs to illustrate the applications of different data types such as arrays, structures, pointers, and functions.

Preamble:

This syllabus offers a comprehensive introduction to programming, focusing on foundational concepts such as algorithms, flowcharts, and the C programming language. It covers essential topics including input/output operations, control statements, arrays, strings, functions, and pointers. Students will gain a deep understanding of C, from basic syntax to advanced features like recursion and user-defined data types, preparing them for more complex programming challenges. Through these modules, learners will build a strong foundation in both theoretical and practical aspects of programming.

MODULE 1

BASICS OF C: Introduction: Why Learn C? The Future of C, Structure of a C Program, Concept of a Variable. Data Types in C. Program Statement: Declaration, How Does The Computer Store Data in Memory? How are Integers Stored? How Floats and Doubles are Stored? Tokens, Operators, and Expressions. Expressions Revisited, Lvalues and Rvalues, Type Conversion in C.

INPUT AND OUTPUT: Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Functions **(05 hours)**

MODULE 2

CONTROL STATEMENTS: Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection. Selection Statements, The Conditional Operator, The Switch Statement Iteration and Repetitive Execution: while, for, do-while, Goto Statement/Unconditional statements and Nested Loops. **(05 hours)**

MODULE 3

ARRAYS: One-Dimensional Array: Declaration of a One-dimensional Array, Initializing Integer Arrays, Accessing Array Elements, Other Allowed Operations, Internal Representation of Arrays in C Working with One-dimensional Arrays.

Two-Dimensional Arrays: Declaration of a Two-dimensional Array, Accessing 2D Arrays. Working with Two-dimensional Arrays.

(06 hours)

MODULE 4

STRINGS: One-dimensional Character Arrays, Declaration of a String, String Initialization, Printing Strings, String Input, Character Manipulation in the String, String Manipulation, String operations: using built-in functions.

FUNCTIONS: Introduction: Concept of Function, why are Functions Needed? Using Functions, Function Prototype Declaration, Function Definition, Function Calling.

Call by Value Mechanism: Working with Functions, Passing Arrays to Functions, Scope and Extent: Concept of Global and Local Variables, Scope Rules. -Call by Reference

(05 hours)

MODULE 5

INTRODUCTION TO POINTERS AND STRUCTURES

Introduction: Understanding Memory Addresses, Address Operator (&), Pointer: Declaring a Pointer, Initializing Pointers. Void Pointer, Null Pointer, Use of Pointers, Arrays and Pointers, Pointers and Strings.

Structures: Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef and its Use in Structure Declarations, Nesting of Structures. Arrays of Structures, Initializing Arrays of Structures, Arrays within the Structures.

Structures and Pointers, Structures and Functions

(05 hours)

Course Outcomes:

The students will be able to:

CO1: Describe the basic structure of a C program, variable concepts, data types, and input and output operations in C.

CO2: Demonstrate the use of appropriate conditional statements and iterative loops to manage control flow.

CO3: Apply concepts of arrays and strings, to implement solution for the given problems.

CO4: Develop modular programs using functions, recursion, and different storage classes in C.

CO5: Use the concept of pointers and structures, in manipulation of the complex data of real world objects.

Experiments

Sl.No	Name of the Experiment
1.	a. Implement a C program to compute area of circle by using the concept of constant. b. Implement a c program to compute area of triangle, given length of all three sides
2.	a. Design and develop C program to find the bigger number among three numbers using ternary operator. b. Develop a C program to find the swap to numbers without using temporary variable.
3.	a. Develop C program to build simple calculator using switch. b. Develop C program to check whether given number is Armstrong number or not.
4.	a. Write a C program to evaluate quadratic equation of the form $ax^2+bx+c=0$. Given a,b and c values b. Develop a C program to convert decimal to binary number.
5.	a. Develop a C program to find the sum of even numbers and odd numbers in the array of elements and also compute average of all the elements of array. b. Develop C program to find the maximum marks scored among the marks of N students.
6.	Develop C program to compute sum of elements of each row in the given matrix.

7.	Develop C program to perform matrix multiplication and check for the compatibility rules**.**
8.	Develop C program to search for a key element in an array of 'n' elements using binary search.
9.	Define structure to store student details like USN, name, percentage, and semester. Write C program to display names of students who scored above 75%.
10.	Implement C program to compute sum, variance, standard deviation of N real numbers using pointers

TEXTBOOKS:

1. Behrouz A. Forouzan, Richard F. Gilberg **"Computer Science: A Structured Programming Approach Using C",** Third Edition, Cengage India Private Limited, ISBN 9788131503638, January 2007.
2. Pradip Dey and Manas Ghosh, **"Programming in C"** Second Edition, Oxford University Press 2011.

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, **"The 'C' Programming Language"**, Prentice Hall of India.
2. Computer fundamentals and programming in c, **"Reema Thareja",** Oxford University, Second edition, 2017.

Alternate Assessment Tools (AATs) suggested:

- Certification courses on Infosys springboard/NPTEL etc.
- Programming Quiz

Web links/e-resources:

- E-learning.vtu.ac.in/econtent/courses/video/BS/15PCD23.html
- https://nptel.ac.in/courses/106/105/106105171

Programming Language Courses

1. **Introduction to Web Programming BPLC15A/25A**
2. **Introduction to Python Programming BPLC15B/25B**
3. **Basics of Java Programming BPLC15C/25C**
4. **Introduction to C++ Programming BPLC15D/25D**

B.E in COMPUTER SCIENCE AND ENGINEERING
Choice Based Credit System (CBCS) Scheme 2024
SEMESTER - I/II

Introduction to Web Programming (2:0:2) 3
(Effective from the academic year 2024-25)

Course Code	**BPLC15A/25A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 hours of theory + 14 hours of Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To use the syntax and semantics of HTML and XHTML
2. To develop different parts of a web page
3. To understand how CSS can enhance the design of a webpage.
4. To create and apply CSS styling to a webpage
5. To get familiarity with the JavaScript language and understand Document Object Model handling of Java Script

Preamble:

This course will cover the basics of the Internet, introduction of web development techniques that use HTML, CSS and JavaScript as web development essentials. It utilizes the capabilities of web browsers for client-side applications

Module – I

Traditional HTML and XHTML: First Look at HTML and XHTML, Hello HTML and XHTML World, HTML and XHTML: Version History, HTML and XHTML DTDs: The Specifications Up Close, (X)HTML Document Structure, Browsers and (X)HTML, The Rules of (X)HTML, Major Themes of (X)HTML, The Future of Markup—Two Paths?

TextBook1: Chapter 1 (**8 hours)**

Module –2

HTML5 :Hello HTML5, Loose Syntax Returns, XHTML5, HTML5: Embracing the Reality of Web Markup, Presentational Markup Removed and Redefined, HTML5 Document Structure Changes, Adding Semantics, HTML5's Open Media Effort, Client-Side Graphics with <canvas>, HTML5 Form Changes, Emerging Elements and Attributes to Support Web Application

TextBook1: Chapter 2 (**8 hours)**

Module – 3

Cascading Style Sheets (CSS):Introduction, CSS Overview , CSS Rules, Example with Type Selectors and the Universal Selector,CSS Syntax and Style, Class Selectors, ID Selectors, span and div Elements, Cascading, style Attribute, style Container, External CSS Files, CSS Properties, Color Properties, RGB Values for Color, Opacity Values for Color, HSL and HSLA Values for Color,

Font Properties, line-height Property, Text Properties, Border Properties, Element Box, padding Property, margin Property

TextBook2: Chapter 3 **(8 hours)**

Module – 4

Tables and CSS, Links and Images

Table Elements, Formatting a Data Table: Borders, Alignment, and Padding, CSS Structural PseudoClass Selectors, thead and tbody Elements, Cell Spanning, Web Accessibility, CSS display Property with Table Values, a Element, Relative URLs, Navigation Within a Web Page, CSS for Links,Bitmap Image Formats: GIF, JPEG, PNG, img Element, Responsive Images, Positioning Images,Shortcut Icon, iframe Element

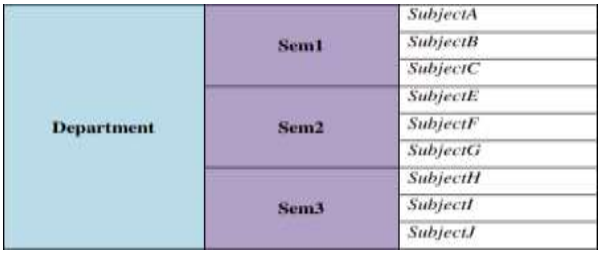
TextBook2: 5.2 to 5.8, 6.2, 6.3, 6.6., 6.7, 6.9, 6.10, 6.12, 7.2 to 7.4 **(8 hours)**

Module – 5

Introduction to JavaScript: Functions, DOM, Forms, and Event Handlers History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Forms and How They're Processed: Client-Side Versus Server-Side, form Element, Controls, Text Control, Accessing a Form's Control Values, reset and focus Methods

TextBook2: 8.2 to 8,13, 8.15, 8.16 **(8 hours)**

Experiments

1.	Create an XHTML page using tags to accomplish the following: (i) A paragraph containing text "All that glitters is not gold". Bold face and italicize this text (ii) Create equation: $x = 1/3(Y_1^2+Z_1^2)$ (iii) Put a background image to a page and demonstrate all attributes of background image (iv) Create unordered list of 5 fruits and ordered list of 3 flowers
2.	Create following table using XHTML tags. Properly align cells, give suitable cell padding and cell spacing, and apply background color, bold and emphasis necessary. 
3.	Use HTML5 for performing following tasks: (i) Draw a square using HTML5 SVG , fill the square with green color and make 6px brown stroke width (ii) Write the following mathematical expression by using HTML5 MathML.d=x2-y2 (iii) Redirecting current page to another page after 5 seconds using HTML5 meta tag

4.	Demonstrate the following HTML5 Semantic tags- <article>, <aside>, <details>, <figcaption>, <figure>, <footer>, <header>, <main>, <mark>, <section> for a webpage that gives information about travel experience.
5.	Create a class called income, and make it a background color of #0ff. Create a class called expenses, and make it a background color of #f0f. Create a class called profit, and make it a background color of #f00. Throughout the document, any text that mentions income, expenses, or profit, attach the appropriate class to that piece of text. Further create following line of text in the same document:The current price is 40₹
6.	Change the tag to have the following properties: • A display status of inline • A medium, double-lined, black border • No list style type Add the following properties to the style for li: • Margin of 5px • Padding of 10px to the top, 20px to the right, 10px to the bottom, and 20px to the left Also demonstrate list style type with user defined image logos
7.	Create following web page using HTML and CSS with tabular layout 
8.	Create following calculator interface with HTML and CSS 
9.	Write a Java Script program that on clicking a button, displays scrolling text which moves from left to right with a small delay

10.	Create a webpage containing 3 overlapping images using HTML, CSS and JS. Further when the mouse is over any image, it should be on the top and fully displayed.

Course outcomes:

CO1: Demonstrate the historical context and justify HTML over XHTML
CO2: Apply HTML5 concepts to build a meaningful webpage.
CO3: Analyse various attributes, values and types of CSS
CO4: Implement core constructs and event handling mechanisms of JavaScript

Textbooks:

1. HTML & CSS: The Complete Reference Thomas A. Powell, Fifth Edition, TataMcGraw Hill,
2. WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition

References:

1. Randy Connolly, Ricardo Hoar, Fundamentals of Web Development, Pearson 1st Edition, 2011.
2. Robin Nixon, Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5- O'Reilly, 4th Edition, 2015.

Alternate Assessment Tools (AATs) suggested:

1. MOOC : Complete the online Course (MOOC) of 10 hours duration certification in the domain of web programming and submit the certificate .
2. Tool usage : Investigate any modern relevant tools for web development.

Web links

https://onlinecourses.swayam2.ac.in/aic20_sp11/preview.

B.E. in COMPUTER SCIENCE AND ENGINEERING

Choice-Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

Introduction to Python Programming (2:0:2) 3

(Effective from the academic year 2024-25)

Course Code	**BPLC15B/25B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 hours of theory + 14 hours of Practical	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Learn fundamental features of Python
2. Set up Python IDE to create, debug and run simple Python programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of modular programming & recursion.

Preamble: Python is an open-sourced programming language that combines the features of C and Java. It has exceptional procedural as well as object-oriented capabilities. Its simplicity and readability make it an ideal choice for beginners, while its extensive libraries and frameworks offer advanced capabilities for experienced developers. This course introduces undergraduate students to the fundamentals of Python, focusing on core concepts such as variables, control structures, data types, and functions. By the end of the course, students will be equipped with the skills needed to write efficient Python programs and apply them to solve real-world problems across various domains.

Module – 1

Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, **Flow control:** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit()

Textbook 1: Chapters 1 – 2 **(5 Hours)**

Module – 2

Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number

Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References

Textbook 1: Chapters 3-4 **(5 Hours)**

Module – 3

Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things

Manipulating Strings: Working with Strings, Putting Strings Inside Other Strings, Useful String Methods, Numeric Values of Characters with the ord() and chr() Functions, Coping and Pasting Strings with the pyperclip Module, Project: Multi-Clipboard Automatic Messages

Textbook 1: Chapter 5-6 **(5 Hours)**

Module – 4

Reading and Writing Files: Files and File Paths, The File Reading/Writing Process, Saving Variables with the shelve Module,Saving Variables with the print.format() Function

Working with Excel Spreadsheets : Excel Documents, Installing the openpyxl Module, Reading Excel Documents

Working with CSV files and JSON data : The csv Module, Project: Removing the Header from CSV Files, JSON and APIs, The json Module

Textbook 1: Chapters 9,13,16 **(6 Hours)**

Module – 5

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying

Classes and functions: Time, Pure functions, Modifiers

Classes and methods: Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation

Textbook 2: Chapters 15 – 17 **(5Hours)**

Sl. No.	Experiments
1.	a. Develop a program to read the student details like Name, USN, and Marks in three subjects. Display the student details, total marks and percentage with suitable messages. b. Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
2.	a. Develop a program to generate Fibonacci sequences of length (N). Read N from the console. b. Write a function to calculate the factorial of a number. Develop a program to compute binomial coefficient (Given N and R).
3.	Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
4.	Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with a suitable message.
5.	Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display dictionary slice of first 10 items]]
6.	Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), readlines(), and write()].
7.	Create a program multiplicationTable.py that takes a number N from the command line and creates an N×N multiplication table in an Excel spreadsheet.
8.	Consider a studData.csv file. File has the USN, Name and CGPA of the students in the class. Develop a program to find the first topper of the class.
9.	Define a function which takes TWO objects representing complex numbers and returns a new complex number with an addition of two complex numbers. Define a suitable class 'Complex' to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.
10.	Develop a program that uses class Student which prompts the user to enter marks in three subjects and calculates total marks, percentage and displays the score card details. [Hint: Use

	list to store the marks in three subjects and total marks. Use __init__() method to initialize name, USN and the lists to store marks and total, Use getMarks() method to read marks into the list, and display() method to display the score card details.]

Course Outcomes: The students will be able to

CO1: Demonstrate problem-solving techniques and Python constructs.
CO2: Apply Python programming concepts to solve practical problems.
CO3: Analyse concepts of Object-Oriented Programming as used in Python.
CO4: Develop solutions to problems by breaking them down into modular components.

Textbooks:

1. Al Sweigart,"Automate the Boring Stuff with Python Practical Programming for total beginners", 2nd Edition, No Starch Press, 2019. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18, except 12) for lambda functions use this link:https://www.learnbyexample.org/python-lambda-function/
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)

Reference Books:

1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, by Charles Dierbach, Wiley India Edition, 2018, ISBN : 978-81-265-5601-4
2. PYTHON PROGRAMMING AN INTRODUCTION TO COMPUTER SCIENCE, John Zelle, Franklin, Beedle & Associates Inc,2016,ISBN 9781590282755

Practical Programming, Third Edition An Introduction to Computer Science Using Python 3.6 by by Paul Gries, Jennifer Campbell, Jason Montojo,O'Reilly; 3rd edition (9 January 2018)

Alternate Assessment Tools (AATs) suggested:

- Conduct on spot problem solving based on Python Programming
- Use of Online Platforms: Utilize platforms like LeetCode, HackerRank, or CodeSignal to set up assessments that test specific Python skills through problem-solving tasks.

Web links / e – resources:

- **https://www.learnbyexample.org/python/**
- **https://www.learnpython.org/**
- **https://pythontutor.com/visualize.html#mode=edit**

B.E. in COMPUTER SCIENCE AND ENGINEERING

Choice-Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/ II

Basics of Java Programming (2:0:2) 3

(Effective from the academic year 2024-25)

Course Code	**BPLC15C/25C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 hours of Theory + 14 hours of Practical	Exam Hours	3

Course Objectives:

This course will enable students to: (List as per the requirement of your course)

1. Learn fundamental features of object-oriented language and JAVA
2. Set up Java JDK environment to create, debug, and run simple Java programs.
3. Learn object-oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception-handling mechanisms.

Preamble: This course enables the student to learn the fundamentals of Java Programming. They will be able to create, manipulate, and operate on classes and objects to utilize them for real world problem solving with exception handling.

Module – 1

An Overview of Java: History of Java. Features of Java. Object-oriented concepts in Java. Difference between C language with Java. Class Structure of Java. A simple Program in Java, Using Blocks of code, Lexical issues, and Java Keywords.

Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

Text book 1: Chapter 1, 2, 3 **(5 Hours)**

Module – 2

Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return)

Text book 1: Chapter 4, 5 **(5 Hours)**

Module – 3

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, This Keyword, Garbage Collection..

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, introducing final, exploring String Class

Text book 1: Chapter 6, 7 **(6 Hours)**

Module – 4

Inheritance: Inheritance Basics, using super, creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes. Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class.

Interfaces: Interfaces, Default Interface Methods.

Text book 1: Chapter 8, 9 **(5 Hours)**

Module – 5

Packages: Packages, Packages and Member Access, Importing Packages.

Exceptions: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, using try and catch**,** Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions

Text book 1: Chapter 9, 10 **(5 Hours)**

Experiments

1.	Write a Java program to store and display the number of students, the average score, the grade, and whether the student passed or failed.
2.	Write a Java program to convert a user's account balance from double to integer and display both the original and converted values.
3.	Write a Java program that takes the user's age as input and checks if they are eligible to vote, handling invalid input errors
4.	Write a Java program to check if a student's grade is higher than a given threshold and determine if they passed with distinction.
5.	Write a Java program to check room availability using if statements and categorize the room type (single, double, suite) using switch.
6.	Write a Java program to generate the first 10 prime numbers using a for loop, break to stop after finding 10 primes, and continue to skip non-prime numbers.
7.	Write a Java program for a car rental company with overloaded methods for different car types and a recursive method to calculate total rental cost for multiple rentals.
8.	Track the total number of university courses using static methods and variables. Set a constant limit on the maximum courses a student can take using the final keyword.
9.	Write a program to manage different types of employees using an interface with a calculateSalary() method. Implement this method in various employee classes, and use the final keyword to make some attributes constant.
10.	Write a program to handle exceptions in an online payment system using try, catch, finally, and throw.

Course Outcomes: The students will be able to:

CO1: Demonstrate the fundamentals of Java programming constructs.
CO2: Interpret the object-oriented features of Java programming language.
CO3: Apply the object-oriented programming constructs to solve complex problems.
CO4: Develop the solutions using the OOP concepts for simple to complex problems.
CO5: Design applications using Object Oriented programming for real-time applications.

Textbooks:

1. Java: The Complete Reference, Twelth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422E.

Reference Books:

1. Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2. Thinking in Java, Fourth Edition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

Alternate Assessment Tools (AATs) suggested:

- Conduct on spot problem solving based on JAVA
- Use of Online Platforms: Utilize platforms like LeetCode, HackerRank, or CodeSignal to set up assessments that test specific Java skills through problem-solving tasks.

Web links / e – resources:

- Java Tutorial: https://www.geeksforgeeks.org/java/
- Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
- Java Tutorial: https://www.w3schools.com/java/ Java Tutorial: https://www.javatpoint.com/java-tutorial
- **https://onlinecourses.nptel.ac.in/noc22_cs47/preview**

B.E. in Computer Science and Engineering

Choice-Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/ II

Introduction to C++ Programming (2:0:2) 3

(Effective from the academic year 2024-25)

Course Code	**BPLC15D/25D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:2	SEE Marks	50
Total Number of Contact Hours	26 Hours Theory + 14 Hours Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

- Understand and use the basic programming constructs of C/C++
- Manipulate various C/C++ data types, such as arrays, strings, and pointers
- Use memory appropriately, including proper allocation/deallocation procedures
- Create and process data in files using file I/O functions
- Apply object-oriented approaches to software problems in C++
- Use the generic programming features of C++ including Exception handling

Preamble:

Although there are numerous programming languages available in the market to work on, C++ has never lost its charm since its inception and still has a strong impact on the development world. C++ comes under a few top programming languages across the world. Alike the C programming language, C++ also makes it easier for you to understand the underlying architecture of programming, although it also supports other additional features such as object-oriented programming, exception handling, etc. Moreover, various IT giants Google, Amazon, Microsoft, etc. offer numerous career opportunities to C++ professionals, hence you're strongly recommended to start to learn C++ Programming.

Module 1

An Overview of C++: Drawbacks of C Programming, What Is Object-Oriented Programming? Advantages of OOPs (Encapsulation, Polymorphism, Inheritance), A Closer Look at the I/O Operators, Introducing C++ Classes and objects, Structures and Classes, Constructors, Static Class Members: Static Data Members, Static Member Functions. When Constructors and Destructors are Executed, The Scope Resolution Operator.

Textbook 1: Chaptrer-11 & 12 **(05 Hours)**

Module 2

Passing Objects to Functions, Returning Objects, Object Assignment, Arrays of Objects, Pointers to Objects, this Pointer with sample programs, References - Reference Parameters, Passing References to Objects, Returning References, type checking C++ Pointers, Pointers to Derived types, Pointers to Class members.

Textbook 1: Chaptrer-13 **(05 Hours)**

Module 3

Dynamic Memory Allocation Operators in C++ New & Delete Operator, Functions Overloading, Operator Overloading, Types Of Constructors, Destructors, Operator Overloading Using Friend Function, Unary Operator Overloading, Binary Operator Overloading.

Textbook 1: Chaptrer-13,14 &15 **(05 Hours)**

Module 4

Assignment Operator Overloading (=,+=),Inline function, Inheritance: Base-Class Access Control, Inheriting Multiple Base Classes, Constructors, Destructors in inheritance.

Textbook 1: Chaptrer-15 & 16 **(05 Hours)**

Module 5

Passing Parameters to Base-Class Constructors, Virtual Base Classes with example programs, Virtual Functions and Polymorphism with example programs, Pure Virtual Functions example programs, Abstract Classes, Early vs. Late Binding. Introduction to Exceptions.

Textbook 1: Chaptrer-17 **(04 Hours)**

Lab Programs

1.	Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
2.	Write a C++ program to create an array of pointers. Invoke functions using array objects.
3.	Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class.
4.	Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
5.	Consider a complex number class, Complex. Apply operator overloading concept, to add two complex numbers and print the sum on the output terminal.
6.	Write C++ programs that illustrate how the following forms of inheritance are supported: a)Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance
7.	Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

Course Outcomes:

The students will be able to:

CO1: Define key concepts and terminology related to C++ programming.

CO2: Design and implement the solution to a problem using object-oriented programming concepts.

CO3: Apply the concept of polymorphism for over loading unary and binary operators

CO4: Achieve code reusability and extensibility using Inheritance and Polymorphism.

CO5: Demonstrate the features like virtual functions/classes for late binding and exceptions handling to manage unexpected or erroneous situations gracefully.

TEXTBOOKS:

1. Herbert Schildt, "The Complete Reference – C++", Fourth Edition, McGraw-Hill.

REFERENCE BOOKS:

1. Bjarne Stroustrup, "Programming: Principles and Practice Using C++", 3rd Edition, 2024
2. Stanley Lippman, Josée Lajoie, Barbara Moo, "C++ Primer", 5th Edition, Addison-Wesley Professional, 2012.

Alternate Assessment Tools (AATs) suggested:

- Certification courses on Infosys springboard/NPTEL etc.
- Presentation

Web links / e-resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs103/preview - Programming In Modern C++
2. https://www.learncpp.com/
3. https://www.programiz.com/cpp-programming

Emerging Technology Courses -I/II (ETC I/II)

1. **Introduction to IoT (BETC15A/25A)**
2. **Introduction to Cyber Security (BETC15B/25B)**
3. **Introduction to Cloud Computing (BETC15C/25C)**
4. **Rapid Prototyping (BETC15D/25D)**
5. **Introduction to Robotics (BETC15E/25E)**
6. **Introduction to Green buildings (BETC15F/25F)**
7. **Introduction to Intelligent Transportation systems (BETC15G/25G)**
8. **Introduction to Bio sensors (BETC15H/25H)**
9. **Introduction to Nano Technology (BETC15I/25I)**
10. **Introduction to Renewable Energy Systems (BETC15J/25J)**
11. **Introduction to Electric Vehicles (BETC15K/25K)**

B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

Introduction to IoT (3:0:0) 3

(Effective from the academic year 2024 -2025)

Course Code	**BETC15A/25A**	**CIE Marks**	50
Number of Contact Hours/Week	3:0:0	**SEE Marks**	50
Total Number of Contact Hours	40	**Exam Hours**	03

Course Learning Objectives: This course will enable students to:

- Understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
- Understand the recent application domains of IoT in everyday life.
- Gain insights about the current trends of Associated IOT technologies and IOT analytics

Preamble: The Internet of Things is a network of physical objects that are connected to the internet and can communicate with other devices and systems. These objects are embedded with sensors, software, and other technologies. IoT is used in many settings, including homes, retail environments, and human bodies.

Module 1

Basics of Networking: Introduction, Network Types, layered network models Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.

Textbook1: Chapter 1 **(**8 Hours)

Module 2

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

Textbook1: Chapter 5 **(**8 Hours)

Module 3

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

Textbook1: Chapter 6 **(**8 Hours)

Module 4

Associated IoT Technologies: Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor -Cloud: Sensors-as-a-Service. IOT Case Studies Agricultural IoT – Introduction and Case Studies

Textbook1: Chapter 10 **(**8 Hours)

Module 5

IOT Case Studies and Future Trends: Vehicular IoT – Introduction, Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction.

Textbook1: Chapter 17 **(**8 Hours)

Course Outcomes: The student will be able to:

1. Understand the characteristics and scopes of IoT
2. Apply the knowledge of device management, networking to build an IoT solution
3. Analyze the different associated technologies for IoT system
4. Interpret the given case study material related to IoT

5. Develop an IoT application using modern tool and submit report.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021

Reference Books:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Alternate Assessment Tools (AATs) suggested:

1. Experiential Learning
2. Certification course
3. Field study
4. Project Based Learning

Web links / e – resources:

1. https://books.google.co.in/books?id=zioNEAAAQBAJ&pg=PR7&source=gbs_selected_pages&cad=1#v=onepage&q&f=false
2. https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLaxu2gn-9WXMf_ln5pMvxjf043jzof4-i

B.E. in Computer Science and Engineering
Choice Based Credit System (CBCS) applicable for 2024 Scheme
SEMESTER – I/II

Introduction to Cyber Security (3:0:0) 3
(Effective from the academic year 2024-25)

Course Code	**BETC15B/25B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Identify and explain the core concepts and principles of cyber security.
2. Assess and differentiate various types of cyber threats, vulnerabilities, and risks.
3. Demonstrate proficiency in using cyber security tools and techniques to detect, analyze, and respond to security incidents.

Preamble:

In the modern world, where everything is connected online, keeping information and data safe is a top priority for everyone from individuals to big companies and countries. Cyber Security, which involves safeguarding systems, networks, and software from online attacks, is crucial for keeping information private, accurate, and accessible. As online threats become more complex and advanced, the demand for experts who can predict, recognize, and deal with these threats is at an all-time high. This course, titled "Introduction to Cyber Security," will give you a basic grasp of the main concepts, technologies, and methods that form the basis of Cyber Security.

Module – 1

Cybercrime:

Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws. Global Perspectives.
Textbook:1 Chapter 1 (1.1 to 1.5, 1.7-1.9) **(08 Hours)**

Module – 2

Cyber Offences:

Categories of cybercrimes, Reconnaissance, Passive attacks, Active attacks, Scanning and Scrutinizing gathered Information, Attack (Gaining and Maintaining System access), Social Engineering-Classification of Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnet-The fuel of Cybercrime, Attack Vector, Cybercrime and Cloud Computing.
Textbook:1 Chapter 2 (2.1 to 2.7) **(08 Hours)**

Module – 3

Tools and Methods used in Cybercrime:

Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.
Textbook:1 Chapter 4 (4.1 to 4.9, 4.12) **(08 Hours)**

Module – 4

Phishing and Identity Theft:

Introduction, methods of phishing, phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft
Textbook:1 Chapter 5 (5.1. to 5.3) **(08 Hours)**

Module – 5

Understanding Computer Forensics:

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing

Chapter 7 (7.1. to 7.5, 7.7 to 7.9) **(08 Hours)**

Course Outcomes:

The students will be able to:

CO1: **Understand** the principles of cyber security, including the concepts of confidentiality, integrity, and availability.

CO2: Apply cyber security tools and techniques to identify and mitigate vulnerabilities in networks and systems.

CO3: **Analyse** different types of cyber threats and attacks.

CO4: **Create** a comprehensive cyber security plan that includes policies, procedures, and controls to safeguard an organization's information.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley ,First Edition (Reprinted in 2018).
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCE BOOKS:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group.

Alternate Assessment Tools (AATs) suggested:

- **Case Study on different kinds of cyber-attacks/Crimes.**
- **Presentation**

Web links / e – resources:

1. Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3. Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17
4. Cyber Attacks and Counter Measures: User Perspective http://uou.ac.in/progdetail?pid=CEGCS-17

B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

Introduction to Cloud Computing (3:0:0) 3

(Effective from the academic year 2024-25)

Subject Code	**BETC15C/25C**	CIE Marks	50
Teaching Hours/Week (L :T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable the students to:

1. Explain the fundamentals of cloud computing
2. Illustrate the cloud application programming and Aneka platform
3. Contrast different cloud platforms used in industry

Preamble:

In today's rapidly evolving technological landscape, cloud computing has emerged as a transformative force, reshaping the way businesses and individuals interact with digital resources. By offering scalable, on-demand access to computing power, storage, and various applications, cloud computing provides unprecedented flexibility and efficiency.

Module – 1

Introduction: Understanding Cloud Computing: Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges.

Chapter-3 (8 Hours)

Module – 2

Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models**.**

Chapter-4 (8 Hours)

Module – 3

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Centre Technology, Virtualization Technology, Web Technology, Multitenant Technology, Containerization.

Chapter-5 (8 Hours)

Module – 4

Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication, Ready-Made Environment.

Cloud Delivery Model Considerations: Cloud Delivery Models: The Cloud Provider Perspective.

Chapter-7, Chapter-14 (8 Hours)

Module – 5

Cloud Delivery Model Considerations: Cloud Delivery Models: The Cloud Consumer Perspective.

Fundamental Cloud Security: Basic Terms and Concepts, Threat Agents, Cloud Security Threats, Additional Considerations.

Chapter-14, Chapter-6 (8 Hours)

Course outcomes:

The students will be able to:

1. Understand the basic concepts and terminologies of cloud computing
2. Apply the concept of cloud computing to different real word examples
3. Analysis the cloud frameworks and technologies for different IT Industry
4. Design real word cloud applications
5. Study the framework of Aneka cloud for data intensive Application

Text Books

1.Cloud Computing: Concepts, Technology & Architecture, by Zaigham Mahmood, Ricardo Puttini, Thomas Erl, Released May 2013, Publisher(s): Pearson, ISBN: 9780133387568

References

1. Dan C. Marinescu, Morgan Kaufmann, Cloud Computing Theory and Practice, Elsevier, 2nd Edition 2013.

Alternate Assessment Tools (AATs) suggested:

1. Technical Presentations
2. Project-Based Assessments

Web links / e – resources:

1. Cloud Computing - Overview (youtube.co m)
https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J

B.E MECHANICAL ENIGINEERING
Choice Based Credit System (CBCS)

RAPID PROTOTYPING (3:0:0) 3
(Effective from the academic year 2024-2025)

Course Code	**BETC15D/25D**	Semester	I/II
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Lecture Hours	40	SEE Marks	50
Examination nature (SEE)	Descriptive	Exam Hours	03

Course objectives:
This course will enable students:
1. To learn the need for rapid manufacturing.
2. To understand various concepts of rapid manufacturing to acquire a functional understanding of the equipment.
3. To acquire knowledge of various process parameters, its influence on performance and applications.
4. To understand rapid manufacturing and minimize errors.

Preamble:
Rapid manufacturing, a subset of advanced manufacturing techniques, harnesses cutting-edge technologies to reduce lead times, lower costs, and increase production capabilities. By leveraging tools such as 3D printing, additive manufacturing, and advanced materials processing, rapid manufacturing enables industries to transition from design to finished product in a fraction of the time traditionally required.

Module – 1

Rapid Manufacturing (RM) Basic Principles: Need for rapid manufacturing, Generic RM process, stereo lithography or 3d printing, rapid proto typing, the benefits of AM, distinction between RM and CNC machining, other related technologies- reverse engineering technology.

RM Process chain: Introduction, the eight steps in additive manufacture, variations from one AM machine to another, metal systems, maintenance of equipment, materials handling issues, design for RM, and application areas.

(8 hours)

Module – 2

Photo polymerization processes: Stereo lithography (SL), materials, process, benefits and drawbacks, applications.

Powder bed fusion processes: Selective Laser Sintering (SLS) process, materials, process parameters, advantages and limitations, applications.

(8 hours)

Module – 3

Extrusion-based systems: Fused Deposition Modelling (FDM) process, process parameters, materials, process parameters, advantages and limitations, applications.

Printing Processes: evolution of printing as an additive manufacturing process, research achievements in printing deposition, technical challenges of printing, printing process modelling, material modification methods, three-dimensional printing, advantages of binder printing.

(8 hours)

Module – 4

Sheet Laminated Manufacturing: Laminated object manufacturing principle, process details, materials, advantages, limitations, applications.

Laser Engineered Net Shaping: principle, process parameters, advantages, limitations, applications.

(8 hours)

Module – 5

Post- Processing: Support material removal, surface texture improvements, preparation for use as a pattern, property enhancements using non-thermal techniques and thermal techniques.

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation-errors due to tessellation, errors due to slicing, Part building errors, Part finishing, Selection of part build orientation.

(8 hours)

Course outcomes: The students will be able to:

CO 1: Choose appropriate rapid manufacturing processes to build the part

CO 2: Interpret the process parameters that affect the rapid manufacturing processes.

CO 3: Infer the benefits, drawbacks and uses of various rapid manufacturing processes.

Textbooks:

1. Dr. Ian Gibson., Dr. David. W. Rosen., Dr. Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", Springer, 2nd Edition, 2014
2. D T Pham., S. S. Dimov., "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", 1st edition, Springer, 2001.

References:

1. Andreas Gebhardt, "Rapid Prototyping", Hanser Pub Inc, 1st Edition, 2003.
2. Chua Chee Kai, Leong Kah Fai., Chu Sing Lim., "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling", 2nd edition, World Scientific, 2010.

B.E MECHANICAL ENIGINEERING
Choice Based Credit System (CBCS)

Introduction to Robotics (3:0:0) 3
(Effective from the academic year 2024-2025)

Course Code	**BETC15E/25E**	Semester	**I/II**
Teaching Hours/Week (L: T:P: S)	3:0:0	CIE Marks	50
Total Hours of Pedagogy	40	SEE Marks	50
Credits	03	Total Marks	100
Examination Pattern (SEE)	**Theory**	Exam Hours	03

Course objectives: students will be able to

1. Acquire knowledge on industrial robot anatomy, configuration control system, sensors and end effectors.
2. Explore the industrial applications of robots and their benefits.
3. Gain the mathematical knowledge to analyze the robot motion in a 2-Degree of freedom scenario.

Preamble:

Industrial robots have been instrumental in transforming the manufacturing sector for the past few decades. It has been supporting in terms of production of parts, assembly, inspection, transportation and storage. Current course is designed to provide the basic understanding on construction, configuration and motion analysis of industrial robots. It also emphasizes various sensors, transducers, machine vision system and end effectors attached to the robots for its functionality. Finally, the course discusses various industrial applications of robots.

Module-1

Fundamentals of Industrial Robotics: Robot Anatomy, Robot configurations: Polar, Cartesian, Cylindrical, and Jointed Arm, Robot motions, Robot joints, 3-dgree of freedom of robot arm, Joint notation scheme, Work Volume, Robot Drive Systems, Control Systems

Robot control system: Commercially available robot controls, Speed of response and stability, Precision of Movement: Spatial resolution, Accuracy, Repeatability, Compliance.

(08 hours)

Module-2

End Effectors: Gripper and Tool, Mechanical Grippers: Operation and Types, Mechanism of Actuator: Linkages actuation, Gear and Rack actuation, Cam actuation, Screw actuation. Other Types of Grippers: Vacuum cup, Magnetic, Adhesive, Hooks and scoops. Tools as End Effectors. Considerations in Gripper Selection and Design

(08 hours)

Module-3

Sensors and Transducers in Robot: Desirable features of Sensors, Tactile Sensors, Proximity and Range Sensors, Miscellaneous Sensors, Uses of Sensors in Robotics

Machine Vision: The Sensing and Digitizing Function, Analog to digital signal conversion, Image Processing and Analysis, Training the Vision System, Robotic Applications of Machine Vision.

(08 hours)

Module-4

Robot motion analysis: Manipulator Kinematics, Position Representation, Forward Kinematics of 2-Degree of Freedom Arm, Reverse Kinematics of 2-Degree of Freedom Arm

(08 hours)

Module-5

Industrial Robot Applications: Material transport and machine loading/unloading, Processing Operations: Spot welding, Arc welding, spray coating. Assembly and Inspection

(08 hours)

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

CO 1. Describe the configuration, joint notation, drive systems and control of industrial robots.

CO 2. Appraise various sensors, transducers and end effectors used in an industrial application.

CO 3. Analyze the motion and position of the end effector of an industrial robot.

CO 4. Discuss various applications of robots in a manufacturing industrial scenario.

Textbooks

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, "Industrial Robotics: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 2017.
2. John J. Craig, "Introduction to Robotics: Mechanism and Control", 4rd Edition, Pearson publication, 2022.

Web links and Video Lectures (e-Resources)

1. Industrial Robotics : Theories For Implementation, Prof. Arun Dayal Udai | IIT-ISM Dhanbad, Link: https://onlinecourses.nptel.ac.in/noc23_me143/preview

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

INTRODUCTION TO GREEN BUILDINGS (3:0:0) 3
(Effective from the academic year 2024-25)

Course Code	**BETC15F/25F**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

1. Understand the Definition, Concept & Objectives of the terms cost effective construction and green building
2. Apply cost effective techniques in construction
3. Apply cost effective Technologies and Methods in Construction
4. Understand the Problems due to Global Warming
5. State the Concept of Green Building
6. Understand Green Buildings

Module-1

Introduction to the concept of cost effective construction -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Poszolana Cement- type of cement, Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.

Module-2

Environment friendly and cost effective Building Technologies - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products - steel and plastic - Contributions of agencies - Costford - Nirmithi Kendra – Habitat

Module-3

Global Warming – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials, Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.

Module-4

Green Building rating Systems- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only), Building information modeling (BIM) in green building.

Module-5

Utility of Solar Energy in Buildings Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Green Composites for Buildings Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

Course Outcomes

The Students will be able to:

CO 6: Understand the economics accepts of building materials in construction.
CO 7: Comprehend the economics accepts of building Technologies in construction
CO 8: Interpret the influence of green building materials on global warming reduction.
CO 9: Illustrate the Green buildings and Green rating system.
CO 10: Identify the alternate source of energy and management of water and waste generated.

Text Books

1. HarharaIyer G, “Green Building Fundamentals”, Notion Press,2022.
2. Dr. Adv. HarshulSavla, “Green Building: Principles & Practices” Notion Press,2021.
3. Vinod B R and Shobha R “Green Building Materials and Techniques” ,Notion Press,2023.

Web links and Video Lectures (e-Resources)

- https://www.youtube.com/watch?v=THgQF8zHBW8
- https://www.youtube.com/watch?v=DRO_rIkywxQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students have to visit a building which is green rated and prepare a report

B.E. CIVIL ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS (3:0:0) 3
(Effective from the academic year 2024-25)

Course Code	**BETC15G/25G**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course overview:

This course provides an in-depth introduction to Intelligent Transportation Systems (ITS), focusing on the technological, systems, and institutional aspects that contribute to the development and deployment of these systems. Students will learn about the benefits of ITS, various data collection techniques, and the applications of ITS in improving transportation efficiency, safety, and sustainability.

Course objectives:

1. Understand the fundamental concepts and components of Intelligent Transportation Systems (ITS).
2. Explore the technological, systems, and institutional aspects of ITS.
3. Analyze the benefits of ITS in enhancing transportation efficiency, safety, and sustainability.
4. Examine various ITS data collection techniques and their applications.
5. Discuss real-world ITS implementations and case studies.

Module-1

Introduction to Intelligent Transportation Systems (ITS): Definition and overview of ITS, Importance and need for ITS in modern transportation, Basic elements of ITS: technological, systems, and institutional aspects. **Advanced Traveller Information Systems (ATIS):** Principles and functionalities of ATIS, Real-time information dissemination, Traveler behaviour and decision-making.

Module-2

Technological Aspects of ITS: Overview of ITS technologies, Communication systems and data processing, Sensor technologies and their applications.

Advanced Transportation Management Systems (ATMS): Components and operations of ATMS, Traffic monitoring and control systems, Incident management and response.

Module-3

Benefits of ITS: Enhanced traffic management, Reduced congestion, Improved safety and emergency response, Environmental sustainability. Advanced Public Transportation Systems (APTS) and Commercial Vehicle Operations (CVO), Electronic Toll Collection (ETC) and New Technologies.

Module-4

ITS Data Collection Techniques: Overview of data collection methods, Detectors: inductive loops, infrared sensors, microwave radar, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Video data collection and analytics.

Module-5

Regional Architecture and Infrastructure Integration: Development of regional ITS architecture, Integration of infrastructure, ITS Issues and Emerging Trends: Technical, economic, and policy challenges in ITS, Future directions and emerging trends in ITS, Impact of autonomous vehicles and smart cities on ITS.

Course Outcomes

On completion of the course, students will be able to:

CO 1: Comprehend on Intelligent Transportation Systems and Advanced Traveller Information Systems.

CO 2: Explore Advanced Transportation Management Systems.

CO 3: Analyse Advanced Public Transportation Systems (APTS), Commercial Vehicle Operations (CVO), new technologies, and Electronic Toll Collection (ETC).

CO 4: Examine the various data collection techniques used in ITS and be able to apply this knowledge to real-world transportation challenges.

CO 5: Discuss regional architecture, infrastructure integration, and summarize ITS issues considering various factors and emerging trends.

Text Books

1. A. J. Khattak and B. N. Janson, Intelligent Transportation Systems: Smart and Green Infrastructure Design. McGraw-Hill, 2019.
2. R. E. Brydia, Introduction to Intelligent Transportation Systems. Artech House, 2013.

Reference Books

1. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House,2003.
2. Pradip Kumar Sarkar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Publisher,2018.
3. Kan Paul Chen, John Miles, "Recommendations for World Road Association (PIARC)" ITS Hand Book 2000.
4. Sussman, J. M., "Perspective on ITS", Artech House Publishers, 2005.
5. US Department of Transportation, "National ITS Architecture Documentation", 2007 (CDROM).
6. Turban. E and Aronson. J. E, "Decision Support Systems and Intelligent Systems", 7th Edition, Pearson Publisher,2004.

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/105107210**
- **https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html**

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Virtual Lab experiments

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B.E ELECTRONICS AND COMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Introduction to Bio Sensors (3:0:0) 3
ETC-I/II
(Common to: CSE/ME/EEE/CIV/AIML/CSBC)
(Effective from the Academic Year 2024-25)

Course Code:	**BETC15H/25H**	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives:
This Course will enable students to:
1. To learn the Fundamentals of biosensors.
2. To acquaint the student with design and construction of biosensors.
3. To expose the students to recent advances in application of biosensors in health, environment, agriculture and food industry.

Teaching-Learning Process
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective
1. Include traditional teaching learning process such as Chalk and Talk using writing boards.
2. Construct graphical and pictorial representation of the subject in the form of Chart, hand-outs or PowerPoint presentations.
3. Collaborate with students how tools are applied to solve biological problems.
4. Integrate real time case studies in various scientific tools used.
5. Reflective approaches on analysing how and why the tools are used in self-reflected or published data.
6. Incorporate Inquiry based approach using demonstration, field study, experiments and project work

Preamble: This course highlights the Evolution of Electronics system, industrial development and research in Bio sensor. The impact of Bio sensors on society and its economic growth, scope and career prospective in the field of Health, Environment, Food and Agriculture Industry are discussed.

Module-1

Introduction to Biosensors
Introduction to biosensor, General components of biosensor, Biomolecules in biosensors such as enzyme, DNA, antigen antibody, protein, Classification of biosensors based on principle: amperometric, potentiometric biosensors, optical, acoustic, piezoelectric, and calorimetric biosensors, scope of biosensors and its limitations. **(08Hours)**

Module-2

Basic Design and Transducer

Design Considerations: calibration, dynamic Range, signal to noise, sensitivity, selectivity, Interference recognition.

Transduction membrane protein sensors: ion channels, Types of Transducer, Optical; Fiber Optic, ECL, Surface Plasmon Resonance, Electro chemical; FET, Impedance, Piezoelectric; Cantilever, **(8 Hours)**

Module-3

Applications of Biosensors in Health and Environment

Biosensors and diabetes management, Microfabricated biosensors and point-of-care diagnostics systems, Noninvasive biosensors in clinical analysis; Surface plasmon resonance and evanescent wave biosensors, Biosensor in cancer and HIV early diagnosis.

(8 Hours)

Module-4

Applications of Biosensors in Food and Agriculture Industry

Detection of product content, allergic components, pathogens, pesticide residues. Monitoring of raw material conversions. Detection of crop diseases, pathogens in plants, Detection of soil nutrients, pesticide and its residual detection. **(8 hours)**

Module-5

Applications of Nanomaterials in Biosensors

Nano Materials in biosensors; Carbon based Nano Material, Metal oxide and nano particle, Quantum dots, Role of nano material in Signal Amplifications, Detection and Transducer Fabrication **(8 hours)**

Suggested Learning Resources:

Text Books:

1. Jeong-Yeol Yoon,Introduction to Biosensors, Springer-Verlag New York Ed. 2016
2. Mohammed Zourob,Recognition Receptors in Biosens; Publisher: Springer-Verlag New York Ed. 2010

Reference Books:

1. Zvi Liron,Novel Approaches in Biosensors and Rapid Diagnostic Assays; Publisher: Springer US Ed..2001
2. Pierre R. C, and Loïc J.B,Biosensor Principles and Applications, , CRC Press, 2019

Course outcome (Course Skill Set)

CO1: Classify types of biosensors based on principle
CO2: Able to differentiate different types of transducers based on their physicochemical characteristics
CO3: Apply bio sensing techniques in health, environment, agriculture and food industry.
CO4: Use biomaterial and nanomaterials in biosensors for signal amplification, Detection and Transducer Fabrication

Alternate Assessment Tools (AATs) suggested:

- AV presentation by students (on specific topics).
- Discussion of case studies based on research findings.
- Model making and Poster presentations

Web links and E-resources:

- https://www.youtube.com/watch?v=kQ6CY1qpGjY
- https://nptel.ac.in/courses/102101054
- https://onlinecourses.nptel.ac.in/noc20_ph13/preview
- https://onlinecourses.nptel.ac.in/noc22_ph01/preview

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B.E ELECTRONICS AND COMMUNICATION ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – I/II

Introduction to Nano Technology (3:0:0)

Course Code:	**BETC15I/25I**	CIE Marks	50
Course Type (Theory/Practical /Integrated)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives: Students will be taught

- To provide a comprehensive overview of synthesis and characterization of nanoparticles, nanocomposites and hierarchical materials with nanoscale features.
- To provide the engineering students with necessary background for understanding various
- nanomaterials characterization techniques
- To develop an understanding of the basis of the choice of material for device applications
- To give an insight into complete systems where nanotechnology can be used to improve our
  everyday life

Teaching-Learning Process
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Chalk and Talk
2. Power point presentation
3. Video Lecturing
4. E-sources
5. Self-learning

Preamble: This course highlights the Evolution of Electronics system, industrial development and research in the field of Nano Technology. The impact of electronics on society and its economic growth, scope and career prospective in the field of Nano materials and Nanotechnology are discussed.

Module-1

Introduction to Nanomaterials
Nanotechnology, Frontier of future-an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems, Surface to Volume Ratio, Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of nanomaterials-Sol-gel, Precipitation, Solution Combustion synthesis, Hydrothermal, SILAR, Chemical Bath Deposition. Top-Down approach- Ball milling technique, Sputtering, Laser Ablation. **(8 Hours)**

Module-2

Characterization of Nanomaterials
Basic principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope,

Atomic Force Microscope –different imaging modes, comparison of SEM and TEM, AFM and STM, AFM and SEM.

Basic principles of working of X-ray diffraction, derivation of Debye-Scherrer equation, numerical on Debye Scherrer equation, Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement) **(8 Hours)**

Module-3

Carbon Based Materials

Introduction, Synthesis, Properties (electrical, Electronic and Mechanical), and Applications of Graphene, SWCNT, MWCNT, Fullerenes and other Carbon Materials: Carbon nanocomposites, nanofibres, nanodiscs, nanodiamonds. **(8 Hours)**

Module-4

Nanotechnology in Energy storage and conversion

Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells.

Batteries: Nanotechnology in Lithium ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms, limitations of graphite anodes, Advances in Cathodic materials, Anodic materials, Separators

Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes

Self-study for lifelong learning:
Super capacitors: Introduction, construction and working of supercapacitor **(8 Hours)**

Module-5

Applications of Nanotechnology

Nanotech Applications and Recent Breakthroughs: Introduction, Significant Impact of Nanotechnology and Nanomaterial, Medicine and Healthcare Applications, Biological and Biochemical Applications (Nano biotechnology), Electronic Applications (Nano electronics), Computing Applications (Nano computers), Chemical Applications (Nano chemistry), Optical Applications (Nano photonics), Agriculture and Food Applications, Recent Major Breakthroughs in Nanotechnology.

Self-study for lifelong learning:
Nano coatings (Photocatalysts) and super hydrophobic coatings (Lotus effect) **(8 Hours)**

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: Demonstrate the synthesis of nanoparticles by various techniques. [L2]

CO2: Analyze the working of basic instruments used in characterization of nanoparticles. [L2]

CO3: Discuss the application of nanotechnology to real time application.

CO4: Classify the nanomaterials based on the dimensions. [L3]

C05: Assess the suitability of nanomaterials for various device applications. [L4]

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers
2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science
3. Nano Essentials- T. Pradeep/TMH
4. Peter J. F. Harris, Carbon nanotube science: synthesis, properties, and applications. Cambridge

University Press, 2011
5. M.A. Shah, K.A. Shah, "Nanotechnology: The Science of Small", Wiley India, ISBN 13: 9788126538683

Reference Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2. Understanding Nanotechnology, Scientific American 2002
3. Nanotechnology, M. Ratner and D. Ratner, Prentice Hall 2003
4. Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton 2002
5. Recent reviews on Li-ion batteries, solar cells and fuel cells

Alternate Assessment Tools (AATs) suggested:

- Poster presentations and case studies
- Simulation of nano devices

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/118104008
- https://www.digimat.in/nptel/courses/video/118104008/L16.html
- https://archive.nptel.ac.in/courses/113/106/113106099/
- https://nptel.ac.in/courses/112107283
- https://onlinecourses.nptel.ac.in/noc22_me131/preview

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

INTRODUCTION TO RENEWABLE ENERGY SYSTEMS (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**BETC15J/25J**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Create awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.
2. Learn the fundamental concepts about solar energy systems and devices.
3. Study on the applications of wind energy.
4. Understand the working of OTEC, Biomass energy, and geothermal energy system.
5. Understand the working of Fuel cell and hydrogen production technologies

Preamble:

Renewable energy is generated by sources that can be replenished within a relatively short period of time. Solar, wind, water, biomass, and geothermal are all renewable energy sources. Green energy, while similar to renewable energy, is a subset of sources that have the highest environmental benefits. This course aims at bringing the technological developments and research trends in the field of non-conventional energy sources with emphasis on engineering and design aspects.

Module – 1

Introduction: Principles of Renewable Energy. Energy and sustainable development, fundamentals and social implications. worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy. Oil shale, Introduction to Internet of energy (IOE). 8 HOURS

Module – 2

Solar Energy: Fundamentals, Solar Radiation, Estimation of solar radiation on horizontal and inclined surfaces. Solar radiation Measurements: Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector. Solar distillation, Solar pond electric power plant. Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system. 8 HOURS

Module – 3

Wind Energy, Biomass Energy

Wind Energy: Properties of wind, availability of wind energy in India. Wind velocity and power from wind. Major problems associated with wind power. Basic components of wind energy conversion system (WECS). Classification of WECS: Horizontal axis- single, double and muliblade system.

Biomass Energy: Introduction, Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies -fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft) . 8 HOURS

Module – 4

Tidal Power, Ocean Thermal Energy Conversion

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC. 8 HOURS

Module – 5

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy. 8 HOURS

Course Outcomes:

The students will be able to:

CO1: Explain the importance and applications of renewable Energy.
CO2: Describe the method of power generation from Solar, wind, biomass Energy
CO3: Describe the Tidal energy and Ocean Thermal Energy Conversion.
CO4: Describe Fuel cell and hydrogen production technologies.

Textbooks:

1. Non Conventional Energy sources, G D Rai, Khanna Publication, Fourth Edition
2. Energy Technology, S.Rao and Dr. B.B. Parulekar, KhannaPublication.Solar energy, Subhas P Sukhatme, Tata McGraw Hill, 2nd Edition, 1996.
3. Principles of Energy conversion, A.W.Culp Jr. McGraw Hill, 1996
4. Non-Conventional Energy Resources, ShobhNath Singh, Pearson, 2018

References:

1. Principles of Energy conversion, A. W. Culp Jr., McGraw Hill, 1996
2. Non-Conventional Energy Resources, Shobh Nath Singh, Pearson, 2018

Alternate Assessment Tools (AATs) suggested:

- Design of Solar Panel

Web links / e – resources:

1. https://www.investopedia.com/terms/i/internet-energy
2. https://www.pdfdrive.com/non-conventional-energy-sources-e10086374.html
3. https://www.pdfdrive.com/non-conventional-energy-systems-nptel- d17376903.html
4. https://www.pdfdrive.com/renewable-energy-sources-and-their-applications-e33423592.html
5. https://www.pdfdrive.com/lecture-notes-on-renewable-energy-sources- e34339149.html
6. https://onlinecourses.nptel.ac.in/noc18_ge09/previe

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS) applicable for 2024 Scheme

SEMESTER – I/II

INTRODUCTION TO ELECTRIC VEHICLES (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**BETC15K/25K**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. To understand the basics, architecture, present & Future technologies of EV and market
2. To understand the concept of Vehicle configuration.
3. To understand the concept of vehicle mechanics.
4. To study about the motors & drives for electric vehicles.
5. To understand various energy storage technologies and charging mechanism

Preamble: This course covers the basic components of EVs, including electric motors, batteries, and power electronics, and explores how these elements work together to drive vehicle performance. Students will learn about the principles of energy storage and electric propulsion as well as the infrastructure required for charging and maintaining EVs.

Module – 1

Introduction to Electric Vehicles: Historical journey of Electric Vehicles (EV), Hybrid Electric Vehicles (HEV) and Fuel cell Vehicles (FEV). Types of different pollutants produced due to IC engine vehicle (ICEV) and their effect on human health. Economic and environmental impacts of using Electrical vehicles. EV Market- Present and future trends**. (8hours)**

Module – 2

Classification of Electric Vehicles: Battery Electric vehicle (BEV). Hybrid Electric vehicle (HVE): Micro, Mild and Full hybrid, series hybrid. Parallel hybrid, series parallel hybrid, complex hybrid. Grid able HVE: plug in hybrid (PHEV), Range Extended (REV), Fuel cell electric vehicle (FCEV) (**8 hours)**

Module – 3

Vehicle Mechanics: Laws of Motion, Rolling Resistance Force, Aerodynamic Drag, Hill Climbing Force, Acceleration Force, Total Tractive Effort, Tractive Power, Energy required, Numericals **(8 hours)**

Module – 4

Electric Vehicle Motors and Selection: Difference between the electrical motors for electrical vehicles and for other industrial purposes. Classification, Construction, and working principle of electrical motors used for EV applications: Induction Motor, Permanent magnet motor, switched reluctance motor, PMSM.

Factors to be considered for selection of motor. Configuration of motor layout: single motor configuration, dual motor configuration, in wheel motor configuration**. (8 hours)**

Module – 5

Energy storage for EV & HEV and Charging: Energy storage requirements, Battery parameters: Physical Dimensions, Voltage and current rating, Capacity and power 'C' Rate, Battery Efficiency, Energy Density, Power Density, State of charge (SOC), Depth of discharge (DoD), State of Health (SoH), Operating Temperature, Lifetime.

Types of Batteries, Principle of operation: Lead-acid battery, Nickel based batteries, Lithium-based batteries.
Battery Management System: Need of battery management system, Block diagram of BMS
Charging of EV and HEV: AC charging and DC Charging. **(8 hours)**
Summary: The student will be able to get a comprehensive idea on introduction to electric vehicles, covering technical, economic, and environmental aspects. It prepares students for a career in the EV industry or further studies in sustainable transportation.

Course Outcomes:
The students will be able to:
CO1:Relate the necessity of electric vehicle in present scenario and compare various electric vehicles
CO2: Classify Electric Vehicles based on various configurations
CO3:Analyze various factors affecting movement of electric vehicles.
CO4: Explain constructional features & working of motors used in EV and the selection criteria
CO5: Explain the key parameters, working of different batteries and battery management system used in EVs and HEVs.

Textbooks:
1. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, M. Ehsani, Y. Gao, S. Gay and Ali Emadi, CRC Press, 2005
2. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2005

References:
1. Electric Vehicle Technology Explained, James Larminie, John Lowry, John Wiley & Sons Ltd, 2012
2. Hybrid, Electric and Fuel Cell Vehicles, Jack Erjavec and Jeff Arias, Cengage Learning, 2012

Alternate Assessment Tools (AATs) suggested:
- Mooc Course
- Poster Presentation

Web links / e – resources:
1. https://archive.nptel.ac.in/courses/108/106/108106170/

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – I

Communicative English (0:0:1) 1
(Common to all Branches)
(Effective from the academic year 2024-2025)

Course Code	**BENGL16**	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Total Number of Lecture Hours	26	Exam Hours	01

Course objectives:

This course will enable students to

1. Familiarise with basic English Grammar and Communication Skills in general.
2. Identify the nuances of phonetics, intonation and enhance pronunciation skills
3. Enhance English vocabulary and language proficiency for better communication skills.
4. Learn about Techniques of Information Transfer through presentation

Module – 1: Fundamentals of Communication

Introduction, Communication-an overview, Definition of communication, Features of successful professional communication, Importance of communication, Purpose of professional communication, Rule of critical and creative thinking in effective communication, Role of emotions in communication, Role of Inter-Cultural Communication, Different forms of communication, Communication network in an organization, Barriers to communication, Some remedies.

Non-verbal communication: Introduction, Body language, Paralinguistic features, Proxemics/ Space distance, Haptics.

4 Hours

Module – 2: Grammar Essentials and Phonetics

Grammar: Essentials and Applications

Introduction, Parts of Speech, Articles and Prepositions, Modals, Sentences and their types, Subject-verb, Concord, using tenses, Moods of Verbs, Active passive voice, Direct indirect speech, Clause and its types, Using non-Finites.

Basic of Phonetics: Introduction, Reasons for incorrect pronunciations, received pronunciation, Misconceptions about sounds, Transcriptions, Problems of Indian English, Syllables, Word stress, How to transcribe, Weak forms, Intonation and rhythm, Difference between British American and Indian spoken English**.** **6 Hours**

Module – 3: Reading and Listening Skills

Reading skills: Introduction, need for developing efficient reading skills, Benefits of effective reading, Speed of reading, four basic steps to effective reading, overcoming common obstacles, Types, Approaches to efficient reading, Tips for effective reading, employing different reading skills, Understanding the authors point of view, Identifying the central idea, inferring lexical and contextual meaning, employing discourse analysis, Worked out passages.

Listening skills: Introduction, Listening is an art, Listening vs hearing, Poor vs effective listening, Advantages of good listening, Process of listening, Types of listening. Intensive listening vs extensive listening, Barriers to effective listening, five steps of active listening techniques for effective listening, Listening and not taking.

8 Hours

Module – 4: Paragraphs and Precis Writing

Introduction, precise, Summary, Abstract, Synopsis, Paraphrasing, Art of condensation, Some working principles, Seven step ladder to writing an effective precis, Writing precise for given passages, Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Descriptive writing techniques, Augmentative paragraph, Analytical paragraph.

4 hours

Module – 5: Professional Presentations and Writing

Professional Presentations: Introduction, combating stage fright, preparing PPT slides, Describing objects, Situations and people, Individual and group presentations, Delivering JAMs

Essays, Letters, Resumes: Introduction, Types of essays, Characteristic features of an essay, Stages in essay writing, Components comprising an essay, Essay writing-guiding principles, Business letters and resumes- Importance, Elements of structure, Layout. Business letters- Elements of style, Types of business letters, Resume preparation.

4 Hours

Course Outcomes: The students will be able to:

1. Understand and apply basic English grammar for effective communication.
2. Identify the nuances of phonetics, intonation, and enhance pronunciation skills.
3. Understand and use all types of English vocabulary and language proficiency.
4. Enhance their knowledge about techniques of information transfer through presentations.

Textbooks

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication Principles and Practice, Oxford Publications, 3rd Edition, 2015
2. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University Press,
3. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru - 2022.

References

1. Gajendra Singh Chauhan, Technical Communication Cengage Learning India Pvt Limited, Latest Revised Edition, 2019
2. Michael Swan, Practical English Usage, Oxford University Press, 2016
3. N.P.Sudharshana and C.Savitha, English for Engineers, Cambridge University Press, 2018

CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN

- The Weightage of Continuous Internal Examination (CIE) is 50% and for Semester End Examination (SEE) is 50 %
- The minimum passing mark for the CIE is 40% of the Maximum marks (ie 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (ie 18 out of 50 marks)
- A student will be declared to have passed the course if they secure a minimum of 40% (ie 40 marks out of 100) in the combined total of CIE and SEE.

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – II

Professional Writing Skills in English (0:0:1) 1
(Common to all Branches)
(Effective from the academic year 2024-2025)

Course Code	**BPWSL26**	CIE Marks	50
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	50
Total Number of Lecture Hours	26	Exam Hours	01

Course objectives:
This course will enable students to
1. Identify the Common Errors in Writing and Speaking of English.
2. Achieve better technical writing and Presentation skills for employment.
3. Acquire Employment and Workplace communication skills.
4. Enhance their conversation and public speaking skills.
5.

Module – 1: Advanced Vocabulary

Introduction, learning through speeches, Descriptions, Word formation, Synonyms, Antonyms, learning words through situations, Homonyms and Homophones, Words often confused, One word substitution, Phrasal verbs, Idiomatic expressions, Developing technical vocabulary, Eponyms,
Jumbled sentences: Introduction, Steps to approach jumbled sentences, Unscrambling a paragraph

4 Hours

Module – 2: Technical Reports and Proposals

Reports and Proposals: Introduction, Definition, Salient Features, Significance, Types, Use of Graphic Aids/Illustrations, Preparation and Planning, Data Collection, Analyzing and Organizing the Data, Writing and Revising, Preparing an Outline, Structure of Formal Reports, Styles of Reports, Preparing a Checklist, Sample Reports, Technical Proposals - Purpose, Importance, Types and Structure.

4 Hours

Module – 3: Technical Writing Skills

Email and Other Writings: Introduction, Email Writing- Reasons for Popularity, Some Common Pitfalls, Guiding Principles for Composition, Maintaining Common Etiquette.
Itinerary Writing, Inter-office Memorandum (Memos), Circulars, Notice, Agenda, and Minutes, Writing Instructions, Advertising.
Blogs and Reviews: Introduction, Movie Review, Book Review, Blog Writing **6Hours**

Module – 4: Professional Speaking Practices

Conversations, Dialogues and Debates: Introduction, Purpose of General Conversations, Features of a Good Conversation, Tips for Improving Conversations, Short Conversations, Telephonic Skills, Debate, Situational Dialogues and Role Plays.
The Art of Negotiation: Introduction, Definition, Different Types of Negotiation Styles, Tips for Win-Win Negotiation.

6 Hours

Module – 5: Communication in Workplace.

Public Speaking: Introduction, choosing an appropriate pattern, selecting an appropriate method, Art of Persuasion, making speeches interesting, Delivering different types of speeches.

Group Discussion: Introduction, Definition, Difference between GD and debate, Number and duration, Personality traits to be evaluated, Dynamics of Group Behaviors/Group Etiquette and mannerisms, Type, opening of a GD, summarizing a discussion, Some tips for GD

Job Interviews: Introduction, Definition, Process, Stages of Interview, Types, Desirable Qualities, Preparation, Using Proper Verbal and Non-verbal Clues, Exhibiting Confidence, Tips for Success**.**

6 Hours

Course Outcomes: The students will be able to:

1. Understand and identify the Common Errors in Writing and Speaking.
2. Enhance Technical Writing and Presentation skills.
3. Exhibit Employment and Workplace communication skills.
4. Analyze and apply various Techniques of Information Transfer through presentation in different levels

Textbooks

1. "Professional Writing Skills in English" published by Fillip Learning – Education (ILS), Bangalore – 2022.
2. "Functional English" (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learning India Pvt Limited [Latest Edition 2019]

References

4. Gajendra Singh Chauhan, Technical Communication, Cengage Learning India Pvt Limited, Latest Revised Edition, 2019
5. N.P. Sudharshana and C. Savitha, English for Engineers, Cambridge University Press ,2018.

Meenakshi Raman and Sangeetha Sharma, Technical Communication – Principles and Practice, Oxford University Press, Third Edition 2017.

CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN

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- A student will be declared to have passed the course if they secure a minimum of 40% (ie 40 marks out of 100) in the combined total of CIE and SEE

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – I/II

Indian Constitution (0:0:1) 1
(Common to all Branches)
(Effective from the academic year 2024-2025)

Course Code	**BICO17/27**	CIE Marks	50
Teaching Hours/Week (L: T:P)	1:0:0	SEE Marks	50
Total Number of Lecture Hours	15	Exam Hours	01

Course objectives: This course will enable students to

- Familiarize with the basic structure of our Indian Constitution.
- Understand the Concept of Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.
- Enhance their knowledge on administrative mechanism at the Union and State government.
- Learn about elections, emergency provisions, amendments and Special constitutional provisions.

Module – 1

Preamble: Significance and Scope of the course, Importance of the course in societal, political and economic growth of the nation.

Introduction and Basic information about the Indian Constitution:

Indian Constitution: Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Salient Features.

3 Hours

Module – 2

Preamble and Fundamental Rights: Preamble of the Indian Constitution & Key concepts of the Preamble. Fundamental Rights (FR's) and its restrictions and limitations in different Complex Situations. Case studies

3 Hours

Module – 3

Directive Principles of State Policy and Fundamental Duties:

Directive Principles of State Policy- Importance and its relevance. Fundamental Duties and their significance. Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes and Women & Children. **3 Hours**

Module – 4

Union and State Administration:

The Union Executive-The President and The Vice President, The Prime Minister and The Council of Ministers, The Union Legislature -Lok Sabha & Rajya Sabha, Parliamentary Committees, Important Parliamentary Terminologies. The Union Judiciary- The Supreme Court of India and its jurisdiction. Judicial Review and Judicial Activism.

The State Executive-The Governors, The Chief Ministers and The Council of Ministers, The State Legislature- Legislative Assembly and Legislative Council, The State Judiciary- The State High Courts and its jurisdiction. **3 Hours**

Module – 5

Elections, Constitutional Amendments and Emergency Provisions:
Elections-Electoral Process in India, Election Commission of India: Powers & Functions, Constitutional Amendments- methods and Important Constitutional Amendments ie 42nd, 44th, 61st,74th, 76th, 77th, 86th ,91st, 100, 101st, 118th, Emergency Provisions-types and its effect. **3 Hours**

Course outcomes: The students will be able to:

1. Understand the basic structure of our Indian Constitution.
2. Analyse the Concept of Fundamental Rights, Directive Principles of State Policy and Fundamental Duties
3. Have knowledge of administrative mechanisms at the Union and State government.
4. Understand the system of elections, emergency provisions, amendments and Special constitutional provisions.

Textbooks

1. "Constitution of India" (for Competitive Exams), Naidhruva Edutech Learning Solutions, Bengaluru. – 2022.
2. Durga Das Basu (DD Basu): "Introduction to the Constitution of India" (Students Edition.) Prentice –Hall, 2008.

Reference Books:

1. Shubham Singles, Charles E. Haries, and et al, "Constitution of India, Professional Ethics and Human Rights", Cengage Learning India, Latest Edition – 2019.
2. Merunandan K B, "The Constitution of India", Merugu Publication, Second Edition, Bengaluru.
3. Justice H N Nagamohan Dhas "Samvidhana Odu" - for Students & Youths, Sahayana, kerekon.

CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN

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Non-IPCC Courses-01 Credit -Multiple Choice Question Type						
Evaluation Type		Internal Assessments (IAs)	Test/Exam marks conducted for	Marks to be scaled down to	Min. marks to be scored	Evaluation details
Continuous Internal Evaluation Component	CIE-IA Tests (MCQs)	CIE – Test 1(1 hr)	40	40 40	-	The question paper pattern for this course shall be an MCQ of 1 or 2 Marks.

		CIE – Test 2(1 hr)	40			The questions with 2 marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be 80 Marks, and the same will be scaled down to 40 Marks
	CIE-CCAs	CCA	10	10	-	Any one assessment method
	Total CIE			50	20	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an MCQ of 1 or 2 Marks. The examination duration is 1 hour.
CIE+SEE				100	40	

Choice Based Credit System (CBCS)
SEMESTER – I/II

Scientific Foundations of Health (0:0:1)1
(Common to all Branches)
(Effective from the academic year 2024-2025)

Course Code	**BSFH18/28**	CIE Marks	50
Teaching Hours/Week (L: T:P)	1:0:0	SEE Marks	50
Total Number of Lecture Hours	15	Exam Hours	01

Course objectives: This course will enable students to

- Know about Health and wellness (and its Beliefs) & It's balance for positive mindset.
- Build a healthy lifestyle for good health for a better future.
- Create a Healthy and caring relationship to meet the requirements of good/social/positive life.
- learn about Avoiding risks and harmful habits in their campus and outside the campus for their bright future
- Prevent and fight against harmful diseases for good health through a positive mindset

Module – 1

Good Health & Its balance for positive mindset: Health -Importance of Health, influencing factors of Health, Health beliefs, Advantages of good health, Health & Behaviour, Health & Society, Health & Family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.

03 Hours

Module – 2

Building healthy lifestyles for better future: Developing healthy diet for good health, Food & Health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, eating disorders, Fitness components for health, Wellness and physical function, how to avoid exercise injuries.

03 Hours

Module – 3

Creation of Healthy and caring relationships: Building communication skills, Friends and friendship - Education, the value of relationship and communication skills, Relationships for better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviors through social engineering.

03 Hours

Module – 4

Avoiding risks and harmful habits: Characteristics of health-compromising behaviors, Recognizing and avoiding of addictions, how addiction develops, Types of addictions, influencing factors of addictions, Differences between addictive people and non-addictive people & their behaviors. Effects of addictions Such as..., how to recover from addictions.

03 Hours

Module – 5

Preventing & fighting against diseases for good health: How to protect from different types of infections, How to reduce risks for good health, Reducing risks & coping with chronic conditions, Management of chronic illness for Quality of life, Health & Wellness of youth: a challenge for upcoming future, Measuring of health & wealth status.

03 Hours

Course Outcome(Course Skill Set):

At the end of the course, the students will be able to

1. Understand and Analyse about Health and Wellness (and its beliefs) and it's balance for positive mindset.
2. Develop healthy lifestyles for good health for a better future.
3. Build a healthy and caring relationship to meet the requirements of good/social/positive life.
4. Learn about avoiding risk and harmful habits in their campus and outside the campus for their bright future.
5. Prevent and fight against harmful diseases for good health through positive mindset.

Text Books:

1. Scientific Foundations of Health" – Study Material Prepared by Dr. L Thimmesha, Published in VTU- University Website.
2. "Scientific Foundations of Health", (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore – 2022.
3. Health Psychology - A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press

Reference Books:

1. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor –Published by Routledge 711 Third Avenue, New York, NY 10017.
2. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.
3. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes.
4. Scientific Foundations of Health (Health & Welness) - General Books published for university and colleges references by popular authors and published by the reputed publisher.

CONTINUOUS INTERNAL EVALUATION (CIE) and SEMESTER END EXAMINATION (SEE) PATTERN

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Evaluation Type		Internal Assessments (IAs)	Test/Exam marks conducted for	Marks to be scaled down to	Min. marks to be scored	Evaluation details

Continuous Internal Evaluation Component	CIE-IA Tests (MCQs)	CIE – Test 1(1 hr)	40	40 40	-	The question paper pattern for this course shall be an MCQ of 1 or 2 Marks. The questions with 2 marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be 80 Marks, and the same will be scaled down to 40 Marks
		CIE – Test 2(1 hr)	40			
	CIE-CCAs	CCA	10	10	-	Any one assessment method
	Total CIE			50	20	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an MCQ of 1 or 2 Marks. The examination duration is 1 hour.
CIE+SEE				100	40	

BMS Institute of Technology and Management, Bengaluru 560064
Choice Based Credit System (CBCS)

Innovation and Design Thinking (0:0:1)1
Common to all Branches
(Effective from the academic year 2024-25)

Course Code	**BIDTL18/28**	Semester	I/II
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	50
Total Number of Hours	26	SEE Marks	50
Examination Nature	Project Viva Voce	Exam Hours	02

Course objectives:

This course will enable students to:

1. Demonstrate the concept **understanding** phase in design thinking process.
2. Illustrate **observation** phase for design thinking process.
3. **Define** the problem based on user's requirements.
4. Understand **ideate** phase process products and services.
5. Develop **prototype** and test for innovative products and services.

PROBLEM SPACE

Part A: UNDERSTAND PHASE

Principles and process of design thinking, Double- diamond model , how to plan a Design Thinking project?, How to understand the problem**,** Search field determination, problem clarification according to Kepner/Tregore, Questionnaire to clarify the problem according to Andler, understanding of the problem, the blind spot of knowledge and awareness, PESTEL-Analysis, Ishikawa diagram.

Part B: OBSERVATION PHASE

How to Observe: Empathetic design, Tips for observing, five factors of a customer experience, Behavioural Mapping and Tracking, Empathy Map, Cognitive walkthrough, Heuristic Evaluation, Critical-Incident Techniques.

Part C: DEFINE PHASE

Point-of-view phase, Persona, Checklist for identifying jobs, checklist for identifying customer problems, checklist for the identification of customer needs/wishes, Cognitive ladder of Means-end approach.

SOLUTION SPACE

Part D: IDEATE PHASE

Four phases of creative process, Internal and external sources of information, Rules and tips for brainstorm, list of prefixes, Osborn Checklist, TRIZ: ideality formula, checklist ideality. innovation checklist, Evaluation of ideas: Proc-Cons lists, SWOT analysis.

Part E: PROTOTYPE AND TESTING PHASE

Prototype phase, classical test methods, MVP as test methods, Test Phase, tips for prototyping testing, Desirability testing, desirability toolkits Agility for design thinking.

Course Outcomes: The students will be able to:

1. Demonstrate the concept of **understanding** in design thinking.
2. Illustrate **observation** phase for design thinking problems.
3: Describe **define** phase for design thinking problems
4. Apply i**deate** process for design thinking problems
5. Develop **prototype** and test

Textbook:

1. Christian Mueller-Roterberg, Handbook of Design Thinking, Tips & Tools for how to design thinking, Kindle Direct Publishing, 2018.

Reference Book:

1. A Nil Hasso Plattner, Christoph Meinel and Larry Leifer (, Design Thinking: Understand – Improve – Apply, Springer, 2011.

Assessment Method

CIE Marks Distribution (50 Marks)

First Stage Presentation (Problem Space) :15 Marks

Second Stage Presentation (Solution Space) : 20 Marks

CIE Test : 15 Marks

(One CIE test is conducted for 40 Marks and scaled down to 15 Marks)

Total CIE Marks : 50 Marks

SEE Marks Distribution (50 Marks)

Project Viva Voce

Part A, B and C(Problem Space) : 30 Marks

(Each part caries 10 Marks)

Part D and E (Solution Space) :30 Marks

(Each part caries 15 Marks)

Presentation :15 Marks

Questions and Answers : 10 Marks

Project Report : 15 Marks

Total Viva Voce Marks : 100 Marks

(Project Viva Voce is conducted for 100 Marks and is reduced to 50 Marks)

Thank You